P36 SPECIFICATION FOR

NZ Transport Agency

VARIABLE MESSAGE SIGNS

DATE 15 JUNE 2011

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<tr><td colspan="2">Title & Subtitle:
Specification for NZ Transport Agency Variable Message Signs</td><td>Author(s):
Henry Pretorius
Neil Garnett</td></tr>
<tr><td colspan="2">Management Details
Project Sponsor: Neil Walker
Project Manager: Henry Pretorius
Address: Private Bag 6995, Wellington</td><td>Contact Details of Client
Tel: 04 894 5400
E-mail: neil.walker@nzta.govt.nz
Tel: 04 894 5400
E-mail: henry.pretorius@nzta.govt.nz
Fax: 04 894 6100</td></tr>
<tr><td colspan="2">Author(s) Organisation Name & Address:
Henry Pretorius NZ Transport Agency

Neil Garnett, Opus International Consultants Ltd</td><td>Contact Details of Author(s):
Tel: (04) 894 6492
E-mail: henry.pretorius@nzta.govt.nz
Tel: (03) 363 5480
E-mail: neil.garnett@opus.co.nz</td></tr>
<tr><td colspan="3">This document is the NZ Transport Agency Specification for Variable Message Signs (VMS).

A separate document titled NZ Transport Agency Notes for Variable Message Signs is available to assist site selection, design, environmental planning, construction of support structures, reticulation of power and communication services, and post construction acceptance and maintenance of the supports.
NZ Transport Agency's requirements for VMS messages are described in the National VMS Operating Policy, & National VMS Operating Procedures.
Requirements for Mobile VMS are set out in SP/M/031 Specification for Mobile VMS, and the associated Notes.</td></tr>
<tr><td colspan="3">Document Purpose
The purpose of this document is to provide a set of specifications for the design and procurement of electronic VMS signage for motorway and regional applications on the State Highway network and local roads where NZ Transport Agency has a responsibility to provide driver information.
The specifications for VMS found in this document, including references to communications and external standards, are to be regarded as mandatory when any part of this document is referenced as part of any related procurement process.
It is mandatory that this document be issued in its entirety as part of any VMS purchase process.</td></tr>
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1. Introduction

1.1. Scope

This Specification outlines requirements for VMS, sign controllers, communication systems, power supply, warranties and maintenance. The Specification sets out mandatory (shall/must/will), and optional (should/may/can), requirements.

This document must be supplied and referenced as part of any procurement process for the acquisition of any VMS for NZ Transport Agency.

Accordingly the scope of this document has been defined as follows

1. VMS operated mainly as a text based line matrix with graphics capabilities via full matrix technology. This also includes lane control signs. Excludes those electronic signs that are predominantly graphics (pictogram) displays used as part of specific Temporary Traffic Management and specialist electronic signage such as speed limit signs.
2. Communication systems interfacing with the software control system, and the sign controller.
3. Power supply.
4. The construction requirements for the enclosure.
5. The requirements for the internal environmental controls.
6. Warranty, serviceability and maintenance requirements for VMS.

Exclusions:

7. User interface definitions and Advanced Traffic Management Systems (ATMS) definitions.
8. ATMS software or sign control software, standards or processes.

1.2. Definitions and Acronyms

Term/Acronym	Definition
ADSL	Asynchronous Digital Subscriber Line.
ATMS	Advanced Traffic Management System.
Bezel	The border surrounding the VMS enclosure, mounted flush with the polycarbonate front panel.
cd	Candela.
CDMA	Code Division Multiple Access. The term refers to a cellular telecommunication network.
Character Height	The height of an upper case character expressed in millimetres.
Character Spacing	The horizontal spacing between individual characters on the same line of a message. Character spacing is expressed as the number of columns of blank pixels.
CIS	(NZTA) Customer Information Services
CMS	Changeable Message Sign
COPTTM	NZTA Code Practice for Temporary Traffic Management.
Design Wind Speed	Ultimate wind speed at the site based on terrain and return period.
DHCP Delivered IP	Dynamic Host Configuration Protocol - it allows devices to configure their own network settings by querying a host server about the details

