Appendix – B

Transport and Main Roads Specification

MRTS202 Variable Message Signs

November 2021

Contents

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# Appendix B – VMS Product Approval Checklist

| **Item #** | MTRS202 – VMS Product Approval Requirement | **Reference Document** | **MRTS202 2021 Reference clause** | **VERIFICATION METHOD** | | | | | **Product Compliance (Y, TBC, N, N/A)** | **Vendor Comments** | **TMR Comments** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Visual inspection** | **NATA approved certificate (or  equivalent)** | **Field / bench Test / Demo** | **Detailed drawings** | **Manufacturer conducted tests records / other documents** |
| Functional Requirements | | | | | | | | | | | |
| 1 | The overall functions of the VMS are described in the Austroads Guide to Traffic Management Part 10. The Queensland specific requirements are supplemented as Queensland practice variations in the TRUM Part 10 Traffic Control and Communication Devices. | MRTS202 | 5.1 |  |  |  |  |  |  |  | Vendor to note. |
| 2 | It shall be possible to monitor and control the VMS by TMS via a single VMS controller. | MRTS202 | 5.1 | \* |  |  |  | \* |  |  |  |
| 3 | The VMS message shall be controlled using the VMS controller:   * Locally, when the VMS controller has been selected for LOCAL operation using a local facility switch and/or hardwired inputs to select one of the pre-determined messages. | MRTS202 | 5.2 |  |  | \* |  |  |  |  |  |
| 4 | The VMS message shall be controlled using the VMS controller:   * Locally, when the VMS controller has been selected for MAINTENANCE operation via the PHCS. | MRTS202 | 5.2 |  |  | \* |  |  |  |  |  |
| 5 | The VMS message shall be controlled using the VMS controller:   * Remotely by the TMS when the VMS controller has been selected for REMOTE operation. This shall be the normal mode of operation. | MRTS202 | 5.2 |  |  | \* |  |  |  |  |  |
| 6 | VMS controller shall:   * Monitor, log and support TMS requests for operation and status. | MRTS202 | 5.3 |  |  | \* |  |  |  |  |  |
| 7 | VMS controller shall:   * Store up to 255 frames in its non-volatile memory for the DU. | MRTS202 | 5.3 |  |  | \* |  |  |  |  |  |
| 8 | VMS controller shall:   * Allow local automatic reset of the VMS display and the VMS controller itself such as via watchdog(s). | MRTS202 | 5.3 |  |  | \* |  |  |  |  |  |
| 9 | VMS controller shall:   * Allow integration of radar vehicle detectors to activate VMS display, only when vehicles are presence in the viewing range of the sign. | MRTS202 | 5.3 |  |  | \* |  |  |  |  |  |
| 10 | VMS controller shall:   * Be capable of dimming the connected signs based on the average of the light sensor outputs. | MRTS202 | 5.3 |  |  | \* |  |  |  |  |  |
| 11 | VMS controller shall:   * Check validity of commands made by TMS and/or PHCS. | MRTS202 | 5.3 |  |  | \* |  |  |  |  |  |
| 12 | Communications timeout:   * VMS controller shall monitor loss of communications with the TMS and timeout after a specified period. When the VMS controller is in the REMOTE mode, expiry of this period shall cause the VMS controller to blank the entire VMS. The period shall be a configurable parameter. | MRTS202 | 5.4 |  |  | \* |  |  |  |  |  |
| 13 | Communications timeout:   * The VMS controller shall also be capable of monitoring communications with each DU and timeout after a specified period when such communication is lost. Communications timeout check shall be performed periodically and shall be a configurable parameter. | MRTS202 | 5.4 |  |  | \* |  |  |  |  |  |
| 14 | In LOCAL mode, the communications timeout check with the TMS shall be ignored. | MRTS202 | 5.4 |  |  | \* |  |  |  |  |  |
| 15 | Relevant Config Parameters from Appendix A: | MRTS202 | 5.4 |  |  |  |  |  |  |  | Vendor to note. |
| 16 | Configuration management  All settings in the VMS controller shall be accessible using the PHCS (Product Host Control System). | MRTS202 | 5.5 |  |  | \* |  |  |  |  |  |
| 17 | Sign fault management  The VMS controller shall monitor and log the following conditions:   * loss of communication with the FP and each DU * high enclosure temperature * illumination faults, and * other faults relating to the VMS.   The log shall identify the DU and its respective fault. | MRTS202 | 5.6 |  |  | \* |  |  |  |  |  |
