NZ TRANSPORT AGENCY
WAKA KOTAHI

NZ Transport Agency

MOBILE VARIABLE MESSAGE SIGNS SPECIFICATION (ITS- 06- 04)

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This document is an updated version of the Design Guide & Specification for Mobile Variable Message Signs (VMS)	Tel: E-mail: Fax:

Document Purpose

The purpose of this document is to provide a set of specifications for the design and procurement of NZTA Mobile Variable Message Signs.

It is mandatory that this document be issued in its entirety as part of any Mobile VMS purchase process for Mobile VMS owned by the NZTA.

A separate document titled NZTA Notes for Mobile Variable Message Signs is available to assist site selection, positioning & alignment, and posting of messages for Mobile VMS on the State Highway network and local roads.

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1. INTRODUCTION

1.1 Scope

This Specification outlines requirements for Mobile VMS including display, sign controllers, communication systems, power supply, enclosure, trailer, approved font, 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 Mobile VMS for NZ Transport Agency (NZTA).

Accordingly the scope of this document has been defined as follows:

1. Text based VMS with graphics capabilities – operated as a line matrix via full matrix technology.
2. Communication systems interfacing with the software control system, and the sign controller.
3. Power supply options.
4. The construction requirements for the enclosure and mounting trailer
5. Approved font (Appendix A).
6. Operation of Mobile VMS in conjunction with NZTA's VMS Operating Policy and Procedures.
7. Warranty and maintenance requirements for Mobile VMS.

All Mobile VMS deployed on the State Highway in speed environments at or above 70km/h must meet "Core Attributes" listed in Table 1 from 1 July 2015.

A separate document titled NZTA Notes for Mobile Variable Message Signs is available to assist site selection, positioning & alignment, and posting of messages for Mobile VMS.

A Purchasing Checklist is provided in Appendix B. The Purchasing Checklist is to be provided to the supplier with each order to clarify optional items that may be required.

A Supplier's Equipment Schedule is provided in Appendix C. The supplier must furnish NZTA with a complete schedule as part of any pricing submission.

1.2 Definitions and Acronyms

Term/Acronym	Definition
Approved font	A slightly compressed font approved by NZTA which must be used for NZTA Mobile VMS
Barrier Protection	Generic term covering various roadside protective barrier systems including rails, fences, and crash cushions, which are designed to restrain vehicles which are out of control.
Bezel	The border area 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.
CIS	(NZTA) Customer Information Services
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.
Dynac	The NZTA's software that monitors and controls most ITS applications, and is used to change VMS messages.
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
FCD	Field Controller Device
GDM	NZTA Geometric Design Manual.
GSM	Global System for Mobile communication.
GVM	Gross vehicle mass.
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
MACA	Monitoring And Control Application. NZTA's software that monitored and controlled VMS message changing was replaced by DYNAC in 2012.
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
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.
RCA	Road Controlling Authority
Road Reserve	The area from the legal boundary on one side to the legal boundary on the other side.
RS-232/485	Is a standard for serial connections
SNMP	Simple Network Management Protocol
TCDM	Traffic Control Devices Manual.
TTM	Temporary Traffic Management.
UMTS	Universal Mobile Telecommunications System
VMS	Variable Message Sign.

1.3 VMS Display Technology Options

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

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

2. GENERAL DESCRIPTION

This section outlines the general overarching requirements for Mobile VMS which are intended for all applications on State Highways.

2.1 Major Components

Mobile VMS shall comprise:

- A VMS display panel
- A local sign controller
- All ancillary equipment including power supplies required to operate the equipment
- A trailer to allow transportation between sites upon which the other components are permanently mounted and suitably housed to provide

environmental and security protection, and prevent unauthorised operation

2.2 General Requirements

When in the transportation mode the complete unit shall satisfy all New Zealand legal requirements relating to trailers.

As all of the equipment will be subject to frequent transportation, the supplier shall give due consideration to the vibration and damage that may occur:

- Screw fastenings shall include shake-proof fixtures and fitting
- Where appropriate, threads should be secured with a locking compound
- All auxiliary items shall be securely fastened down at all times
- All cables and conduits shall be securely fixed and sealed to prevent chaffing and ingress from external events (e.g. water)

2.3 Transportation and Operation Modes

The display panel shall have two "modes":

1. **Transportation mode**; this mode will be used for both transportation, and storage when non-operational.
2. **Operation mode**; this mode will be used when Mobile VMS are deployed and a message is displayed.

In transportation mode the position of the display panel shall minimise wind resistance when being towed. This shall be achieved by ensuring that the narrowest part of the display panel faces the direction of travel or lies flat as part of trailer infrastructure.

Operation mode shall only be used when the VMS is stationary. Once in operation mode, the lower edge of the display panel enclosure shall be between 2.10m and 2.50m above local ground level measured to the parking area below the sign.

In operation mode the rear of the trailer and the display panel shall face approaching traffic.

It shall be possible for a single person to easily and securely fix the display panel in the aligned operation modes or transportation mode.

3. SUMMARY TABLE OF MAIN ATTRIBUTES

The main attributes of NZTA's Mobile VMS are summarised in the following table. The table is intended as a quick reference only. Please refer to the relevant section of this Specification for the ***full list of attributes***, and further relevant details.

