

Technical Specification

**Transport and Main Roads Specifications
MRTS218 Vehicle Activated Signs**

March 2023

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1 Introduction

This Technical Specification defines the design, supply, installation, testing and commissioning, performance, documentation, training, maintenance and handover requirements for Vehicle Activated Signs (VAS).

Vehicle Activated Signs (VAS) are digital road side signs that display a message when they are approached by a vehicle exceeding a pre-set speed. The VAS are always used to supplement existing static road side signs and not intended to replace them. The VAS units are discrete signs, which remain blank until activated by an approaching vehicle exceeding a preset 'trigger speed'.

This Technical Specification shall be read in conjunction with MRTS01 *Introduction to Technical Specifications*, MRTS50 *Specific Quality System Requirements* and other Technical Specifications as appropriate.

This Technical Specification forms part of the Transport and Main Roads Specifications Manual.

2 Definition of terms

The terminologies defined in MRTS201 *General Equipment Requirements* apply to this Technical Specification. Additional terminology relevant under this Technical Specification are defined in Table 2 below.

Table 2 – Definitions

Term	Definition
4G/5G	Fourth / Fifth generation mobile phone technology
ADSL	Asymmetric digital subscriber line, a broadband technology
Conspicuity devices	Device for making the whole sign more obvious or for reducing Sun Phantoms or Veiling effects
Event	Any operation of the sign signifying a change of state, occurrence of a fault or change in mode of operation of the sign
IPRT	Internet Protocol Remote Telemetry (the department's core ITS network supplied by Telstra)
ITS	Intelligent Transport Systems
LED	Light Emitting Diode
NATA	National Association of Testing Authorities
Pixel	The smallest discretely controlled light emitting component of the sign display
Principal	Agency responsible for the contract (e.g. Transport and Main Roads / Local Govt)
PV	Photovoltaic
QTDF	Queensland Traffic Data Format
RCM	Regulatory Compliance Mark
Sign	Refers to Vehicle Activated Sign, also VAS
STREAMS	The Principal's traffic management system and primary user interface to ITS field devices
TMC	Traffic Management Centre

Term	Definition
TMS	Traffic Management System nominated by the Principal but maybe the supplier sign management system, if so specified in the contract
VAS	Vehicle (Speed) Activated Sign

3 Referenced documents

The requirements of the referenced documents listed in Table 3 of MRTS201 *General Equipment Requirements* and Table 3 below apply to this Technical Specification. Where there are inconsistencies between this Technical Specification and the referenced documents, the requirements specified in this Technical Specification take precedence.

The latest versions of the referenced standards shall be used, unless otherwise advised.

Table 3 – Referenced documents

Reference	Title
AS/NZS 1170.1	<i>Structural design actions – Permanent, imposed and other actions</i>
AS/NZS 1170.2	<i>Structural design actions – Wind Actions</i>
AS/NZS ISO 9001	<i>Quality management systems – Requirements</i>
AS 2898	<i>Radar Speed Detection</i>
AS 5156	<i>Electronic speed limit signs</i>
MRTS01	<i>Introduction to Technical Specifications</i>
MRTS14	<i>Road Furniture</i>
MRTS50	<i>Specific Quality System Requirements</i>
MRTS51	<i>Environmental Management</i>
MRTS61	<i>Gantries and Support Structures for Road Signs, Tolling Systems and ITS Devices</i>
MRTS91	<i>Conduits and Pits</i>
MRTS92	<i>Traffic Signal and Road Lighting Footings</i>
MRTS94	<i>Road Lighting</i>
MRTS201	<i>General Equipment Requirements</i>
MRTS263	<i>Standalone Solar (PV) Power Systems</i>
MUTCD	<i>Queensland Manual of Uniform Traffic Control Devices</i>
QTDF	<i>Queensland Traffic Data Format</i>
TRUM Manual	<i>Traffic and Road Use Management Manual</i>

4 Quality system requirements

4.1 Hold Points, Witness Points and Milestones

General requirements for Hold Points, Witness Points and Milestones are specified in Clause 5.2 of MRTS01 *Introduction to Technical Specifications*.

The Hold Points, Witness Points and Milestones applicable to this Technical Specification are summarised in Table 4.1.

Additional quality system requirements defined in MRTS50 *Specific Quality System Requirements* and MRTS201 *General Equipment Requirements* also apply to this Technical Specification.