| 18 | Local event logging  The VMS controller shall log in non-volatile memory, operational and fault events such as message changes, hardware resets, establishment or discontinuation of communications, local manual operations and clearance of faults. Each event shall be date and time stamped, accurate to at least one hundredth of a second. Once a fault has occurred and been logged, a recurrence of the same fault need not be logged again until after the fault has been cleared. | MRTS202 | 5.7 |  |  | \* |  |  |  |  |  |
| 19 | Once a fault has occurred and been logged, a recurrence of the same fault need not be logged again until after the fault has been cleared. | MRTS202 | 5.7 |  |  | \* |  |  |  |  |  |
| 20 | The event log shall have space for at least 1,000 entries. Where separate logs are used for operational and fault events, each log shall have space for at least 1,000 entries. The oldest event record shall be overwritten first when this allocated space has been exceeded. | MRTS202 | 5.7 |  |  | \* |  |  |  |  |  |
| 21 | All log entries shall be available for upload from all communication ports upon request from the TMS and/or PHCS. The log shall be uploaded in order of most recent to oldest record. A request by the TMS for the event log shall provide for no less than 20 entries at a time.  Events shall be retained in the log even after retrieval by the PHCS and/or TMS. | MRTS202 | 5.7 |  |  | \* |  |  |  |  |  |
| 22 | Watchdog  The VMS controller and the DU shall monitor the state of its respective processor and blank the respective display(s) if processor failure occurs. | MRTS202 | 5.8 |  |  | \* |  |  |  |  |  |
| 23 | Time synchronisation  The VMS controller shall be provided with an internal system clock in accordance with MRTS201 *General Equipment Requirements*. VMS shall synchronize it's time with TMS periodically.  **MRTS201 *General Equipment Requirements*:**  **9.11 Internal system clock** | MRTS201, MRTS202 | 5.9 |  |  | \* |  |  |  |  |  |
| VMS configuration options | | | | | | | | | | | |
| 24 | VMS shall operate in either of the following configuration options.   1. A VMS capable of displaying 3 lines of 18 characters per line as specified in AS 4852.1 Section 5.1.2 *Display dimensional requirements*. The sign shall be capable of displaying pictograms / graphics in the entire area or sectionalised portion of the display in compliance with the Austroads Guide to Traffic Management Part 10. 2. A VMS capable of displaying 3 lines with the exception of only 8 characters per line compliant to AS 4852.1 Section 5.1.2 *Display dimensional requirements*. The sign shall be capable of displaying pictograms / graphics in the entire area or sectionalised portion of the display in compliance with the Austroads *Guide to Traffic Management* Part 10.   The VMS shall also include a VMS controller, FP, mounting structure, a telecommunications field cabinet, a switchboard and associated infrastructure / equipment complied with the requirements of this specification and/or relevant other specifications. | MRTS202 | 6 |  |  | \* |  |  |  |  |  |
| Mechanical and Physical Requirements | | | | | | | | | | | |
| 25 | Mechanical and physical requirements  The mechanical and physical requirements defined in MRTS201 *General Equipment Requirements* and MRTS61 *Gantries and Support Structures for Road Signs, Tolling Systems and ITS Devices* apply to work provided under this Technical Specification. | MRTS61 MRTS201 MRTS202 | 7 |  |  |  |  |  |  |  | Vendor to note. |
| 26 | Design life  Unless otherwise specified, the design life of the VMS components shall be in accordance with Clause  2.2 of AS 4851.1. | MRTS202 | 7.1 |  |  |  |  | \* |  |  |  |
| 27 | Display enclosure  The sign enclosure shall house the DU and associated control electronics and comply with the requirements of MRTS201 *General Equipment Requirements*. The sign enclosure shall be made of Marine Grade Aluminium compliant to AS 4852.1 Clause 3.1.1. | MRTS202 | 7.2 |  |  |  |  |  |  |  | Vendor to note and comply. |
| Variable Massage Display Requirements | | | | | | | | | | | |
| 28 | VMS Display Requirements  Variable message displays shall utilise a series of pixels forming a dot matrix display system. A “full matrix” configuration shall be used to allow the display of graphics as well as alphanumeric characters. | MRTS202 | 8.1 |  |  |  |  |  |  |  | Vendor to note and comply. |
| 29 | The horizontal and vertical pitch of the pixels in the matrix shall be the same. | MRTS202 | 8.1 | \* |  |  |  |  |  |  |  |
| 30 | The variable message display pixels shall be in modules of a size capable of being removed and installed by hand via the rear access door(s). | MRTS202 | 8.1 | \* |  |  |  |  |  |  |  |