Table 1: Main Attributes Summary Table

"Core Attributes", required for all Mobile VMS deployed on the State Highway in speed environments at or above 70km/h from 1st July 2015, are in bold highlight in the table below:

Attribute	Specification	Reference Section
Design life of Mobile VMS	10 years	5.1 & 8.2
Character height	**300 – 350mm**	**4.1**
Number of characters & lines	**Minimum 9 characters per line x 3 lines. With approved compressed font, up to 12 characters per line may be possible**	**4.1**
Pixel configuration	**Minimum of 56 pixels across Minimum of 27 pixels high Full matrix**	**4.1**
Pixel spacing / Display font	**Spacing in Section 4.3 Pictures of approved font in Appendix A.**	**4.3 Appendix A**
Alternating panes	**Both single pane, and two alternating panes for message display must be available**	**4.3 Appendix C&D**
Visual performance	**In accordance with EN 12966- 1**	**4.2**
Beam width	**EN 12966- 1. Class B3. Corresponds to 20º 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**
Lanterns	*If specified*	4.4
Radar & Speed Indicator	*If specified*	4.5
Enclosure width	Maximum of 3.7m	5.1
Ingress protection	EN 12966-1. Minimum IP55	5.3
Front of display cover	UV stabilised polycarbonate >4mm thickness coloured matt black	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	Semi-gloss safety orange	5.1.2
Environmental protection	EN 12966-1. Class T1. Corresponds to -15ºC to +60ºC	5.3
Router, comms, controller		6.0
Trailer wind loading in operational mode	40m per second from any direction, with the display raised to the lowest operational configuration	8.1

4. DISPLAY

4.1 Display Attributes

For general use, a three line Mobile VMS with 300-350mm character height is specified. This character height provides a longer reading distance ensuring it is adequate for deployment in the high speed environments usually applicable to the NZTA network. The large sign is also more conspicuous in congested urban situations especially when drivers first encounter a recent deployment. (See the table below).

Table 2: Display Size and Type

Type	No Of Rows	Pixels per Row (Minimum)	Pixels per Column (Minimum)	Character Ht (Minimum)	Lanterns
3x56- 300	3	56	27	300	If specified

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.

Stipulating a minimum 56 pixels per line is designed to provide at least 9 characters per line. Up to 12 characters per line may be possible in conjunction with the approved compressed font.

To provide 3 blank rows between lines of text, the display shall be at least 27 pixels high.

Refer to section 4.4 for specifications covering the lanterns.

Where a Mobile VMS will be consistently deployed in slow speed and/or less congested and/or windy environments, or where the local requirements dictate, an alternative type with 200mm character height may be considered subject to approval from the NZTA Customer Information Services Manager.

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.

4.2.1 Display Flicker

The image displayed on a message screen 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 Mobile VMS shall meet Class B3 for EN 12966-1; i.e. have a minimum of twenty (20) degrees total beam width.

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 of NZTA 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 Mobile VMS LED life expectancy is 100,000 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.

Pixel mounting blocks shall be modular and 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 pixel boards 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 EN 12966-1. The supplier shall provide test results for Luminance and Luminance Ratio from an acceptable independent certified testing body.

The Mobile VMS shall include no less than two integral light sensors (facing forward and to the rear) to measure the ambient external light conditions from all directions and automatically adjust the intensity of the sign display to a minimum of four different levels. This system shall ensure that the luminance output of the sign is maintained in accordance with the ambient and background light conditions, including direct sunlight and darkness. The controller shall ensure that the intensity of the sign display is unaffected by short fluctuations in ambient light conditions by averaging light sensor readings over an appropriate (configurable) period of time.

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.

4.3 Font Display

The Mobile VMS must be able to display the following fonts and text layout:

- Font — NZTA approved font (Refer Appendix A).
- Character height — 7 pixels
- Character width — 3-5 pixels using the approved compressed font.
- Character spacing (pitch) — Equal to or greater than width of down stroke
- Word spacing — 4 pixels
- Line spacing — 3 pixels

The associated controller software functionality shall allow:

- Proportional spacing
- Centre, left or right justification
- Single pane, and two alternating panes, for message display
- Alternating panes shall be displayed at 3 seconds per pane.

4.4 Lanterns – if Specified by NZTA

Lanterns (if specified) shall be 125mm in diameter, located at each corner within sign enclosure, and centred at least 100mm from the horizontal and vertical edges on the display.

The lanterns shall:

- Allow the operator to remotely display messages with, and without, activating the lanterns
- When activated, the lanterns shall flash alternately at 1 Hertz, and be configurable to simultaneously flash diagonally opposite corners, or top-bottom-top.
- Have an optical performance equal to or better than a minimum luminous intensity on the 0° Horizontal and 0° Vertical axis of 500cd.
- Have a luminance uniformity of 10:1 or better.

- When measured on-axis under simulated solar illumination of 40,000 Lux at an angle of 10° to the axis, have a ratio of the actual luminous intensity of the lantern light to the luminous intensity of the phantom signal greater than 8:1.

4.5 Radar and Speed Indicator Function – if Specified by NZTA

On some occasions NZTA may wish to deploy the Mobile VMS as a speed indicator device. If this function is specified by NZTA the following requirements must be met.

4.5.1 Radar

The radar shall be activated by an approaching vehicle only, and not one travelling in the opposite direction. It shall have a normal operating range of approximately 200m.

The radar unit shall be totally enclosed within the display cabinet, and be fixed to an easily aimed adjustable mounting e.g. a gimbal type.

Once a vehicle enters the radar field, the radar must be consistently capable of registering the speed and sending a message to the display in <100 milliseconds.

The radar shall be accurate to +/- 2%.

Technical specifications of the radar are to be provided by the supplier.

4.5.2 Controller, Threshold Adjustments, & Messages

When the Mobile VMS is used as a speed indicator device, the display controller shall incorporate an adjustable lower threshold which, when it is not exceeded, results in the sign remaining blanked. This threshold will typically be set 20 kph below the posted speed limit.

When the nominated lower threshold is exceeded the words “YOUR SPEED” shall be displayed, *and* the approaching vehicle’s speed shall be displayed as a figure in kph.