	of the network.
DTMF	Dual Tone Multiple Frequency. Also known as touch tones.
Enclosure	The enclosure housing the display and the electronics systems immediately associated with the display.
Ethernet Protocol	Industry standard network Broadcast technology.
FAT	Factory Acceptance Test (Also see SAT).
FCD	Field Controller Device.
Frangible	Performance capability of structures, which are designed to shear or collapse when struck by a vehicle, minimising the impact hazard to the vehicle's occupants.
Gantry	In the context of this document, a support structure with legs on each side of a carriageway, designed to support an overhead sign.
GDM	NZTA Geometric Design Manual.
GPRS	General Packet Radio Service.
GSM	Global System for Mobile communication
HVU	High Volume Urban. In the context of this document HVU refers to non-motorway, generally high volume roads, in urban environments.
ITS	Intelligent Transport Systems.
Lantern	In the context of this document, a lantern consists of multiple LEDs in a circular grouped array.
LCD	Liquid Crystal Display.
LED	Light Emitting Diode.
Line Spacing	The vertical space between lines of text. Line spacing is expressed as the number of rows of blank pixels.
Luminance Ratio	The ratio of light emitted from the active display area, to that of the inactive display area when illuminated by an external light source.
M 23	NZTA specification for Road Safety Barrier Systems.
MACA	Monitoring And Control Application. NZTA's software that monitors and controls VMS message changing.
MIB	Message Information Block
Motorway	Roads designated as motorways, generally characterised by high volume multilane carriageways.
MOTSAM / TCDM	The NZTA *Manual Of Traffic Signs And Markings,* and its progressive replacement, the Traffic Control Devices Manual.
NCHRP 350	National Highway Cooperative Research Programme report. *Recommended Procedures for the Safety Performance Evaluation of Highway Features.*
NTCIP	National Transportation Communications for ITS Protocol.
NZTA	NZ Transport Agency
P/24	NZTA Performance Based Specification for Traffic Signs, which covers performance of frangible structures.
Pixel	A single point in a graphic image. In the context of this document pixels must achieve the viewing angle, luminance, and other performance characteristics described in this Specification. The performance characteristics may be achieved with a pixel consisting of a single LED, or closely grouped LEDs, that present a single point of light at a normal viewing distance.
Pixel Pitch	The distance between centres of adjacent pixels.
RCA	Road Controlling Authority
Regional VMS	In the context of this document Regional VMS refers to non-Motorway VMS. Regional VMS are not as large and are generally mounted on roadside structures as opposed to overhead gantries.

Road Reserve	A corridor of land owned by the crown, which is designated for roading infrastructure.
RS-232/485	Is a standard for serial connections
Rural	In the context of this document Rural refers to low volume uncongested roadways in non-urban environments.
SAT	Site Acceptance Test (Also see FAT).
SNMP	Simple Network Management Protocol
Stroke	Stroke may be illustrated using the letter "T": In single stroke the cross arm and the down leg are *one* lit pixel in thickness. In double stroke the cross arm and the down leg are *two* lit pixels in thickness.
Support Structures	Structures supporting VMS.
TCDM	Traffic Control Devices Manual.
TTM	Temporary Traffic Management.
UB	Universal Beam. Used in this document in context of support structure materials.
UMTS	Universal Mobile Telecommunications System
UPS	Uninterruptible Power Supply.
VMS	Variable Message Sign.
Word Spacing	The horizontal space between the end of one word and the beginning of the next word on the same line of text. Word spacing is measured between the closest edges of illuminated pixels of adjacent words. It is expressed as the number of blank pixels.

1.3. VMS Display Technology Options

For all VMS applications, NZTA has selected LED display technology as the default technology of choice for the displays. This provides good visibility under most viewing conditions and has low maintenance requirements.

The VMS display must consist of a full matrix; and be capable of displaying a single steady screen and 2 alternating screens depending on message length.

Other technologies may be considered subject to specific approval from NZTA National Office Network Operations – Customer Information Services Manager.

2. General Description of VMS Categories

2.1. Motorway

Motorway environments are characterised by high volumes, multiple lanes and frequent congestion. Motorway VMS generally exhibit the following features;

- Large full matrix displays consisting of three lines with 18 characters having 400mm high text, capable of being read by large volumes of traffic travelling at high speed
- Mounted on overhead gantries to ensure all lanes of a multi-lane environment can view the message. In many cases the gantry structures and VMS displays are provided as an integrated package.
- Controlled singly or in groups from a remote Traffic Operations Centre (TOC).
- Located in an urban environment where power and fixed line communications technologies are readily available, (Fibre optic cable, subscriber based ADSL lines).

2.2. Regional VMS

Regional VMS encompass:

1. ***High Volume Urban (HVU) VMS***
2. ***Rural VMS***

Regional VMS contrast to ATMS motorway VMS in that they generally:

- Have smaller display sizes with either 300mm or 200mm character height, and either four or two line displays.
- Are mounted on roadside supports located on the left side of the highway within the road reserve, or sometimes on private land.

2.2.1. High Volume Urban VMS

High volume urban (HVU) VMS have similar functional applications to motorway VMS, but can be located in lower speed environments that are either single or multi-lane.

The HVU VMS displays may have a smaller character size, and a correspondingly smaller display size based on road and speed environment. The signs are generally positioned in the road reserve, rather than overhead on a gantry.