| 31 | The VMS display technology shall be light emitting diode (LED). The display pixels may be formed by arranging one or more LEDs in a cluster to achieve the required luminance levels. | MRTS202 | 8.2 |  |  | \* |  |  |  |  |  |
| 32 | Facilities shall be included to detect failures within the display control system. The DU shall blank the display in the event of a sign processor fault. Time to blank shall be a configurable setting with ranges as given in Appendix A. | MRTS202 | 8.3 |  |  | \* |  |  |  |  |  |
| 33 | The DU shall monitor communications with the VMS controller and blank the displays if loss of communication experienced. The communications timeout period shall be a configurable setting. | MRTS202 | 8.3 |  |  | \* |  |  |  |  |  |
| 34 | The VMS controller shall be able to periodically detect the failure of any LED in the display even if the LEDs are required to be ‘off’ at the time of the periodic check. | MRTS202 | 8.3 |  |  | \* |  |  |  |  |  |
| 35 | The display shall be blanked upon failure of equal or more than four contiguous pixels in either horizontal or vertical direction | MRTS202 | 8.3 |  |  | \* |  |  |  |  |  |
| 36 | The display shall be blanked upon failure of more than 20% of LEDs. | MRTS202 | 8.3 |  |  | \* |  |  |  |  |  |
| 37 | On power restoration after loss of power, the VMS shall become available for activation and remain blank until commanded by any one of the control methods. The power recovery delay time shall be configurable. At no time shall partial or incomplete frames be displayed. | MRTS202 | 8.3 |  |  | \* |  |  |  |  |  |
| 38 | The VMS controller shall allow the sign’s display to remain blank for a minimum time once the display has been blanked irrespective of the cause. This minimum blank time shall be configurable. | MRTS202 | 8.3 |  |  | \* |  |  |  |  |  |
| 39 | Single LED failure, provided that the cumulative LED loss remains below the four contiguous and/or 20% thresholds described above or VMS light sensor failure, should not result in blanking of the display. The failure of any LED shall be reported in the log. | MRTS202 | 8.3 |  |  | \* |  |  |  |  |  |
| 40 | If colours are generated with a colour mixing technology from a cluster of LEDs, failure of any LED within the cluster shall automatically turn off the entire cluster to avoid generation of colour noise. | MRTS202 | 8.3 |  |  | \* |  |  |  |  |  |
| 41 | All configurable setting shall be as shown in Appendix A. | MRTS202 | 8.3 |  |  | \* |  |  |  |  |  |
| 42 | Each individual LED shall be driven with a continuous current with no peak and/or magnitudes exceeding 70% of the LED manufacturer's recommended maximum continuous rating. | MRTS202 | 8.4 |  |  | \* |  |  |  |  |  |
| 43 | Type A, Type B and Type C VMS shall comply with the display dimensional requirements of the AS 4852.1. | MRTS202 AS 4852.1 | 8.5 |  |  | \* |  |  |  |  |  |
| 44 | Each alphanumeric character in the DU shall be formed by a matrix arrangement of horizontal and vertical pixels. |  | 8.5 |  |  | \* |  |  |  |  |  |
| 45 | The display resolution of each alphanumeric character shall be the Standard proportional font (7x5) as per AS 4852.1. | MRTS202 AS 4852.1 | 8.5 |  |  | \* |  |  |  |  |  |
| 46 | The signs shall have sufficient vertical pixels to permit lower case text, with descenders lie wholly below the base of the upper-case characters. The character format shall be complied with the requirements of the AS 4852.1. | MRTS202 AS 4852.1 | 8.5 |  |  | \* | \* | \* |  |  |  |
| 47 | Where specified by the principal VMS with characters per line of 8 is acceptable. However, all other display dimensional requirement of these VMS shall be complied with AS 4852.1. | MRTS202 AS 4852.1 | 8.5 |  |  | \* | \* | \* |  |  |  |
| 48 | As a minimum, the variable message display shall generate single stroke alphanumeric character fonts generally to the requirements of AS 1742, AS 1743 and AS 1744. The characters shall be arranged to have a minimum of two pixels between characters and two pixels between lines. | MRTS202 AS 1742 AS 1743 AS 1744 | 8.6 |  |  | \* | \* | \* |  |  |  |
| 49 | Variable message display changes shall be in accordance with the VMS use and operations guidelines stated in the Austroads Guide to Traffic Management Part 10. The Queensland specific requirements are supplemented as Queensland practice variations in the TRUM Part 10 Traffic Control and Communication Devices. | MRTS202 TRUM Part 10 | 8.7 |  |  |  | \* | \* |  |  |  |