When the nominated upper threshold is exceeded the words “YOUR SPEED” and the speed figure shall be replaced by the message “SLOW DOWN”. When the message “SLOW DOWN” is displayed, the words “SLOW” and “DOWN” shall alternate at one second intervals.

The lower and upper thresholds shall be adjustable in steps no greater than 5kph.

5. DISPLAY CABINET

5.1 Enclosure Design

The display cabinet shall not exceed 3.7m in width to assist deployment where space is limited, unless otherwise agreed with NZTA National Office and Network Operations staff.

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 display cabinet for a period of not less than ten (10) 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 via finger movement 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 enclosure through appropriately constructed, sealed and glanded entry holes.

The front face of the display shall be protected by a UV stabilized, and UV filtering, polycarbonate front panel (not < 4mm) covering the display elements.

5.1.1 Display Shading and Bezel Requirements

The front of the sign shall have matt black coloured 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 minimum width of at least 200mm. Note the bezel must be included as part of the total sign surface for wind loading calculations.

5.1.2 Colours

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

The back, top, bottom, and sides of the enclosure shall be coloured safety orange. The finish shall be semi-gloss to reduce the effects of specular glare.

5.2 Covers and Doors

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.

Where access doors, including battery compartment doors, are provided, these shall be fitted with a suitable 'stay' to retain the door in the open position for the safety of maintenance personnel working on the display panel. 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.

Access doors comprising a sliding arrangement should avoid having an exposed bottom rail which may act as a dirt trap.

5.3 Environmental Protection

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^{0}C and a maximum of $+60^{0}$C.

The equipment located within the enclosure shall be protected from moisture, dust, dirt, and corrosion. The enclosure shall provide a minimum IP55 ingress protection as described for Class P2 in Table 9 of EN 12966-1.

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.

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

6. ROUTER, COMMUNICATIONS AND SIGN CONTROLLER

6.1 Router, Communications and Sign Controller - Functional Requirements

The Mobile VMS shall be able to be operated in the following control modes:

- Local control mode (standalone) using built in controls.
- Remote and Local control mode using proprietary software installed on a computer running Microsoft Windows. Vendor to provide software unless otherwise specified. The vendor will also supply a cellular router, and a description of this shall be submitted for approval by the NZTA Customer Information Services (CIS) Manager.
- Remote control mode using NTCIP Version 1 (and should include capability to upgrade to Version 3 in the future) from an NZTA approved control system via an NZTA approved cellular router. The vendor shall discuss with NZTA CIS Manager, any requirement to connect with a national control system.

The Mobile VMS shall be capable of operating in both local control mode (i.e. no external communications) and remote control mode (communicating with an external control system). Any communication – local or remote, will be made through a sign controller installed within the VMS. Remote control will be through a cellular router.

An external antenna is required and shall be mounted in an appropriately secure position.

To fulfil all of NZTA's requirements it may be necessary to have more than one sign controller and this is accepted.

The Sign Controller shall be able to send alphanumeric displays from a library of pre-defined screens and messages stored within the controller via three separate mechanisms:

- A locally stored program schedule activated by sign control keypad
- Direct instruction from a remote or local PC/Laptop via vendor communications software/hardware
- Direct instruction from an NZTA NTCIP VMS control system using Ethernet / SNMP communications protocols approved by the Engineer

The Sign Controller shall have sufficient memory to store a minimum of 150 message strings for immediate display upon command from the VMS master or local control. The controller shall also have sufficient RAM memory to upload and download non-library messages.

When controlled remotely via NTCIP the sign controller shall provide the electronics necessary to:

- receive and interpret SNMP commands from the VMS central control system
- to issue a SNMP response to the VMS central control system
- to display messages on the sign.

6.2 Sign Controller – Operational Requirements

Each Mobile VMS Sign Controller shall have as a minimum:

- Monitor, control and capture the operation of the Display Panel, all power sources and ancillary equipment in both local and remote mode
- Control the operation of the Display Panel and lanterns to display messages
- Act as an interface to all external control sources
- Provide information to operators at the sign.
- An interface for plugging in a laptop computer for running diagnostic testing and downloading/uploading messages.

The Sign Controller shall be housed in a secure enclosure, which shall be mounted on the Mobile VMS trailer. The enclosure shall have a minimum rating of IP56.

The Sign Controller shall support NTCIP in accordance with the NZTA ITS-06-03. In brief this requires the controller to include an Ethernet interface with a fixed IP address and to support SNMP for device management.

The Sign Controller shall:

- Operate without user intervention for extended periods of time
- Restart upon power resumption, or a reset, without user intervention. (N.B. In this case 'without user intervention' shall mean that no human interaction is required to restart the equipment, acknowledge alarms, press keys, etc.)
- Incorporate a password or other means of protection to prevent unauthorised setting of messages or changes to operational parameters for devices where there is an embedded server accessible with a computer or other manually accessible menu system. There is no requirement to password protect the Ethernet/NTCIP interface that the NZTA cellular modem would interface with.
- Provide separate levels of access as a minimum for "Operator" and "Supervisor" access.
- Provide information to local users. This may be in the form or individual status indicators or a display panel. The local information shall typically comprise:
    - Current configuration
    - Any fault status
    - Status of power supplies and stored charge
- Include a hardware based 'Watchdog' facility which in the event of a major fault shall automatically re-initialise the display.
    - A "major fault" shall be one which prevents a message from being correctly displayed, or a major failure of an element of the VMS.
    - The occurrence of such events shall be recorded within operational/fault logs

  - The occurrence of such events shall also be reported in accordance with NZTA control system protocol when such a control system is enabled.
- Include an easily accessible reset switch for use in the event of any irrecoverable software 'lock-up' or for other maintenance purposes.
  - The switch shall not be accidentally operable i.e. operated by inadvertently knocking the switch during maintenance work;
  - The switch shall be located within a locked equipment enclosure.