2.2.2. Rural VMS

The Rural VMS application is characterised by significantly larger geographic coverage of NZTA's network, and low volume uncongested roads.

- Located on low volume roadways typically consisting of one lane in each direction, where motorists can slow down or pull out of the traffic flow while they consider their response to the VMS message.
- May be sited in isolated rural locations where there are minimal competing artificial light sources.
- May be located long distances from critical incident locations, or alternative routes (50 - 100 km is not uncommon).
- Often have cross-regional function, in that the messages displayed may also have relevance in adjacent NZTA region(s).
- The isolated nature of some sites may mean that access to mains power, and fixed line and cellular communications systems is not readily available.

3. Summary Tables of Main Attributes

3.1. Summary Table of Motorway VMS

The main attributes of NZTA's Motorway VMS are summarised in the following table.

The table is intended as a quick reference only. Please refer to the relevant section of the manual for the ***full list of attributes***, and further relevant details.

Table 1: Motorway VMS Main Standard Attributes Summary Table

Attribute	Specification	Reference Section
Design life of Motorway VMS	15 years	
Character height	400mm for overhead mount or side mount with <6m offset (450mm is required for side mount with >6m offset)	4.1.1
Number of pixels across	Minimum 124 pixels per line	4.1.1
Number of pixels vertically	Minimum 30 pixels	4.1.1
Number of lines of characters	3 lines	4.1.1
Pixel configuration	Full matrix	4.1.1
Display font / pixel spacing	NZTA approved font Spacing in Section 4.2.7	4.2.7
Lanterns	Optional	TBA
Visual performance	In accordance with EN 12966-1	
Beam width	EN 12966-1. Class B2. (Corresponds to 14° minimum total angle)	4.2.2
Display colour	EN 12966-1. Class C1.	4.2.4
Luminance	EN 12966-1. Class L3.	4.2.5
Luminance ratio	EN 12966-1. Class R3.	4.2.5
Front of display cover	UV stabilised polycarbonate >4mm thickness ***or*** a design that meets the specified impact test	5.1
Display to be shaded	Internal louvers or drilled external mask	5.1.1
Bezel width	Minimum 300mm	5.1.1
Colour of enclosure	Front including bezel: matt black Rear top bottom & sides: semi gloss aircraft grey	5.1.4
Environmental protection	EN 12966-1. Class T1. (Corresponds to -15°C to +60°C)	5.3
Ingress protection	EN 12966-1. Class P2. Water (Minimum IP55) EN 12966-1. Class D3. Dust & other pollutants	5.3

3.2. Summary Table of Regional VMS

The main attributes of NZTA's Regional VMS are summarised in the following table.

The table is intended as a quick reference only. Please refer to the relevant section of the manual for the ***full list of attributes***, and further relevant details.

Table 2: Regional VMS Main Standard Attributes Summary Table

Attribute	Specification	Reference Section
Design life of Regional VMS	15 years	
Character height & Number of lines of characters	Type A: 300mm x 4 lines	4.1.1
	Type B: 300mm x 2 lines	4.1.1
	Type C: 200mm x 4 lines	4.1.1
	Type D: 200mm x 2 lines	4.1.1
	* Type F: 160mm x 2 lines	
Number of pixels across	96 - 100 pixels per line	4.1.1
Number of pixels vertically:	4 line VMS: minimum of 38 pixels 2 line VMS: minimum of 18 pixels	
Pixel configuration	Full matrix	4.1.1
Display font / pixel spacing	NZTA approved font Spacing in Section 4.2.7	4.2.7
Visual performance	In accordance with EN 12966-1	
Beam width	EN 12966-1. Class B5. (Corresponds to 30° minimum total angle)	4.2.2
Display colour	EN 12966-1. Class C1.	4.2.4
Luminance	EN 12966-1. Class L3.	4.2.5
Luminance ratio	EN 12966-1. Class R3.	4.2.5
Front of display cover	UV stabilised polycarbonate >4mm thickness ***or*** a design that meets the specified impact test	5.1
Display to be shaded	Internal louvers or drilled external mask	5.1.1
Bezel width	Minimum 200mm	5.1.1
Colour of enclosure	Front including bezel: matt black Rear top bottom & sides: semi gloss aircraft grey	5.1.4
Environmental protection	EN 12966-1. Class T1. (Corresponds to -15°C to +60°C)	5.3
Ingress protection	EN 12966-1. Class P2. Water (Minimum IP55) EN 12966-1. Class D3. Dust & other pollutants	5.3

* Type F is only recommended for slow speed sites with tight space constraints

4. Display

4.1. Display Attributes

4.1.1. Display Size

The choice of display is dictated by the intended ITS application and message requirements. For the previously described applications, NZTA utilises the following standard VMS display types:

Table 3: Standard Display Types

	Number of Lines of Characters	Number of Pixels per Row	Number of Pixels Vertically	Minimum Character Height mm
Application	Standard	Standard*	Minimum	
ATMS Motorway	3	124	30	400
Regional 4 line	4	96 - 100	38	200/300
Regional 2 line	2	96 - 100	18	200/300

* Having the standard number of pixels per row is important to ensure compatibility with NZTA control software and other NZTA systems. For special applications written approval must be obtained from NZTA National Office Network Operations CIS Manager for any VMS with non-standard numbers of pixels per row.