| 50 | All display changes shall be effected by first blanking and then activating all required pixels of the respective display simultaneously (as visible to the eye). | MRTS202 TRUM Part 10 | 8.7 |  |  | \* |  |  |  |  |  |
| 51 | The VMS display shall be either be capable of displaying Monochrome (Yellow) or 4 Colour (Yellow, White, Red and Green) compliant with AS 4852.1 as follows. | MRTS202 AS 4852.1 | 8.8 | \* | \* |  |  | \* |  |  |  |
| 52 | VMS display shall be able to display individual pixels in Yellow against a matt Black background. LEDs shall be used within pixels to generate the output colour. | MRTS202 | 8.8 | \* | \* |  |  | \* |  |  |  |
| 53 | The VMS display shall be able to display individual pixels in either Yellow or White or Red or Green colours, against a matt Black background. LEDs shall be used within pixels to generate output colours. The individual pixels may generate colour with either discreate LED(s) for each of the 4 colours or via a colour mixing arrangement with RGB LEDs or equivalent technologies. In the event of the use of colour mixing or equivalent technology, any non-compliant colours to AS 4852.1 shall neither be configurable nor displayed under any circumstances. | MRTS202 AS 4852.1 | 8.8 |  | \* |  |  | \* |  |  |  |
| 54 | The VMS display's colours shall remain within their corresponding chromaticity coordinates, as specified in the Section 5.2.4 of AS 4852.1, for every configurable brightness level. The sign’s display colours shall remain within their corresponding specified chromaticity coordinates for at least 10 years of pixel service life specified in the Section 5.1.1.4 of AS 4852.1. It should be noted that this requirement is additional to the warranty requirements outlined in the Clause 4.3. | MRTS202 AS 4852.1 | 8.8 |  | \* |  |  | \* |  |  |  |
| 55 | Fall-back displays Fall-back for VMS shall be blanked display unless otherwise specified. | MRTS202 | 8.9 |  |  | \* |  |  |  |  |  |
| 56 | Conspicuity devices Conspicuity devices shall be provided as specified in AS 4852.1. | MRTS202 AS 4852.1 | 8.10 |  |  |  |  | \* |  |  |  |
| 57 | The luminance and luminance ratio of the LED shall comply with the requirements of AS 4852.1 | MRTS202 AS 4852.1 | 8.11.1 |  | \* |  |  | \* |  |  |  |
| 58 | LED dimming The LED intensity shall be controlled to provide maximum legibility distances for the complete range of ambient light under which the VMS shall operate. | MRTS202 | 8.11.2 |  |  | \* |  | \* |  |  |  |
| 59 | LED dimming A VMS shall have a minimum of 16 LED brightness levels. The brightness levels shall be in units of percentage of maximum brightness. The transition between different brightness level shall not cause sudden changes in brightness. | MRTS202 | 8.11.2 |  | \* | \* |  | \* |  |  |  |
| 60 | The transition time between two consequent brightness levels shall be configurable. The range of values and default value shall be as per Appendix A. | MRTS202 | 8.11.2 |  |  | \* |  | \* |  |  |  |
| 61 | LED dimming  The intensity of the conspicuity devices shall be controlled by the same system that controls the intensity of the LED displays. | MRTS202 | 8.11.2 |  |  | \* |  | \* |  |  |  |
| 62 | Luminance intensity half angle The luminance intensity half angle shall comply with the requirements of AS 4852.1. | MRTS202 AS 4852.1 | 8.11.3 |  |  |  |  | \* |  |  |  |
| 63 | Luminance intensity uniformity Luminance intensity uniformity shall comply with the requirements of AS 4852.1. | MRTS202 AS 4852.1 | 8.11.4 |  |  |  |  | \* |  |  |  |
| 64 | Sun phantom The action of sunlight or other bright light sources on the optical elements shall be controlled such that inactive pixels shall not appear active. | MRTS202 | 8.11.5 |  |  | \* |  | \* |  |  |  |
| Control System | | | | | | | | | | | |
| 65 | The control system requirements defined in MRTS201 *General Equipment Requirements* apply to this Technical Specification. Additional control system requirements for equipment provided under this specification are described below. | MRTS202 | 9 |  |  |  |  |  |  |  |  |
| 66 | Each VMS shall be operated by an integral control system that is controlled in the following order of priority:   1. local facility switch 2. hardwired input(s) 3. maintenance communications port using the PHCS, and 4. control communications ports through either PHCS or Principal's host control system.   PHCS shall be provided in accordance with this specification. | MRTS202 | 9.1 |  |  | \* |  | \* |  |  |  |