An associated local control application shall be provided to run on a laptop *as part of any Mobile VMS sign supply contract* and shall provide the facility for control of the sign functions and confirmations, alarm/status alerts and faults, including:

- Power failures
- Communication status
- Displayed message/legend conflicts/confirmations
- Display element failures
- Actual luminance levels (lx)
- Luminance setting of the sign
- Any other alarms as generated by the sign indicating a failure or imminent failure of any components.

Any error condition should be made available for reporting through NTCIP short error codes. Where there is not a direct error code in NTCIP, NZTA are to be consulted for the best way to report this error.

Tests for compliance for NTCIP control and error reporting may be undertaken.

The supply of such software does not remove the requirement for a manual method of changing preset messages via an input device located on the Mobile VMS.

7. POWER SUPPLY

7.1 General

All onboard electrical equipment of the Mobile VMS shall be capable of operating from mains power, and onboard batteries.

All Mobile VMS shall be able to operate without connection to mains electricity for **170 hours (1 continuous week).** This may comprise a combination of onboard batteries plus onboard energy generation. The exact configuration shall be submitted by the supplier.

If batteries and onboard generation is used, the batteries must be able to run the display for at least 48 hours without recharging (starting from a fully charged state).

The onboard equipment may operate from a number of electricity sources; however NZTA's preference is batteries recharged by solar. Specific approval must be obtained from NZTA before Mobile VMS with non- preferred power sources are supplied.

The Mobile VMS shall be provided with an automatic changeover system between each energy source.

The display panel and all ancillary equipment shall be designed to minimise power consumption.

The complete electrical installations shall comply with AS/NZS 3000: 2007, and AS/NZ 3001: 2001.

7.2 Batteries

Batteries shall:

- Provide sufficient storage to run the sign for at least 48 hours without recharging
- Be sealed and maintenance free
- Have a minimum design life of 24 months
- Incorporate control circuits to prevent deep-discharging of any batteries
- Be easily maintained in a charged state from a mains supply, in readiness for deployment at short notice.

7.3 On Board Generation

7.3.1 On Board Generation Requirements

The Mobile VMS may be provided with an onboard electricity generation source.

- This may comprise photo-voltaic solar cells, however other means including a fuel driven generator, may be considered subject to agreement of NZTA
- It may include a combination of sources
- The onboard energy store and the onboard electricity generation source shall be housed in a secure, suitably weatherproof enclosure mounted upon the trailer
- If fuel is required for onboard electricity generation, the fuel and fuel store must comply with any relevant New Zealand legislation relating to dangerous goods
- Where applicable the fuel store shall be bunded such that a failure of the fuel store when at full capacity will not result in a spillage of fuel
- The maximum noise level from any form of generation shall be 75dB as measured at 5m from the Mobile VMS.

Any onboard means of electricity generation requiring a fuel store shall be provided with an emergency fuel isolation facility.

- The handle to the valve may be exposed for ready isolation, or
- Where the valve is concealed it shall be possible to isolate the fuel using a standard tool

7.3.2 Testing On Board Generation and Power Consumption

The onboard equipment shall be designed for unattended operation without a permanent connection to the mains electricity supply. This shall be demonstrated by undertaking the following test on all equipment, for the Test Duration:

- The unit shall operate as described below for 170 hours
- The onboard equipment shall operate continuously and be unattended for the test duration
- The onboard equipment shall operate without a mains electricity supply or any replenishing of fuel supplies for the test duration
- Onboard batteries shall be fully charged and all fuel sources shall be full before testing commences
- Any means of onboard electricity generation shall be operational.

To simulate field conditions, the output generated by any source which does not have onboard fuel supply (e.g. photo-voltaic solar cells or a wind-generator) shall be operated at a maximum of 50% efficiency.

- The display panel shall illuminate 80% of its characters with the symbol 'B'
- Any flashing lanterns shall be operational
- The display panel and lanterns shall be illuminated at 75% of full brightness
- All power sources shall operate the sign within the temperature range -15ºC to +60ºC. However this Test shall be carried out at a nominal operating temperature in the range of + 5ºC to +20ºC

7.4 Mains Power

The Mobile VMS shall be provided with a connection point to allow it to operate from an external mains electricity power supply, and to recharge the batteries.

- The connection point shall be rated at a minimum of IP44
- This external power supply shall operate the display panel and any onboard equipment, and recharge the onboard energy store whenever connected and "live".

The maximum power consumption of the equipment shall be 2.0kW.

The power factor shall be as near unity as practicable. In all operating conditions it shall be not less than 0.85 lagging or 0.95 leading.

A label shall be provided adjacent to the electricity connection point. It shall state values of the following parameters for the equipment:

- Supply voltage
- Supply frequency
- Maximum rated current.

The Mobile VMS shall be provided with a system of earthing which complies with AS/NZS3001: 2001, and AS/NZS 3000: 2007.

- The main system of earthing shall be TN-S
- All extraneous conductive and exposed conductive parts shall be connected to the main earthing terminal.
- The external power supply is to be connected via a 2 pole RCD protection device of 30mA rating.

All mains wiring between modules or within an enclosure shall use the colours defined in AS/NZS 3000: 2007.

The Mobile VMS shall be provided with a main electrical isolation switch. This switch shall be located behind a panel fitted with a hasp and staple, and padlock. The arrangement shall allow the padlock to be easily cut in an emergency. The panel shall be labelled to indicate 'Emergency Isolation'.

The Mobile VMS shall be provided with an external earth connection point to allow an external earth connection to be made.

It should be noted that for any installation of equipment the electrical supply, including the provision of power and earthing cables shall be designed and provided by 'others'.