Both vertical and horizontal spacing of pixels must be the same across the entire display.

Full matrix signs are now standard for all NZTA applications where the flexibility to support text heights greater than the standard line height and/or graphics in the future is required.

4.2. Visual Performance

Except where explicitly defined by this manual the **visual performance** elements of the display shall be in accordance with the European Standard EN 12966-1. All testing of visual performance characteristics shall be undertaken in accordance with the European Standard EN 12966-1.

4.2.1. Display Flicker

The displayed image must not appear to flicker to the normal human eye. Each light pulse must be displayed for at least 0.16 milliseconds. Emitted light shall have a frequency of not less than 90 Hz.

4.2.2. Beam Width

The LED elements for **Motorway VMS** shall meet **Class B2** for EN 12966-1.
I.e. have a minimum of fourteen (14) degrees total beam width.

The LED elements for **Regional VMS** shall meet **Class B5** for EN 12966-1.
I.e. have a minimum of thirty (30) degrees total beam width.

Some situations may require a different LED to be specified.

4.2.3. LEDs

VMS suppliers are required to provide evidence that LEDs supplied as part of any VMS sign meet the quality, life expectancy, candela ratings and batch requirements outlined in this document and any referenced external standard. Details of the current rating of the proposed LEDs to be used, and what actual current they will be driven at to meet the candela requirements for the VMS required must also be provided.

LEDs must all be sourced from the same batch / bin to mitigate minor variations in colour.

In achieving the candela ratings no LED or group of LEDs shall be “overdriven” or supplied additional current so the stated LED life expectancy is compromised. (NZTA’s standard for VMS LED life expectancy is 150,000 hours).

All soldering of LEDs required to form pixels will be of a type that minimizes the exposure of the LEDs to sudden excess heat and creates a reliable, tested set of connections, (wave soldering combined with component PCB preheating) and meet viewing angle performance levels.

The VMS display shall consist of display modules. There is no standard size but each display module shall not be significantly larger than a character in size. The display modules must be easy to swap / replace without requiring any soldering or any other form of heat based bonding to other electrical components as part of the process. It is preferred that any process to swap/replace display modules can be “tool-free” (see 5.1 Enclosure Design).

Where a pixel is comprised of more than one LED, the LEDs shall be grouped to form a symmetrical circular, square or diamond shaped pixel in the display matrix.

4.2.4. Display Colour

The colour of all LED’s shall be yellow and co-ordinates shall meet the C1 class for Colour, described in the European Standard EN 12966-1.

4.2.5. Display Intensity

The display shall meet the L3 class for Luminance, and the R3 class for Luminance Ratio, described in the European Standard EN 12966-1.

The VMS shall include two (2) integral light sensors to measure the ambient external light conditions and automatically adjust the intensity of the display to a minimum of ten different levels. The system must respond appropriately to ambient light intensities between full sunlight and complete darkness. One sensor shall be mounted in the front face and aligned straight ahead of the VMS. The other shall be

mounted in a rear surface of the enclosure and aligned straight to the rear. Both sensors must be aligned horizontally. The support structure must not interfere with operation of either sensor. This system shall ensure that the luminance output of the sign is maintained in accordance with ambient light conditions; *especially when there is low sun directly infront of, or low sun directly behind the VMS.*

The control system shall ensure that:

- The intensity of the display is unaffected by short fluctuations in ambient light conditions.
- Each light sensor reading shall be averaged over a 180 second (configurable) period of time.
- Light sensors are to provide averaged readings.
- The *higher average* shall be used to set the intensity of the display.

4.2.6. Display Refresh

The time to display a fully populated message (i.e. all pixels active) generated at the VMS controller unit shall not exceed 0.5 second from a blank state.

4.2.7. Font Display

The VMS controller shall be capable of generating the following display fonts and text layout:

- Font — NZTA's Motorway or Regional VMS font respectively
- Character height — 7 pixels
- Character width — 5 pixels (Note I, E, F, & L can be 3, 4, 4, & 4 pixels)
- Character spacing — Blank pixel(s) total must equal or exceed stroke
- Word spacing — 5 blank pixels
- Line spacing — 3 or 4 blank pixels – configurable
- Proportional spacing

The VMS shall also be able to generate the following fonts:

- Double stroke
- Double height (14 pixels)
- Capable of displaying any combination of text and numerals, including standard punctuation and arrow display

The associated controller software functionality shall allow;

- Centre, left or right justification

5. VMS Enclosure and Roadside Cabinet Requirements

5.1. Enclosure Design

The structural design of the VMS enclosure, including the load on the sign face and mounting hardware, shall comply with the requirements of the NZTA Bridge Manual - SP/M/022.