| 67 | Local facility switch  A 4-position key operated facility switch that complies with MRTS201 *General Equipment Requirements*, shall be provided to enable selection of the following five display functions for each of the text display and the graphics display:   * OFF – display blank; control via all communications ports inhibited; status and diagnostic commands via all communications ports remain functional * Normal – display active; displayed message selected via the maintenance communications port and/or the control communications port, and * Message 1, Message 2 – display either message 1 or 2; control via all communications ports inhibited; status and diagnostic commands via all communications ports remain functional. | MRTS202 | 9.2 |  |  | \* |  |  |  |  |  |
| 68 | Maintenance communications port It shall be possible to control and interrogate the VMS via a 10/100 base-T Ethernet maintenance communications port via the VMS controller. | MRTS202 | 9.3 |  |  | \* |  |  |  |  |  |
| 69 | Maintenance communications port Ethernet port shall allow local and remote communications via a laptop computer (provided by others) installed with PHCS software. The maintenance communications port shall also allow remote connection of a similar computer via Principal's communications network. | MRTS202 | 9.3 |  |  | \* |  |  |  |  |  |
| 70 | Maintenance communications port When the PHCS is connected and operating, the VMS controller shall automatically change to 'MAINTENANCE' mode. Termination of the PHCS session shall automatically initiate the previous mode of operation unless selected otherwise during the PHCS session. | MRTS202 | 9.3 |  |  | \* |  |  |  |  |  |
| 71 | Control communications port It shall be possible to control and interrogate the VMS via either of two TIA/EIA RS-422 control communications ports. The control communications ports shall allow local connection of a field processor / modem for communications with TMS. | MRTS202 | 9.4 |  |  | \* |  |  |  |  |  |
| 72 | Control communications port While a PC / laptop computer is connected and PHCS session is active to the VMS via the maintenance communications port, control of the VMS via the control ports shall be inhibited. However, status and diagnostic interrogation by STREAMS via the control ports shall remain possible. | MRTS202 | 9.4 |  |  | \* |  |  |  |  |  |
| 73 | Control communications port Complete control and monitoring by STREAMS shall be possible through both control communications ports as determined by telecommunications infrastructure provided at each Site. | MRTS202 | 9.4 |  |  | \* |  |  |  |  |  |
| 74 | Control communications port Where communications equipment is connected to both control communications ports, the primary port shall be used for control commands to / from the VMS, and the secondary port shall be used for status-only communications with the VMS. | MRTS202 | 9.4 |  |  | \* |  |  |  |  |  |
| 75 | Control communications port Where communications equipment is connected to only one control communications port (or in the case of failure of either communications port or attached equipment) the VMS shall automatically revert to full control AND status communications through the active port. | MRTS202 | 9.4 |  |  | \* |  |  |  |  |  |
| 76 | Control communications port VMS communications software shall be capable of operating at all possible modem connection and/or serial / Ethernet port speeds. | MRTS202 | 9.4 |  |  | \* |  |  |  |  |  |
| 77 | Control / diagnostics software The VMS shall be capable of connection to the Principal's host control system, STREAMS, for remote control of the sign. | MRTS202 | 9.5 |  |  | \* |  |  |  |  |  |
| 78 | Control / diagnostics software The VMS shall be provided with manufacturers host control system (the PHCS) that includes additional functions for diagnosis of faults, by local and remote control of VMS. | MRTS202 | 9.5 |  |  | \* |  |  |  |  |  |
| 79 | Control / diagnostics software The PHCS shall report the selected position of the facility switch. | MRTS202 | 9.5 |  |  |  |  |  |  |  |  |
| 80 | Security and compatibility  The security requirements defined in MRTS201 *General Equipment Requirements* apply to this Technical Specification.  **MRTS201 *General Equipment Requirements***  **"Every ITS device and/or system with privacy related data shall be developed in accordance with, and with due regard to, IEC/TC 62443."** | MRTS202 | 9.5.1 |  |  |  |  | \* |  |  |  |
| 81 | Request passwords as part of the access and configuration authorisation process. Passwords shall be generally in accordance with IS18 (Information Security Policy). | MRTS202 | 9.5.1 |  |  | \* |  | \* |  |  |  |