The demarcation point for this cabling shall be the connection points on the Mobile VMS.

8. REQUIREMENTS FOR TRAILERS

8.1 Construction

The VMS display shall be mounted on a trailer to allow it to be transported to and from deployment sites.

In Transportation mode no part of the equipment (including the display panel, stabilisers and ancillary items) shall extend beyond the main structure of the trailer.

In Operation mode the Mobile VMS shall be designed to withstand wind loadings of:

- 40m per second from any direction, with the display raised to the lowest operational configuration

- 45m per second from any direction with the display fully raised and with the trailer lashed down.

The trailer shall be constructed to fully comply with New Zealand's legal requirements for road trailers. The trailer shall be fitted with a manufacturer's plate. This shall comply with all current legislation and display as a minimum:

- Manufacturers name and address
- Chassis or serial number and model number
- Number of axles
- Maximum weight per axle
- Nose weight of coupling
- Maximum gross vehicle mass (GVM)
- Date of manufacture.

The chassis or serial number shall also be covertly marked upon the trailer to facilitate identification following recovery if stolen.

The trailer shall be provided complete with all necessary lamps, reflectors, and devices. The lighting equipment shall be mounted securely to prevent unauthorised removal whilst still allowing routine maintenance.
Protection shall be provided to limit accidental damage during transportation and manoeuvring.

The dimensions of the Mobile VMS shall comply with the following maximums, when in Transportation mode:

Designation	**Length (mm)**	**Width (mm)**	**Height* (mm)**	**Mass** (kg)**
3x56-300	6000	2300	3500	2400

* Height shall not exceed 1.7 times main axle wheel-track
** "Wet weight" i.e. fully laden gross weight of the Mobile VMS

8.2 Ancillary Equipment

The trailer shall be provided with a braking system that is compliant with New Zealand law. It shall incorporate a manually operated handbrake which will hold the dismounted trailer on a slope of 1 in 5.

The trailer shall come with a New Zealand registration plate, 12 months registration, and a current warrant of fitness.

The trailer attachment shall use a 50mm diameter ball hitch, unless a 40mm diameter eye hitch is specified. The coupling shall be a commercially rated cast construction.

The trailer shall come with a compliant safety chain, or where the trailer weight category requires it, a double safety chain that can be crossed over when attached to a towing vehicle.

The trailer shall be provided with a 7-pin connection, type 12N to allow connection to the towing vehicle.

- The trailer shall be able to connect to both 12 volt and 24 volt electrical systems
- The mechanism for changing between electrical systems shall be clearly labelled
- A facility shall be provided to 'house' connection leads when not in use. This may comprise a connector of opposite gender into which it can be inserted to prevent damage.

The trailer shall be provided complete with the following ancillary items, which shall be securely locked to the unit such that they may not be removed by unauthorised personal, but may be utilised as required:

- A telescopic jockey-wheel with pneumatic tyre and anti-vibration body
- Spare wheel with tyre
- Rubber fender units on rear of trailer

All items provided as part of the trailer shall be suitably robust and attached in a suitable manner for the anticipated operation. It shall be anticipated that operators may climb onto the trailer to gain access and items such as mud guards shall allow such loading.

The trailer shall be provided complete with telescopic stabilising legs. The legs shall be raised in Transportation mode and lowered in Operation mode. When lowered the legs shall support the mass of the entire Mobile VMS. A sufficient number of legs shall be provided to ensure the Mobile VMS is stable in Operation mode in all design wind speeds.

The trailer shall have lashing down points. One lashing down point shall be provided coincident with each stabiliser leg. The lashing down point shall allow the trailer to be secured to the parking area and ensure the unit is stable in Operation mode in all design wind speeds.

The trailer shall be provided with lashing down straps. A single strap shall be provided for each lashing down point. They shall be adjustable to allow the trailer to be securely lashed down in operation. They shall be designed for the maximum load exerted in all design wind speeds.

The Mobile VMS shall be provided with at least one lifting eye. This facility will allow the entire unit to be raised up by a suitable lifting device and placed behind an existing safety barrier. The eye(s) shall be sited such that when lifted the Mobile VMS is level and stable.

The Mobile VMS shall include a number of enclosures with protection to IP44. All enclosures shall be securely constructed and provided with a locking mechanism to prevent unauthorised access.

Enclosures shall be provided for the following items:

- Local controller (see Sign Controller above)
- Power supply equipment (see above)
- Storage of miscellaneous items, to house the following and extra items as required:
    - wheel clamps
    - levelling pads
    - a complete set of lashing down straps
    - power cables
    - earth rods
    - all miscellaneous items supplied with the Mobile VMS.

8.3 Trailer Colours and Emergency Contact

The design life of the Mobile VMS is ten (10) years. All metallic items of the trailer and support mounts shall be provided with a suitable finish to ensure the unit meets the required design life without the need for repair or repainting.

The main body of the trailer, including all enclosures, and the structural supports of the display panel shall be painted safety orange. The finish shall be semi-gloss to reduce the effects of specular glare.

All finishes shall have a high quality aesthetic appearance for the design life of the unit.

Non-metallic items shall be manufactured from a suitable material that meets the design life requirement and will not deteriorate when stored in an outdoor environment for the duration of the design life. They shall not be damaged by the effects of ultraviolet light or rain.

The following information shall be painted (or applied with computer cut lettering) preferably on the front, or failing that on the right hand side of the trailer, in 50mm high black lettering:

“Emergency contact:” followed by the phone number of the relevant network contractor, or an NZTA contact.

9. Security

9.1 Standard Security Requirements

It is anticipated that Mobile VMS will be left unattended at the roadside for extended periods of time. Security features shall be incorporated to prevent:

- Removal of the complete unit from site
- Removal of major components, e.g. wheels, solar panels, etc
- Dismantling of the equipment
- Operation of the equipment.