For Regional VMS the enclosure must be sufficiently strong and rigid to support its weight on the vertical supports, and for the standard design solutions to act as the structural connection between the supporting posts.

The VMS enclosure shall be constructed from sheet metal (aluminium or galvanised mild steel) treated as necessary to provide the required protection and mechanical strength for the application and environment. Materials used shall ensure deterioration due to atmospheric and/or local environmental conditions shall have no detrimental effect on the structural integrity or visual appearance (including colour fading or corrosion) of the finished enclosure for a period of not less than fifteen (15) years. Contact between untreated, dissimilar metals shall be avoided.

The enclosure shall be constructed to present a clean, neat appearance.

The design shall ensure that the sign display and control elements are easily accessible and removable for maintenance purposes. Display elements shall be designed such that replacement requires only the loosening of accessible screw fixings or other suitable fastening arrangement and disconnection of power or control connections only.

The enclosure interiors should be non-corrosive metal cage support frames to mount the display elements. The frame support shall be able to withstand and minimize vibration when the sign is mounted with any number of display elements. All power supply, control and communication cabling shall enter the sign housing through appropriately constructed, sealed and glanded entry holes.

The enclosure shall be provided with at least two lifting eyes to be used when mounting the enclosure on the sign structure. The lifting eyes shall be appropriately located ensuring sufficient structural strength to allow the sign to be lifted or moved without causing any damage or permanent deformation to any part of the sign.

Where enclosures are of a ‘walk-in type’, internal lighting shall be provided within the sign using incandescent light fittings.

All enclosures shall be fitted with a minimum of two single-phase switched 10A rated power outlet sockets, PDL 56 series, for portable maintenance equipment.

The standard design to protect the front face of the display shall be a UV stabilized, and UV filtering, polycarbonate panel (not < 4mm) covering the display elements.
Alternatively a design that meets the EN 60 598-1 Impact Test as described in EN 12966-1:2005 (E), may be submitted for consideration at time of tender, provided it is accompanied by the impact test result from a certified independent testing laboratory.

5.1.1. Display Shading & Bezel Requirements

The front of the sign shall have internal louvers; or a matt black coloured drilled mask made of aluminium mild steel or a suitably robust compound mounted over the polycarbonate panel; which allows pixels to meet the stated parameters for optical performance.

The bezel surrounding the primary display elements should have a width minimum of at least 300mm for Motorway VMS, and 200mm for regional VMS. Note the bezel must be included as part of the total sign surface for wind loading calculations.

5.1.2. Vertical Alignment

Angling the display face slightly downwards generally reduces specular glare and reflections on the display face.

Motorway VMS and Regional VMS must either have an enclosure with a front face which is angled down 5 degrees; or an enclosure that can be mounted with the front face angled down 5 degrees where the design of the doors, door stays, weepholes, and all other equipment still ensures satisfactory operation.

5.1.3. Mounting to Support structure

The VMS enclosure shall include structural attachment points, bolts and clamps to mount the VMS on the support structure.

5.1.4. Colours

The front panel of the enclosure and any bezel shall be coloured matt black.

The back, top, bottom, and sides of the enclosure shall be coloured aircraft grey to No 693 as referred to in BS381C or similar. The finish shall be semi-gloss to reduce the effects of specular glare.

5.1.5. Total Sign Mass for Frangible Signs (Types D & F)

Type D and Type F VMS are often mounted on a frangible support structure. To ensure the total mass of the sign plus above ground support structure does not exceed 270 kg, *the weight of Type D and Type F VMS must not exceed 190 kg.*

5.2. Doors and Maintenance Access

All covers, doors, protective screens, plates, glands, external connectors etc shall be provided with rubber seals or equivalent materials which are maintenance free and shall remain effective for the design life of the equipment.

Door seals are considered essential to protect against ingress of insects. In addition they may form part of the water and pollutant ingress protection systems.

Where access doors are provided, they shall be fitted with a suitable ‘stay’ to retain the door in the open position for the safety of maintenance personnel working inside the enclosure. For security, access doors and panels shall be fitted with suitable

locks. Unless specified otherwise all access door locks shall have an identical key, and the supplier shall provide at least 4 copies of the key.

For Regional VMS the bottom of the enclosure is located 3.0 m above ground. The design should ensure ease of access to components for ladder-based access, or facilitate use of portable access equipment (e.g. scissor lift, or cherry picker).