| 82 | Provide two access levels, namely, Administrator and Standard user, as a minimum. | MRTS202 | 9.5.1 |  |  | \* |  | \* |  |  |  |
| 83 | Be compatible with Microsoft Windows® operating system environment, Windows 7, Windows 10, and industry standards current at the time of delivery. Any software provided shall be capable of operating on all such operating systems. | MRTS202 | 9.5.1 |  |  | \* |  | \* |  |  |  |
| 84 | Be backward compatible with existing VMS purchased from the same manufacturer. | MRTS202 | 9.5.1 |  |  | \* |  | \* |  |  |  |
| 85 | The VMS configuration parameters can be set up locally or remotely. When set up remotely, the sign control shall provide a prompted warning to avoid losing connection unintentionally. | MRTS202 | 9.5.2 |  |  | \* |  | \* |  |  |  |
| 86 | The VMS shall have sufficient storage capacity to accommodate future firmware upgrades during the lifetime of the VMS. | MRTS202 | 9.5.2 |  |  | \* |  | \* |  |  |  |
| 87 | Storage capacity wise, no further hardware upgrades shall be required to accommodate ongoing firmware changes / upgrades. | MRTS202 | 9.5.2 |  |  |  |  | \* |  |  |  |
| 88 | The configuration parameters shall be completely protected during software / firmware upgrade. This requirement is necessary to ensure that software upgrades do not affect the existing configuration parameters or new software released by the manufacturer are compatible with existing VMS by the same manufacturer | MRTS202 | 9.5.2 |  |  | \* |  |  |  |  |  |
| 89 | Hardwired inputs The VMS controller shall have the ability to display a predefined message when it receives a voltage free contact closure or similar input from an external device such as a loop detector or vehicle over-height detector. | MRTS202 | 9.6 |  |  | \* |  | \* |  |  |  |
| 90 | Hardwired inputs The VMS controller shall be capable of accepting a minimum of six hardwired inputs. | MRTS202 | 9.6 |  |  | \* |  | \* |  |  |  |
| 91 | Message hierarchy Each VMS controller shall provide a user-configurable message hierarchy for message selection commands and hardwired inputs. | MRTS202 | 9.7 |  |  | \* |  | \* |  |  |  |
| 92 | LED intensity control Each VMS shall support automatic brightness variation, where the VMS determines the LED brightness level using a light sensor reading and a predefined set of light sensor values. | MRTS202 | 9.8 |  |  | \* |  | \* |  |  |  |
| 93 | LED intensity control Each VMS shall be provided with at least two light sensors to detect ambient light levels. These sensors shall be located as follows:   * One sensor facing forward perpendicular to the sign face, and * One sensor facing backward perpendicular to the sign face. | MRTS202 | 9.8 | \* |  |  |  | \* |  |  |  |
| 94 | Time-of-Day intensity settings The VMS controller shall provide means of adjusting the VMS brightness by time-of-day. | MRTS202 | 9.8.1 |  |  | \* |  | \* |  |  |  |
| 95 | Time-of-Day intensity settings In the event of failure of the light sensors, seasonally adjusted time-of-day values stored in the group controller shall be used to adjust the VMS brightness. | MRTS202 | 9.8.1 |  |  | \* |  | \* |  |  |  |
| 96 | Temperature control Each VMS shall be provided with at least one temperature sensor to measure the temperature inside the display enclosure near the top centre. | MRTS202 | 9.9 | \* |  | \* |  | \* |  |  |  |
| 97 | Temperature control  a cooling system consisting of cooling devices and thermostats. | MRTS202 | 9.9 | \* |  |  |  | \* |  |  |  |
| 98 | Temperature control  Each VMS shall be provided with at least one temperature sensor to measure the temperature inside the display enclosure near the top centre and if required a cooling system consisting of cooling devices and thermostats.  Each thermostat shall operate the connected cooling device(s) once the internal ambient temperature (measured at the top of the cabinet) reaches the set point. The thermostat set point (TSP) is a configurable parameter as shown in Appendix A.  The temperature sensor shall not be mounted directly against the top face of the display enclosure. The temperature reading shall be available with a protocol message via STREAMS. The temperature shall be in units of degrees Centigrade. Upon failure of the VMS cooling system, the TMS shall shut down the sign if the temperature reaches a set value.  Furthermore, a configurable early warning temperature setting prior to its' shut down temperature level is required for efficient management of VMS. Both Thermostat High Temperature Shut Down Set Point (TSDSP) and Thermostat High Temperature Early Warning Set Point (TEWSP) shall be configurable, as shown in Appendix A.  98 cont. | MRTS202 | 9.9 |  |  | \* |  | \* |  |  |  |