When designing security features, due consideration shall be given to balance the requirements of security and maintenance. In all cases the primary requirement shall be to ensure that the equipment is secure when in Operation.

The number of exposed nuts, bolts and other fixings shall be minimised. Exposed bolts shall either welded to the part they are securing, or shall have a security head.

The Mobile VMS shall be provided with a main securing point, to allow it to be chained to the parking area (NB: this facility may be provided by placing a chain around a main structural member of the trailer).

The unit shall be provided with a pair of wheel clamps to prevent the trailer being towed. Each wheel clamp shall be secured by a padlock.

Each wheel shall be provided with at least one locking wheel nut. These shall NOT be of a 'protruding-pin' variety.

Each enclosure shall be provided with a locking facility. Where this is provided by a
padlock, it shall be enclosed to prevent the lock from being forced open with a pry-bar.

Where a security fitting is provided for a padlock, it shall be supplied complete with a suitable padlock.

Refer to Section 5.2: Unless specified otherwise all access door locks shall have an identical key, and the supplier shall provide at least 4 copies of the key.

The onboard means of electricity generation shall be housed in a secure enclosure mounted upon the trailer. Whilst it shall be possible to access and remove any means of generation for maintenance, the level of security shall not be compromised and shall take priority over ease of maintenance.

Any fuel store for the onboard means of electricity generation shall be secured to

prevent unauthorised removal of fuel or adding of foreign material to the store.

Any fuel lines shall be routed to prevent accidental or malicious damage to the fuel lines.

9.2 GPS – if Specified by NZTA

Inclusion of a GPS provides a security function that enables the Mobile VMS to be traced. Any GPS equipment purchased by NZTA must meet the fundamental technology standards required for GPS and comply with the overall standards used internationally for GPS equipment.

If specified, the GPS shall be linked to a real time tracking system which shall broadcast the current location of the unit.

The tracking system shall be:

- Supplied complete with any software
- Operated without any external power
- Discretely and securely sited within the unit
- Supplied with a lifetime contract.

10. Testing and Commissioning of the VMS

10.1 Acceptance Testing & Commissioning

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

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

- Optical testing
- Display of messages in all formats
- Environmental protection systems
- Controller functionality
- Testing of each power system.

In all cases, the Contractor shall provide full details of testing and acceptance criteria for the above acceptance testing for the Engineers approval prior to proceeding.

11. Warranty and Maintenance Period

11.1 Standard Warranty

As a minimum the warranty conditions must ensure that in the event of failure due to faulty parts or workmanship in the first 12 months, the Mobile VMS will be repaired and reinstated at no cost to NZTA.

The following conditions shall apply:

- 12 month on-site warranty
- All significant faults (sign unable to display recognisable message), to be addressed within five working days of the supplier being notified
- All other faults within 10 working days.

11.2 Maintenance Period

The supplier shall maintain the Mobile VMS for a period of at least one year following post-commissioning acceptance by NZTA.

12. Post Commissioning Documentation

12.1 As Built Drawings

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

- Display and cabinet
- Trailer and components
- Power supply units.

12.2 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 availability
- 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.

Appendix A: Approved Font

The slightly compressed alpha and numeric fonts approved by NZTA for use in Mobile VMS, is illustrated in the following graphics. These fonts must be used in all NZTA Mobile VMS.

Appendix B: Mobile VMS Purchasing Checklist

NZ TRANSPORT AGENCY
WAKA KOTAHI

Mobile VMS Purchasing Checklist
(To be provided to the supplier in conjunction with the NZTA Mobile VMS Specification)

NZTA Regional Office: . . . . . Contact Person: . . . . . Date: . . . . . .

Number of Mobile VMS in Order: . . . . . .

Clause in Spec	Attribute	Purchaser to Nominate Requirement
	Character Height	
4.1	Purchaser to nominate	• Standard 300mm character height • (or non-standard 200mm - Generally not recommended)
	Power Supply	
7.	In addition to mains, at least one other power source is required	• Solar • Fuel driven generator • Wind turbine • Other
7.2	If batteries supplied, either the Purchaser to nominate, or Supplier to identify:	• Type • Design life • Warranty period
	ID Cellular Network	
6.	Purchaser to identify cellular network service provider (in consultation with CIS Manager Highways & Network Operations)	Cellular service provider: Telecom / Vodafone / Other (Any cellular router will be supplied by NZTA CIS Manager)
	Security / GPS	
9.1	Keys	• All Mobile VMS in purchase order to be keyed-alike • Each Mobile VMS to be keyed differently
9.2	GPS Embedded with Battery	Required: Y / N
	Radar	
	Purchaser to identify any radar requirement	Required: Y / N
	Lanterns	
4.4	Purchaser to identify lantern requirement	• Standard with lanterns • (or non-standard without lanterns)
	Trailer	
8.1	Ball hitch diameter	• Standard 50mm • (or non-standard 40mm)
8.1	Location of covert chassis/serial number	*(Purchaser to advise location on trailer)*
8.2	Emergency contact number	*(Purchaser to advise number)*
	Warranty	
11.1.1	Minimum 12 month on-site warranty. All significant faults (sign unable to display recognisable message), to be addressed within 5 working days of supplier being notified. All other faults within 10 days.	
	Any Other Requirements *(Identify any other requirements)*	

Appendix C: Supplier's Equipment Schedule

NZ TRANSPORT AGENCY WAKA KOTAHI

Mobile VMS Supplier's Equipment Schedule

(Supplier to enter information in *blue fields* & include completed Schedule with tender submssion)

Supplying Company: . . . . . Contact Person: . . . . . .

Tender Reference: . . . . . Date: . . . . . .