Table 4.1 – Hold Points, Witness Points and Milestones

Clause	Hold Point	Witness Point	Milestone
4.2	1. Samples for acceptance (design) 2. Optical performance certification		
6.7	3. Design documentation and Location of mounting structure		
13		1. Location of sign	Submission of civil works design documentation
14.2		2. FAT: Optical performance test 3. FAT: Battery autonomy	
14.3		4. Site Acceptance Test	
14.5		5. System Acceptance Test	

The Principal reserves the right to evaluate the subcontractor’s quality system throughout the contract. Arrangements for conducting evaluations shall be at a time convenient to both parties and shall be confirmed in writing.

In contracts where a subcontractor becomes the major supplier, the subcontractor shall meet the requirements of AS/NZS ISO 9001 *Quality management systems – Requirements* and this Technical Specification.

4.2 Samples for acceptance

The detailed designs of the sign, equipment layout, fabrication and assembly drawings, calculations, specifications of component parts and certifications shall be submitted and approved by the Principal or their delegate for verification prior to manufacture.

Drawings shall specify the sign face, enclosure, solar module(s), radar unit posts and mounting accessories. The sign face drawings shall detail pixel rings, LED pixel arrangements showing horizontal and vertical pitch and character strokes as appropriate.

The Contractor’s specifications shall include the manufacturer and model of all component parts or subsystems used in the VAS. That may include but not restricted to, the LEDs to be used, power supply (charge controller and batteries), modems, communication ports, cable terminations, enclosure types and mounting accessories and conspicuity devices as appropriate.

Unless specified otherwise, a sample of the sign complete with software and hardware necessary for configuration, fabrication and assembly drawings, calculations, specifications, user manuals and certifications shall be submitted to the Principal for acceptance. **Hold Point 1**

NATA optical performance certificates shall be submitted before delivery to site. **Hold Point 2**

4.3 Warranty

The contractor installing the Vehicle Activated Sign shall warrant the installation against defects for a minimum of five years in accordance with the requirements of MRTS201 *General Equipment Requirements*.

Minimum five year warranty provision is required for electronic signage including VAS as they fall under a category of products which are either high cost safety critical or high volume.

5 Functional requirements

5.1 General

The VAS shall be deployed in speed zones with maximum posted speed of up to 100 km/h.

The VAS shall detect and then display the message such that the driver of any target vehicle exceeding the posted speed limit by up to 20 km/h will have sufficient time to be able to read and comprehend the message.

The VAS may display:

- the posted speed
- warning message, or
- a vehicle's travelling speed.

The VAS shall only activate when a vehicle exceeding the pre-set speed limit is detected. Vehicle speed detection shall be through use of a radar unit.

The radar unit shall be mounted such that it is vandal proof and able to be aimed in different directions independently of the sign face. Speed threshold settings, detection distance and range of the radar unit shall be configurable values adjusted to suit the intended location of the sign. Where the carriageway has more than one lane, the radar unit shall be capable of detecting approaching vehicles (including motorcycles and the like) in two lanes.

The sign shall remain blank at all times when not triggered by radar detection of a vehicle travelling above the sign's set speed.

The sign's set speed shall be a configurable parameter ranging from 35 km/h to 105 km/h in 1 km/h increments.

Upon detection of a speeding vehicle, all pixels constituting annulus, the numerals, warning message signs and the words "slow down" shall be activated simultaneously. The sign display shall remain active for a set duration once activated. This duration shall be a configurable parameter with a range of 2 to 8 seconds. The sign shall remain active while the approaching vehicle remains at or over the speed threshold.

The signs shall be capable of autonomous operation and allow for remote configuration. Provision shall be made for connection of the signs to the ITS Platform nominated by the Principal.

5.2 Sign types

Three types of VAS are described in this Technical Specification, broadly categorised by whether they display posted speed, warning message or travelling speed. Examples of these types are shown in

Figure 5.2. For sign detail see the relevant TC reference signs at <https://www.tmr.qld.gov.au/business-industry/Technical-standards-publications/TC-signs>. All sizes are required.

Figure 5.2 - Examples of VAS types



General Vehicle Activated Speed Limit Sign – TC1787

Note: The “80 km/h” shown in the figure is for illustration ONLY. The desired speed shall be as per the terms of contract.



An LED Warning Sign “Curve” with Supplementary “Slow Down” Speed Activated Signs – TC1790_1 and TC1790_2



Speed indicator sign showing vehicle speed and SLOW DOWN – TC1833. Contact the Principal for the latest version prior to use in Contract.