| 99 | Communication protocol Communication between the Field Processor and the VMS shall comply with RMS protocol  TSI-SP-003 Version 2.1 with colour extensions or other protocol accepted by the Principal's representative and the requirements of MRTS201 *General Equipment Requirements*. | MRTS201 MRTS202 | 9.10 |  |  | \* |  | \* |  |  |  |
| 100 | Bus arbitration Each VMS shall act as a slave on the TIA/EIA RS-422 modem bus. | MRTS202 | 9.11 |  |  | \* |  | \* |  |  |  |
| 101 | Display controls When a standalone power system such as solar power has been used to energize the VMS:   * A display control mechanism shall be provided to activate the VMS display only when a vehicle is present within the viewing range of the VMS. * The VMS shall display the full message prior to vehicle entering the viewing range and shall not deactivate the message until the vehicle has left the viewing range of VMS. * The VMS controller shall continuously communicate with the TMS at all times regardless of the status of the display. This facility shall be user configurable for setting up parameters such as enable / disable, and operational range. | MRTS202 | 9.11.1 |  |  | \* |  | \* |  |  |  |
| Mechanical, Physical and Display Enclosure Requirements | | | | | | | | | | | |
| 102 | Mounting The display enclosure shall be capable of being mounted in both the verge and mounted over the carriageway as defined in MRTS201 *General Equipment Requirements*. | MRTS201 MRTS202 | 10.2 | \* |  |  |  | \* |  |  |  |
| 103 | Mounting Access doors shall be provided to allow access to the rear of the VMS for maintenance from the working platform on the mounting structure. The door arrangement shall be compatible with the mounting structure members. The mounting structure shall comply with MRTS201 *General Equipment Requirements*. | MRTS201 MRTS202 | 10.2 | \* |  |  |  | \* |  |  |  |
| 104 | Exterior finish and surfaces The surface finishes shall be compliant to AS 4852.1 Section 3.1.2 with external front face matt black and other external surfaces matt grey. Any interior surfaces that may be visible from outside the sign shall be matt black. | MRTS202 | 10.3 | \* |  |  |  | \* |  |  |  |
| 105 | Weather resistance The display enclosure shall provide a degree of protection of not less than that required for the classification of IP65 in accordance with AS 1939, in normal service. | MRTS202 AS 1939 | 10.4 |  | \* |  |  | \* |  |  |  |
| 106 | Weather resistance Alternatively, the VMS shall have degree of protection of IP65 in accordance with AS 1939 at the modular level. The connections between the modules shall not compromise the degree of protection below IP65. This option may allow for the removal of polycarbonate see through front cover from the enclosure, thus reducing the display optical losses facilitating the use of low power LEDs. However, this approach shall not degrade the performance and design life of the VMS. | MRTS202 AS 1939 | 10.4 |  | \* |  |  | \* |  |  |  |
| 107 | Equipment racks Where required, the display enclosure and/or the control cabinet shall incorporate a standard 19-inch racking system to facilitate installation of all equipment requiring rack-mounting. The height of the racks shall be sufficient for the installation of all such equipment. | MRTS202 | 10.5 | \* |  |  |  | \* |  |  |  |
| 108 | Front cover Where required to meet the weather resistance requirements, a front cover shall be provided. Front cover is not required if the sign design provided the weather resistance protection at modular level as stipulated in this Technical Specification. | MRTS202 | 10.6 | \* |  |  |  | \* |  |  |  |
| 109 | Front Cover Material The front cover material shall be a single, clear Lexan® polycarbonate sheet, or equivalent, with UV resistant and non-reflective finish. The sheeting shall be manufactured from sign-grade material SG300 with a thickness at least equal to that recommended by the manufacturer, and in all cases, at least 4.5 mm. | MRTS202 | 10.6.1 | \* |  |  |  | \* |  |  |  |
| 110 | Viewing angles The viewing window shall not obstruct sign viewing angles of ± 45° (horizontal) and ± 30° (vertical) to the axis perpendicular to the front plane of the display when installed at site. | MRTS202 | 10.6.2 |  | \* |  |  | \* |  |  |  |