Attribute	Specification/ Description	Spec Ref	Attribute Value/Confirm	Components: Manufacturer & Model No
Character height	300 – 350mm. Provide measurement between pixel centres in mm	4.1		
Pixel configuration	Minimum of 56 pixels across, and 27 high Full matrix Y/N	4.1		
Display font / spacing / alternating panes	Font conforms with Appendix A. Y/N Spacing in Section 4.3. Y/N 1 pane, & 2 alternating (3sec) panes Y/N	App A 4.3 4.3		
Visual performance	In accordance with EN 12966. Y/N	4.2		
Beam width	EN 12966. Class B3. Y/N Corresponds to 20º minimum total angle	4.2.2		
Display colour	EN 12966. Class C1. Y/N	4.2.4		
Luminance Luminance ratio	EN 12966. Class L3. EN 12966. Class R3. *(Supplier to provide independent test results for L and R)*	4.2.5		
Lanterns (if specified)	Lanterns Y/N	4.4		
Radar/Speed Indicat (if specified)	Radar/Speed Indicator function Y/N	4.5		
Sign Controller	*(Supplier to provide full details)*	6.0		
Enclosure width	Maximum of 3.7m including bezel. Y/N	5.1		
Bezel width	Minimum 200mm. Y/N	5.1.1		
Front of display cover	UV stabilised polycarbonate >4mm thickness. Y/N	5.1		
Display to be shaded	Internal louvers or drilled external mask. Specify which	5.1		
Colour of enclosure	Semi gloss safety orange. Y/N	5.1.2		
Ingress protection	EN 12966. Minimum IP55. Y/N	5.3		
Environmental protection	EN 12966. Class T1. Corresponds to -15ºC to +60ºC. Y/N	5.3		
Internal heating elements may be reqd to prevent condensation/ snow build up	Are supplementary heating elements included. Y/N	5.3		
Trailer wind loading in operational mode	45m per second from any direction. Y/N	8.1		
Stabiliser system	Supplier to provide description including drawing/photos of stabiliser system	8.1		
Power consumption of unit	Provide power consumption under test condition described in Specification 7.3.2	7.3.2		
Battery type				
Storage capacity of each battery				
Number of batteries				
Solar panel type	) *or*			
Solar panel generation capacity at 50% efficiency	) *provide details of alternative power*) *supply*			
Gross weight	Supplier to provide gross weight (incl full weight of any fuel tank)	8.1		
Supplier's Acceptance Tests	*(Supplier to provide document)*	10.1		

Appendix D: Acceptance Test Template

NZ TRANSPORT AGENCY WAKA KOTAHI

Mobile VMS Acceptance Test

Supplying Company: . . . . . Contact Person: . . . . . .

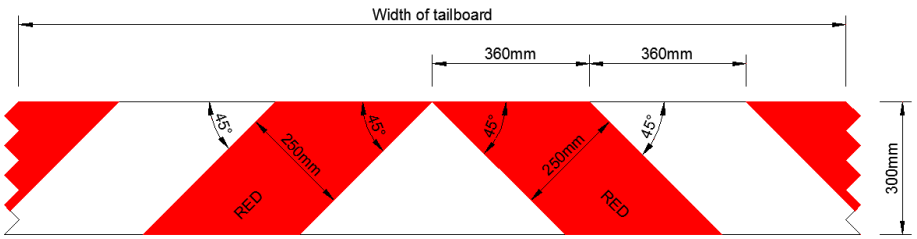
Tender Reference: . . . . . Assessor: . . . . . Date: . . . . . .

Attribute	Specification/ Description	Spec Ref	Attribute Value/Confirm	Comments
Trailer				
Gross weight	Supplier to provide gross weight (incl full weight of any fuel tank)	8.1		
Check max dimensions		8.1		
Hand brake holds on 1:5 slope		8.1		
Towball diam 50mm, chain, 7 pin plug		8.1		
Registration 12 mths, & WoF		8.1		
Manufacturers plate		8.1		
Chassis or serial no covertly marked	Record location of covert marking	8.1		
Emerg contact phone no visible		8.2		
Transport mode – min wind resist		2.3		
Operation mode – display faces back		2.3		
Bottom of display 2.1-2.5m above GL		2.3		
Check ease switching transp - op mode by a single person		2.3		
Auxiliary items fastened down		2.2		
Fittings & screws shake proof		2.2		
Cable & conduits - no chaffing/water ingress		2.2		
Stabiliser legs		8.1		
Telescoping jockey wheel, spare tyre, corner rubbers		8.1		
Lash down points & straps @ each leg	Each lash down strap min 1,500kg	8.1		
Trailer wind loading in operational mode	40m per second any direction, with display at lowest operational height	8.1		
Lifting eye		8.1		
Security				
Wheel clamps & padlocks (2)		9.1		
One locking nut on each wheel		9.1		
Solar/generator secure		9.1		
Enclosures secured		9.1		
All locks keyed alike & 4 copies of key		9.1		
Visual Performance				
Character height	300 – 350mm. Check measurement between pixel centres in mm	4.1		
Pixel configuration	Minf 56 pixels across, 27 high Full matrix	4.1		
Display font / spacing /alternating panes	Check font conforms with App A. Spacing in Section 4.3. 1 pane, & 2 alternating (3sec) panes	App A 4.3		