The design shall eliminate or minimise:

- The need for a lane closure during maintenance
- Exposure to errant vehicles

5.3. Environmental Protection

The equipment located within the enclosure shall be protected from moisture, dust, dirt, corrosion and insects.

The enclosure shall provide a minimum IP55 ingress protection as described for Class P2 in Table 16 of the European Standard EN 12966-1.

The enclosure shall provide a minimum ingress protection against dust and other pollutants as described for Class D3 in Table 17 of the European Standard EN 12966-1.

Unless otherwise advised, the VMS is required to operate in Temperature Range Class T1 in EN 12966-1 Table 8. This range corresponds to a minimum temperature of -15^0C and a maximum of $+60^0$C.

The display cabinet shall include a suitable venting and/or air-cooling system to ensure the manufacturers recommended maximum operating temperature or humidity conditions are not exceeded. All fans and other forced air devices shall be thermostatically controlled and use standard-size removable filters.

As far as practicable the design shall ensure that no untreated/unfiltered external air is able to come into contact with any electronic equipment within the sign.

In order to operate in the specified temperature range, consideration must be given to preventing the accumulation of condensation, or possible snow build up on the display. This may be achieved as a direct result of heat being generated from power supplies in the sign. A heating element (such as a heat strip or wire) may need to be installed around the front panel to prevent ice or frost accumulation on the sign face.

Weep holes must be provided to allow the drainage of any water that may collect in the display cabinet and a suitable moisture inhibitor may be used. Weep holes shall be positioned and protected to prevent ingress of dirt and moisture, and be fitted with insect mesh.

5.4. Interface Between VMS and Support Structure

Where the VMS and the civil works are procured through separate contracts, the interface or integration between the VMS enclosure and the support structure must be closely managed.

Unless otherwise agreed, the Project Manager responsible for the VMS contract shall:

- Determine the VMS dimensions, weight, and method of attachment to the support structure with the contractor supplying the VMS. A clear distinction must be made between the dimensions of the enclosure plus tolerance that are required for connection to the support structure, and the dimensions of the enclosure plus the surrounding bezel (which may be bolted to the enclosure) which are relevant for wind loading calculations.
- Coordinate design for attachment of the VMS to the support structure.
- Communicate this information to the Engineer(s) responsible for the VMS and for the civils works.

5.5. Roadside Cabinet

Where an external roadside cabinet is required, the cabinet shall:

- Be sized to house all communications equipment, comms termination, power supply, batteries/UPS, and power meter. The cabinet shall include two (2) empty 19 inch rack unit spaces to allow for addition of future technology.
- Be manufactured of galvanised steel or aluminium, with an exterior paint finish consistent with the environment (colour beige unless specified otherwise)
- Provide a minimum IP65 ingress protection to AS1939 -1990.
- Be free standing with a front opening door
- Be lockable and with a different key to the sign enclosure
- Be fitted with a minimum of two single phase switched 10A rated power outlet sockets for portable maintenance equipment
- Be fully equipped to withstand Class T1 environmental conditions
- Be fully equipped to maintain the required operation conditions for the equipment which is to be enclosed within the cabinet

6. Communications

All communications and related equipment shall conform to the standards defined by the following NZTA document:

NZTA NTCIP VMS MIB 2011 V3

6.1. Field Control Device

6.1.1. Controller Functional Requirements

A Field Control Device (FCD) located at each VMS site shall be capable of operating the sign in both local control mode (i.e. no external communications) and remote control mode (communicating with an external central control system).

This controller must support NTCIP (NTCIP 1203 for Dynamic Message Signs) and as a minimum support the elements defined in NZTA NTCIP VMS MIB 2011 V3.

The VMS FCD shall provide the electronics necessary to:

- Receive and issue SNMP commands from / to the NZTA central control system.
- Communicate using SNMP commands over Ethernet TCP/IP protocols; Serial tunnelling (RS232 to Ethernet) devices for primary control are not permitted.
- Control the display of messages on the sign.
- Report errors to the central control system.
- Receive direct manual instruction from vendor proprietary PC software (local or remote).

The FCD shall support NTCIP in accordance with NZTA NTCIP VMS MIB 2011 V3.

The FCD shall have sufficient memory to store a minimum of 150 message strings for immediate display upon command from the VMS master or local control that could include operating from a timer. The controller shall also have sufficient RAM memory to upload and download non-library messages. Graphics should be supported in the field controller if the display technology chosen is suitable for displaying graphics.

The FCD shall incorporate a watchdog timer to detect an out-of-program condition and reset the controller. Additionally, a remote reboot function would be required based on input from watchdog timer or other inputs, local or remote.