5.2.1 Type 1 – General vehicle activated speed limit sign

The general vehicle activated speed limit sign shall be as outlined in TC1787.

The display will only be activated when a vehicle travelling above a set speed is registered. In this case, all pixels constituting annulus, the numerals and the words “slow down” shall switch on simultaneously. The sign display shall remain active for a set duration, which is configurable, once activated. The sign shall remain active while the approaching vehicle remains at or over the speed threshold and in any case shall be visible to the driver of the speeding vehicle for at least three seconds.

5.2.2 Type 2 – LED warning signs with supplementary “Slow Down” signs

This type of VAS displays warning messages and is made up of two components:

- An LED Supplementary warning sign showing “SLOW DOWN” as per TC1790_1, and
- An LED warning sign selectable from 11 options as per TC1790_2 to TC1790_12.

Both LED displays will only be activated when a vehicle travelling above a set speed is registered. In this case, all pixels constituting the warning signs and the words “slow down” shall switch on simultaneously. The LED displays for both components (i) and (ii) shall remain active for a set duration once activated. The set duration shall be a configurable parameter between 2 to 8 seconds with a default value of three seconds.

The LED “curve” sign shown in Figure 5.2 is one of 11 signs designated Type 2, namely, Type 2a. All Type 2 VAS are as listed in Table 5.2.2.

Table 5.2.2 – Type 2 VAS

Type 2 VAS designation	Description of LED Traffic Hazard sign	TC reference
2a	“Curve” with Supplementary “SLOW DOWN”	TC1790_1 and TC1790_2
2b	“Reverse Curve” with Supplementary “SLOW DOWN”	TC1790_1 and TC1790_3
2c	“Cross Road” with Supplementary “SLOW DOWN”	TC1790_1 and TC1790_4
2d	“Roundabout” with Supplementary “SLOW DOWN”	TC1790_1 and TC1790_5
2e	“Winding Road” with Supplementary “SLOW DOWN”	TC1790_1 and TC1790_6
2f	“Slippery” with Supplementary “SLOW DOWN”	TC1790_1 and TC1790_7
2g	“Stop sign ahead” with Supplementary “SLOW DOWN”	TC1790_1 and TC1790_8
2h	“Side road junction on outside of a curve” with Supplementary “SLOW DOWN”	TC1790_1 and TC1790_9
2i	“Side road junction on inside of a curve” with Supplementary “SLOW DOWN”	TC1790_1 and TC1790_10
2j	“Steep descent” with Supplementary “SLOW DOWN”	TC1790_1 and TC1790_11
2k	“Give way sign ahead” with Supplementary “SLOW DOWN”	TC1790_1 and TC1790_12

The Type 2 VAS signs listed in this table may change in the future. Consult with the Principal for the required TC sign for each contract.

5.2.3 Type 3 – Speed indicator sign

The speed indicator signs are mainly used for control of speed in roadworks environments.

The speed indicator sign shall be as outlined in TC1833.

Unless advised otherwise, the speed indicator sign shall be used in accordance with the *Traffic Management at Works on Roads* guideline.

The Type 3 VAS sign, in the form of TC1833 may change in the future. The contractor shall consult with the Principal for the required TC sign for each contract.

6 Mechanical and physical requirements

6.1 Compliance to other departmental Technical Specifications

The mechanical and physical requirements defined in MRTS201 *General Equipment Requirements* apply to this Technical Specification. Additional mechanical and physical requirements for equipment provided under this Technical Specification are described below.

The signs shall comply with the requirements of MRTS14 *Road Furniture* and the *Design Guidelines for Roadside Signs*.

Where required, pits and conduits to accommodate power and communication cables shall be supplied and installed according to the requirements of MRTS91 *Conduits and Pits*.

The materials and methods of construction of the materials, equipment and enclosures shall be such that they have the strength and durability to withstand expected conditions of transportation, installation, and operation when installed in the intended environment.

Physical LED protection shall be such that optical performance of the sign is unaffected.

In addition, the VAS shall be fitted with anti-vandal features to reduce and deter vandalism to the whole system.

6.2 Environmental conditions

The signs shall be capable of continuous, normal operation in the environmental conditions described in MRTS201 *General Equipment Requirements*.