Visual performance	In accordance with EN 12966.	4.2		
Beam width	EN 12966. Class B3. Corresponds to 20º min total angle	4.2.2		
Display colour	EN 12966. Class C1	4.2.4		
Luminance Luminance ratio	EN 12966. Class L3. EN 12966. Class R3. *(Supplier to provide independent test results for L and R)*	4.2.5		
Photosensors (2). Min 4 intensity levels		4.2.5		
Display				
Enclosure width	Maximum of 3.7m including bezel	5.1		
Bezel width	Minimum 200mm	5.1.1		
Front of display cover	UV stabilised polycarbonate >4mm	5.1		
Display to be shaded	Internal louvers or drilled external mask	5.1		
Lanterns (if specified)	125mm diam. Alternate flash 1Hz. Configurable diagon or top/bottom	4.4		
Radar/Speed Indicator (if specified)	Check attributes on Radar spec			
Colour of enclosure	Semi gloss safety orange	5.1.2		
Ingress protection	EN 12966. Minimum IP55	5.3		
Weep hole positioning with mesh		5.3		
Environmental protection	EN 12966. Class T1. Corresponds to -15ºC to +60ºC	5.3		
Internal heating elements may be reqd to prevent condensation/ snow build up	Describe any supplementary heating elements	5.3		
Message Setting				
Sign Controller	*(Supplier to provide full details)*	6.0		
Check sign controller operation as outlined 6.2. Controller secure		6.2		
Record type cellular router		6.1		
Check locally stored message setting		6.1		
Check message setting from laptop via vendor comms software		6.1		
Check remote message setting		6.1		
Power				
Power consumption of unit	Provide power consumption under test condition described in Spec	7.3.2		
Battery type		7.2		
Storage capacity of each battery				
Number of batteries				
Solar panel type		7.3.1		
Solar panel generation capacity at 50% efficiency		7.3.2		
Mains connection & recharging		7.4		
Documentation				
Supplier's Acceptance Tests	*(Supplier to provide document)*	10.1		
As-built drawings	*(Supplier to provide)*	12.1		
Operating Servicing & Mtce Manuals	*(Supplier to provide)*	12.2		

Appendix E: Specification for Advanced Warning (Ute Mounted) VMS Display

Upgrade to LED Displays	The original specification required only colours of amber and black. In order to future-proof the options for the AWVMS, displays consisting of red, green and blue LEDs are now specified. Any existing amber and black LED systems may continue to be used until 1 July 2019.	
Specifications	**The AWVMS Display Consists of Four Main Components**	
Xenon Specifications	**Xenon Warning Lights** Area of light emitting surface — >= 700cm² Diameter of light emitting surface — >=300mm (340mm desirable) Angle range – horizontal — +1.5° to -1.5° Angle range – vertical — +1.5° to -1.5° Luminous intensity (cd) for nominal voltage — 2000 IRmin [minimum effective luminous intensity measured on vertical axis] IAmax [maximum effective luminous intensity measured at any point within angle range] — 8000 Flash rate — 60 per minute Colour — Amber The centres of the xenon warning lights shall be positioned 3.5 – 4.25m above the pavement. Must be capable of being turned off when the AWVMS is not used as an advanced warning sign for TTM.	
Top VMS Panel	**Top Panel** Must be a minimum 1,200mm wide x 1,200mm high (+ or – 50mm). Must be capable of being configured to replicate the symbols of existing temporary advanced warning signs as contained within Section B of CoPTTM but with amber symbols on a black background, and without a diamond border. LED Colours: Combinations of red green and blue LEDs capable of producing red, amber, blue, and white colours on a black background.	
Bottom VMS Panel	**Bottom Panel** Must be a minimum 1,200mm wide x 1,500mm high (+ or – 50mm) made up of two areas (Graphics area and Text area). LED Colours: Combinations of red green and blue LEDs capable of producing red, amber, blue, and white colours on a black background.	
Bottom VMS Panel, Graphics Area	**3A. Graphics Area** (Lane use information)	Minimum 1200mm wide x 1200mm high (+ or – 50mm). Configured to only replicate existing approved temporary direction and protection signs contained within the signs information in Section B of CoPTTM.

Bottom VMS Panel, Text Area	**3B. Text Area** (Advisory information such as distance to hazard)	Minimum 1200mm wide x 300mm high (+ or – 50mm). Configured to display amber numerals and upper case characters in 300mm high text (+ or – 25mm); and lower case characters 150 - 200mm high in equivalent font to that detailed for signs in the Traffic Control Devices Manual. The amber display is on a black background
LED Specification Pixel Layout, Temperature Range	Must conform to the NZ Transport Agency Specification for Mobile Variable Message Signs P37 (which are based on EN 12966-1) with respect to: Beam width = B3. Corresponds to 20° total angle Display colour of amber LEDs = C1 Luminance = L3 Luminance ratio = R3 Emitted light shall have a frequency of not less than 100 Hz. The LEDs (or pixels consisting of different coloured LEDs) shall be in a full matrix configuration with centres <25mm apart. The environmental operating conditions in New Zealand correspond to EN 12966-1. Class T1 (-15°C to +60°C).	
Display Intensity	The AWVMS shall include no less than two integral light sensors (facing forward and rear) to measure the ambient external light conditions and automatically adjust the intensity of the display to a minimum of four different levels. This system shall ensure that the luminance output of the sign is maintained in accordance with the ambient and background light conditions. The controller shall average light sensor readings over an appropriate (configurable but typically two minutes) period of time.	
Mounting Height	The bottom of the text panel (i.e. the lower of the two panels) must be a minimum of 600mm above the pavement.	
Tail Board	The tailboard below the bottom text panel must be covered with red and white retro-reflective stripes as detailed in the diagram below.  	
Display Changing	The AWVMS shall have the capability for the display to be changed manually and remotely. Options for remote changing of the display include, but are not limited to: • Cellular • Wireless, which must comply with relevant New Zealand radio transmission regulations	

Power	The AWVMS electrical systems shall operate on either 12 V or 24V. If mounted on a light trailer, there must be sufficient battery capacity to operate the AWVMS on full display continuously for at least 24 hours without recharging.