The FCD shall be designed for fail-safe prevention of improper information display in the case of malfunction. As a minimum, this shall include the ability of an automatic blanking feature, which immediately clears the message displayed on the sign in the event of internal or external failures such as a communications failure with the central control system, invalid transmission from the VMS control system, or power failure.

In local control mode (no external communications), the FCD shall have as a minimum: operator selection of dimming levels, operator selection of pre-stored messages, and diagnostic routines capable of testing full sign operation.

The local control shall be accomplished via thumbwheels, key switch, or with a menu-driven LCD display (preferred).

The FCD shall be provided with an interface for plugging in a laptop computer running a Microsoft Windows Operating System for configuration, diagnostic testing and downloading/uploading messages.

6.1.2. Pixel Failure Criteria

Currently the NZTA implementation of the pixel failure criteria allows for three failed pixels per character module before a critical error must be reported (including instances where there are multiple LEDs per pixel).

Three pixel failures per character module are tolerated. Once the threshold of three pixel failures per character module is exceeded the VMS must blank and the associated errors reported to the central control system.

6.1.3. FCD Location Considerations

In general, there are three possible locations for the VMS FCD controller;

1. Within the sign enclosure.

   This is the default configuration for small HVU or Regional VMS. Any local control keypad should be securely located on the offside support post at chest height. A suitable housing for any power termination and communications equipment may still be required, (if not located within the sign enclosure).

2. In a field cabinet at the immediate base of the VMS support.

   This is a typical Motorway solution as ‘sharing’ the support foundation can make savings, and cabling between the controller and display is minimised. The cabinet is also typically protected from impact behind the support guardrail. Additionally, the VMS support structure is often a good place to mount communication aerials and it is convenient to have the associated communications equipment close to these in the controller cabinet.

3. In a field cabinet upstream of the VMS.

   This option is ideal for ATMS Motorway VMS. However it is likely to be more expensive with additional civil works associated with cabling, cabinet foundations and possible guardrail protection.

The choice of most appropriate controller location is left to the discretion of the designer and the specific requirements of the project and site.

7. Power Supply

7.1. Motorway VMS Uninterruptible Power Supply (UPS)

All Motorway VMS shall be equipped with an uninterruptible power supply (UPS) facility, which shall maintain operation of the controller and communications equipment for a minimum period of 4 hours in the event of mains power failure.

Power to the VMS controller and communications equipment shall be routed via the UPS to ensure a clean and stable power supply.

Batteries shall be of a deep discharge, low maintenance gel type and automatically charged from the mains power supply.

7.2. Regional VMS Uninterruptible Power Supply (UPS)

All Regional VMS shall be equipped with an uninterruptible power supply (UPS) facility, which shall maintain operation of the VMS and ancillary equipment for a minimum of seven (7) hours in the event of mains power failure.
Options include:

- Battery banks
- Back-up generator

Power to the VMS shall be routed via the UPS to ensure a clean and stable power supply.

Batteries shall be of a deep discharge, low maintenance gel type and automatically charged from the mains power supply.

The back-up power facility shall be capable of providing a minimum of seven hours of full VMS operation including pixel lighting in normal daytime mode, communications and controller under normal operational conditions.

7.3. Remote Reboot Capability

Remote reboot capability is advantageous when a site is more than one hours travel from a service person.

When specified, VMS shall be supplied with remote reboot functionality, involving a temporary power cut to the modem, FCD, and all other sign electronics for 10 seconds. The remote reboot device shall be activated by DTMF tones; or it may be activated by another out of band device with prior approval of the CIS Manager.

7.4. Electrical Surge Protection

All display equipment shall be internally protected against damage resulting from:

- Lightning strikes near the VMS/gantry/roadside cabinet
- Electrical transients on power cabling
- Electrical transients on internal & external signal wiring

- Electromagnetic interference
- Static electrical discharge

A lightning protection system shall be installed in accordance with NZS/AS 1768 - 1991. The system shall consist of:

- An air termination to intercept lightning discharges directly
- Down conductors to connect the air terminal to earth terminals. Note that it is possible that these down conductors can be formed from reinforcing steel that may be used in concrete support structures (as applicable)
- Earth terminations to discharge the lightning currents into the general mass of earth. Note that this may in part, or in full, consist of the foundations for the support structure, depending on the calculated required maximum earthing resistance
- Equi-potential bonding between the lightning earthing system and any other earthing systems for personal and equipment protection

Multi-stage surge diversion shall also be provided on the incoming power circuits and communication circuits. Surge diverters shall be field replaceable without the need to disconnect wiring and they shall have integral indicators to show when they have blown (as applicable). A preferred option is to have an auto-reset function which negates the need for an actual site visit.