The equipment and enclosures shall be of suitable design to protect against vandalism, and prevent infestation by vermin. Ingress protection (IP) rating for enclosures shall be no less than IP 55 as per the IP rating scale defined in AS 60529. This includes all cable penetrations and equipment that may be located external to the enclosure. The Ingress protection (IP) rating for all internal electronic circuit board assembly enclosures shall be IP67. The printed circuit board assemblies shall be cleaned of solder flux, dried, and then be coated with a conformal coating suitable to protect the components and conductive tracks.

6.3 Sign placement

Sign placement shall be as directed by the Principal in accordance with requirements of the contract and the MUTCD. In addition, placement of signs shall be such that sighting distance requirements and the distance to allow the proper function of the radar unit are met.

6.4 Sign enclosures

Associated sign control electronics shall be housed in an enclosure and in a manner which allows access for maintenance. Doors shall be capable of being hinged from either the left or right, but unless specified otherwise, shall be hinged from the left. The enclosure shall be fitted with a door switch to indicate if the enclosure door is open or improperly closed. All doors accessible to the public shall be lockable.

Venting and air circulation arrangements shall be such that the thermal ratings of the electronics are not exceeded. The use of air filters and forced air cooling by the use of fans is not allowed.

Peltier devices or other similar means may be used for moisture control. Door seals are to ensure sustained ingress protection for the service life of the sign.

6.5 Lifting attachment and retention points

Any component part of this system which weighs more than 14 kg shall have approved attachment points for mechanical lifting apparatus to be connected. Instructions on the correct use shall be provided with the installation documentation.

Any component part weighing 14 kg or less shall be fitted with approved hand holds to aide human lifting.

Any sub-system component part like the display box or control box that could be lifted by a human being but is less than 14 kg in gross weight shall be fitted with approved hand holds to aid human lifting.

6.6 Design life

Unless otherwise specified, the design life of components shall be as follows:

- LEDs / pixels: a minimum of 10 years
- door switch: 50,000 operations
- other electrical systems: a minimum of 10 years
- sign enclosure: a minimum of 20 years, and
- footings and Structural supports: a minimum of 40 years.

6.7 Design loads

Static and wind design loads shall be in accordance with AS 1170.1 and AS 1170.2.

The footings shall be compliant with MRTS92 *Traffic Signal and Road Lighting Footings* and *Traffic and Road Use Management Manual (TRUM) Volume 3, Part 5: Design Guide for Roadside Signs* and the associated Standard Drawings.

Final footing, support structure design and locations as shown in design documentation, shall be submitted to the Principal's representative for acceptance before fabrication. **Hold Point 3**

6.8 Location and type of mounting structure

Each sign and associated equipment shall be capable of being pole mounted on a standard Transport and Main Roads slip base pole compliant to *Traffic and Road Use Management Manual (TRUM) Volume 3, Part 5: Design Guide for Roadside Signs* and the associated Standard Drawings.

Depending upon the road side safety assessment the system may use a separate support pole for the PV modules from that supporting the sign.

Slip base construction may be used in high speed environments. The decision to use a slip base pole or barriers shall be made by an Engineer with the appropriate RPEQ qualification.

Mounting hardware shall provide means to adjust the vertical and/or horizontal alignment of each sign and of solar panel(s) during commissioning and subsequent maintenance activities.

Unless otherwise specified the pole material and galvanised finish shall be consistent with *Traffic and Road Use Management Manual (TRUM) Volume 3, Part 5: Design Guide for Roadside Signs* and its referenced documents. Poles shall be designed and approved by a structural RPEQ. All footings shall be consistent with MRTS92 *Traffic Signal and Road Lighting Footings* but shall be designed and approved by a structural RPEQ.

The location and type of mounting structure to be provided for each sign and solar panel shall be shown on the design documentation.

6.9 Telecommunications field cabinets

Unless otherwise specified, no telecommunication field cabinets are required.

If specified, provision for connection to field cabinets shall be made by way of ducts and pits if so specified in the design documents. Pits and ducts shall be installed in accordance with MRTS91 *Conduits and Pits*.

6.10 Marking

Each sign shall be durably marked internally to show sign type, serial number, date of manufacture, RCM and firmware release version. The details shall allow traceability of the sign manufacture according to the Contractor's quality system.

The rear of each sign shall be affixed with a unique identification number as nominated by the Principal and a phone number to call in the event of a fault or damage to the sign. The label shall be designed to last 10 years in the range of environmental conditions described in MRTS201 *General Equipment Requirements*. The label shall be clearly legible from 1.5 metres above ground level, a distance of five metres from the base of the sign.