| 111 | Front Cover Retention method Front cover shall be able to be removed for maintenance from outside the VMS without requiring removal of internal components. Fasteners and retaining cover strips shall be easily accessible. | MRTS202 | 10.6.3 | \* |  |  |  | \* |  |  |  |
| 112 | Front Cover Retention method Front cover retention and seal design shall allow for thermal expansion properties of the front cover material. | MRTS202 | 10.6.3 | \* |  |  |  | \* |  |  |  |
| 113 | Front Cover Retention method The front cover surrounding framework and cover strips shall provide the required weather proofing and strength for both positive and negative wind pressures. | MRTS202 | 10.6.3 | \* |  |  |  | \* |  |  |  |
| 114 | Demister A demister or an alternative method shall be provided to prevent condensation on the inside surface of the front cover if the front cover is part of the VMS design. | MRTS202 | 10.7 | \* |  |  |  | \* |  |  |  |
| Environmental | | | | | | | | | | | |
| 115 | The environmental conditions defined in MRTS201 *General Equipment Requirements* apply to this Technical Specification. | MRTS201 MRTS202 | 11 |  |  |  |  |  |  |  |  |
| Electrical | | | | | | | | | | | |
| 116 | The electrical requirements defined in MRTS201 *General Equipment Requirements* and AS 4852.1 apply to this Technical Specification.  **The electrical requirements defined in Clause 10 of MRTS201 *General Equipment Requirements* apply to this Technical Specification.** | MRTS201 MRTS202 AS 3015 AS/NZS 3000 AS/NZS 3100 AS/NZS 3760 | 12 | \* |  |  |  | \* |  |  |  |
| 117 | Power source VMS shall be supplied with mains power compliance with MRTS210 *Provision of Mains Power* or with a standalone power system compliance with MRTS263 *Standalone Solar (PV) Power Systems*. | MRTS202 MRTS210 MRTS263 | 12.1 |  |  |  |  |  |  |  |  |
| 118 | Power source The sign except the display shall operate for 12 hours using a backup power system during a failure of mains power supply for TMS to monitor, log and diagnose the fault. | MRTS202 | 12.1 |  |  |  |  |  |  |  |  |
| 119 | Power source When powered by a standalone power system, it shall have an autonomy time of four days. | MRTS202 | 12.1 |  |  | \* |  | \* |  |  |  |
| 120 | Power source The signs that are powered through the stand alone power systems shall have alarms set up for backup battery system to provide advance warnings to the TMS. | MRTS202 | 12.1 |  |  | \* |  | \* |  |  |  |
| 121 | Power consumption The VMS supplier shall provide the power consumption details of the sign measured and recorded as follows:   * measuring instruments shall have a current calibration certificate issued by the manufacturer * two readings shall be recorded for the minimum and maximum dimming levels * VMS shall display message "REPORT TRAFFIC INCIDENT", with conspicuity devices flashing while the measurements are being taken, and * if the VMS has any other sub-systems that consume power, they shall be active while power measurements are being taken.   A report shall be submitted with details of power consumption together with copies of calibration certificates of the measuring instruments. | MRTS202 | 12.1 |  | \* |  |  | \* |  |  |  |
| Telecommunications Requirements | | | | | | | | | | | |
| 122 | The telecommunications requirements defined in MRTS201 *General Equipment Requirements* and MRTS245 *ITS Telecommunications Network (ITS TN)* apply to work provided under this Technical Specification. | MRTS201 MRTS202 MRTS245 | 14 |  |  |  |  |  |  |  |  |
| Testing and Commisioning | | | | | | | | | | | |
| 123 | Testing and commissioning The optical performance, stated in this specification and to be conducted by a NATA accredited laboratory or NATA endorsed by Mutual Recognition laboratory, shall be determined by measurement under laboratory conditions of the minimum luminance ratio and the minimum and maximum luminance for the five sign illuminance levels listed in AS 4852.1 Table 5.5 in accordance with the test procedures defined therein – Appendix C – Photometric Test Procedures. | MRTS202  AS 4852.1 | 15.2 |  |  |  |  | \* |  |  |  |
| 124 | The colours for the red, green and yellow LEDs shall conform to the colours defined by the colour coordinates in AS 4852.1 Table 5.6, and Appendix D – “Colorimetric Test Procedures”. The optical performance of the VMS shall meet or exceed those quoted parameters. The optical performance report shall cover all parameters described in this specification. | MRTS202 AS 4852.1 | 15.2 | \* |  |  |  | \* |  |  |  |