8. Pre-Award Certification, Testing, and Commissioning

8.1. Pre-Award Certification

Each tender bid must include certification from an accredited independent testing facility, demonstrating compliance with these VMS Specifications for attributes nominated in the following table:

Display colour	**EN 12966-1. Class C1.**
Luminance	**EN 12966-1. Class L3.**
Luminance ratio	**EN 12966-1. Class R3.**
Ingress protection	**EN 12966-1. Class P2. Water (Minimum IP55)**
Ingress protection	**EN 12966-1. Class D3. Dust**
FCD Conformance with NZTA MIB	**Mandatory elements to be agreed with the NZTA CIS Manager**

Additional attributes may also be nominated.

Copies of independent certification for all nominated attributes must be provided with the tender submission, along with evidence to demonstrate that products supplied under the tender will be manufactured to an effectively identical design as the tested product.

The pre-award certification requirements shall be advised in any RFT.

8.2. Factory Acceptance Testing (FAT)

Following internal system testing of the VMS, the Contractor shall provide the Engineer with copies of FAT programmes to be carried out for all key VMS components.

The Contractor shall undertake Engineer (or their representative) witnessed FAT as required by the Engineer on the VMS display/controller following completion and prior to delivery and installation. The FAT may include, but is not limited to;

- Optical testing (Ref 4.2)
- Display of messages in all formats (Ref 4.2.7)
- Environmental protection systems (Ref 5.3)
- Controller functionality (Ref 6.1.1)

The Contractor shall provide full details of testing and acceptance criteria, and the testing methodology for the FAT to the Engineer for approval at least two weeks prior to FAT.

The Engineer shall ensure FAT is undertaken by a competent independent assessor, noting heightened requirements when new types of VMS or firmware update are involved.

The Engineer shall appoint a competent independent assessor from a list of suitably qualified persons recommended by the NZTA National Office CIS Manager.

8.3. Site Acceptance Testing (SAT)

The Contractor shall undertake SAT as required by the Engineer on the VMS display/controller following installation and prior to commissioning. This SAT may include, but is not limited to;

- Any repeat FAT testing as deemed appropriate
- Testing of the power supply and back-up power supply
- Testing of the communications links(s)
- Testing of the central VMS control software application

In all cases, the Contractor shall provide full details of testing and acceptance criteria for the above SAT for the Engineer's approval at least two weeks prior to commissioning.

As is the case for FAT, the Engineer shall appoint a competent independent assessor from a list of suitably qualified persons recommended by the NZTA National Office CIS Manager.

8.4. Commissioning

Following successful completion of all above FAT/SAT, including any modifications and repeat testing the VMS shall be deemed to be commissioned.

9. Post Commissioning Documentation

9.1. As Built Drawings

As built drawings shall be supplied by sign vendors and contractors and will include:

- Support structures
- Installation elevations/plans
- Cabinet drawings
- Power supply arrangements

9.2. Operating Servicing and Maintenance Manuals

The Contractor shall supply an Operating Servicing and Maintenance Manual for all equipment supplied. This shall be carefully laid out with detailed operating procedures for the equipment and systems, including all software supplied. It shall be written in a format that is easily understood by the intended VMS operators.

The manual shall document in detail the maintenance and service aspects of the equipment on an item-by-item basis. This shall include:

- List of Equipment including Part Numbers and procurement source;
- Routine Service/Maintenance Procedures;
- Troubleshooting Guide;
- Details of fault diagnostic features from the control centre;
- Other fault diagnostic procedures to be followed;
- Testing Procedures;
- Software Maintenance Procedures;
- Circuit Diagrams.

10. Maintenance and Spare Parts

The VMS supplier shall provide maintenance services for the contract maintenance period. This will normally be two (2) years from the date of practical completion.

Provision of maintenance services shall include, but are not limited to:

- Trained personnel
- Agreements if necessary, with third parties to provide first response services in remote locations.
- Equipment, tools and back up facilities
- Undertaking a routine preventative maintenance programme every 6 months unless otherwise agreed
- Undertaking reactive maintenance visits
- Meeting agreed response times and clearance times, for urgent and non-urgent faults
- Providing reports for reactive and preventative maintenance visits
- Holding an appropriate inventory of spare parts. This inventory of parts shall become the property of NZTA at the end of the maintenance period.

NZTA has an expectation that spare parts will continue to be available for the entire 15 year service life of the VMS.

11. Warranty / Defects Liability

The requirements for any defects liability period, and warranty must be set out in tender documents. The requirements shall be designed for the specific nature of the given project.

For example; where assets are installed and handed over to another party to maintain, a defects liability period in conjunction and appropriate warranty should be specified. However where the VMS supplier is also responsible for their ongoing maintenance for a specified number of years, defects liability may not be necessary.

The optimal maintenance period is dependent on a number factors including the number of assets and scale of installation. For larger projects the contractor may be asked to provide a maintenance facility for an agreed period of time. (See Section 10. Maintenance and Spare Parts).