7 Operational requirements of VAS

7.1 Common operational requirements

The operational requirements defined in MRTS201 apply to this Technical Specification. Additional operational requirements for equipment provided under this Technical Specification are described below.

The apparent width of all displayed elements including text shall match the respective sign display defined in the MUTCD. The minimum activated sign legibility (sight) distance shall be sufficient for the posted speed limit before the sign.

7.2 Display technology

The display technology shall be light emitting diode (LED). To achieve the required sign luminance levels, the display pixels may be formed by arranging one or more LEDs in a cluster.

The optical and technical performance of the LED sign shall comply with those specified in Clause 8 below.

7.3 Character formats

Only fonts accepted by the Principal's Representative shall be used.

The annulus shall not be less in size than that required for an equivalent static sign.

Numerals and warning messages for either sign type shall be as per the appropriate TC sign indicated in Clause 5.

7.4 Sign display

There shall be no discernible flickering of the displayed numerals or static portion of the annulus. Background flickering as a result of checking the 'on' and 'off' pixel status shall not be visible.

7.5 Display colour

The LED and background colours for each sign type shall be as per the appropriate TC sign indicated in Clause 5.

The red, yellow and white colours for all sign types shall fall within the chromaticity coordinates specified in AS 5156.

7.6 Default display

Facilities shall be included to detect failures within the display control system with the sign blanking the display when major faults are detected.

All VAS shall be able to detect LED failure even if the LEDs may be required to be 'off' at the time of the periodic check. The display shall be blanked upon failure of 2% of contiguous pixels for the displayed image or failure of more than 20% of total LEDs.

The sign shall blank the display for the following conditions:

- a sign processor fault
- battery voltage lower than the set threshold, and
- failure of 20% of LEDs of the annulus and/or any digit or when displayed digit cannot be readily recognised.

Ambient light sensor failure should not result in blanking of the display. Upon failure of the ambient light sensor, the sign should fall back to time-of-day brightness levels.

7.7 Red annulus construction and activation

The annulus for the Type 1 sign shall comply with the requirements of TC1787.

For Type 1 VAS, the red annulus shall consist of suitably constructed, evenly spaced pixel rings with at least three pixel rings. The annulus rings in all cases shall be constructed so that LEDs connected in series are separated by at least three LEDs from other circuits.

LEDs will only be enabled and become activated when a vehicle travelling above a set speed in the designated zone is registered. When activated by a speeding vehicle, the LEDs of the annulus, the numerals and the "Slow Down" message shall not flash, but shall remain ON for a duration that would be visible to the driver of the speeding vehicle for at least five consecutive seconds.

7.8 Internal clock

The sign shall be provided with a 24 hour internal clock. The clock shall be able to be synchronised with the TMS system clock or other appropriate time source as determined by the Principal. Time error shall be no more than one second over a period of one week.

7.9 VAS data

Three types of data are maintained in VAS, namely Production Data, Event Logs and Configuration Settings. All these data shall be kept in non-volatile memory. Production Data and Event Logs which involve reporting time of occurrence shall adopt Australian Eastern Standard Time (AEST).

7.9.1 Production data

Detection of every approaching vehicle shall be in accordance with format prescribed in QTDF, which includes detected speed and time of the detection, alongside with file header and checksum. The speed data shall be reported at the resolution of 1 km/h.

7.9.2 Event logs

The sign shall log all operational and fault events, including the date and time that the event occurs. Details of these events shall be available via the Remote Sign Management System. The logging capacity shall be such that the logged data is retained for a minimum of one month duration. The logged data shall be stored in a removable storage device. The events to be logged include, but are not limited to:

- lower energy alarm (sign will not work in 24 hours if the battery does not receive charge in that time)
- loss of power (main and auxiliary)
- power restoration (main and auxiliary)
- high or low battery voltage occurrence
- any access panel opening
- daily power consumption
- failure to communicate with the remote control centre
- LED failure
- light sensor failure
- radar tilt
- sign tilt
- enclosure tilt
- dimming level
- loss of solar module
- high enclosure temperature (adjustable set point between 40° and 80°)
- local or remote connection, commencement and termination, and
- sign enclosure temperature on each minute.

7.9.3 Configuration settings

VAS configuration parameters can be set up locally or remotely. When set up remotely, the sign control shall provide a foolproof mechanism to avoid losing connection unintentionally. The VAS will have sufficient storage capacity to accommodate future firmware upgrades during the lifetime of the Product. Storage capacity wise, no further hardware upgrades will be required to accommodate ongoing firmware changes / upgrades. In addition, the parameters shall be completely protected against software / firmware upgrade.

7.10 Conspicuity devices

No conspicuity devices or lanterns are required for the signs in this Technical Specification.

However, the signs shall allow conspicuity devices to be added in future if desired.

7.11 Local facility switch

Where specified, a three-position key operated facility switch that complies with MRTS201 *General Equipment Requirements*, shall be provided to enable selection of the following three display functions:

- OFF – display blank, control via all communications ports inhibited, status and diagnostic commands via all communications ports remain functional
- Test Mode – display active, control via all communications ports inhibited, status and diagnostic commands via all communications ports remain functional, and
- Normal – display active, displayed message selected via the maintenance communications port and/or the control communications port.

7.12 Compliant radar unit for all VAS signs

Radar detection shall comply with the relevant requirements of AS 2898.

The radar unit shall detect only approaching vehicles travelling at speeds ranging from at least 20 km/h up to 120 km/h. The detection range shall be adjustable with a maximum detection range of no less than 140 m. Speed detection accuracy shall be better than 3%.

The radar unit shall be adjustable such that there is no interference with other radar units within the same carriageway.

8 Optical performance

Unless otherwise specified the optical performance of the sign shall comply with the relevant Australian Standards below.

8.1 Luminance and colour

The luminance and luminance ratio of the LEDs, when measured under laboratory conditions shall comply with the requirements of AS 5156.

The colour emitted by each LED shall be as defined by the colour boundaries in AS 5156.

8.2 LED intensity control

The LED intensity must be controlled to provide constant apparent brightness and maximum legibility distance for the range of the ambient light under which the sign must operate.

The levels of brightness, the number of light sensors, and the automatic dimming control functionality shall be in accordance with the LED intensity control requirements in AS 5156.

8.3 LED drive limits and output

Each individual LED shall be driven with a continuous current with no peak and/or magnitudes exceeding 70% of the LED manufacturer's maximum continuous rating.

8.4 Luminance intensity half angle

For each LED, the off-axis angle at which the output luminous intensity of the LED is half that of the value measured on the reference axis (the mechanical axis) of the LED, shall be no less than 15°.

8.5 Veiling illuminance effects (sun phantom)

The effect of sunlight or other light sources shining on the optical elements shall be controlled such that inactive pixels do not appear active.

Provision shall be made for each sign to be fitted with a visor to minimize sun-phantom, veiling illuminance effects or to reduce the possibility of a flashing signal being seen by traffic for which it is not intended, or all three.

The visor shall be sufficiently rigid to withstand distortion due to wind and extreme weather conditions including temperature and heavy rain.

The interior surface of visors shall be finished so as to minimize reflections of the illuminated signal.

9 Sign control system

The control system requirements defined in MRTS201 *General Equipment Requirements* apply to this Technical Specification. Additional sign control system requirements for equipment provided under this Technical Specification are described below.

9.1 Autonomy of operation

The sign shall be capable of autonomous operation and allow local as well as remote access by diagnostic software and remote sign management software respectively. Each sign shall be uniquely identifiable electronically for use by the remote sign management software for this purpose.

9.2 Local control access

The sign shall allow local control via a maintenance communications port using a laptop or a handheld device. Local control shall be gained using the diagnostic software. The system shall provide secure access to the signs to prevent unauthorised access to the signs.

All sign diagnostics and configuration parameters able to be changed in the field shall be accessible when the sign is selected for local control. Remote control of the sign shall be disabled when the sign is selected for local control.

Disconnection of a laptop or handheld device shall cause the sign to revert to autonomous operation.

Ending of the maintenance session shall not require further interaction from the user, nor in anyway interrupt operation or require rebooting of the sign but immediately let the sign to revert to autonomous operation.

9.3 VAS remote control and data collection

Each sign control shall be capable of being accessed remotely via a communications port. The sign shall allow for remote synchronisation of time with the remote sign management software.

The sign control shall be able to service requests by the remote sign management software including status reports and a log of events.

The sign control shall be able to send unsolicited status message / alarm to the remote sign management software should an event occur that requires blanking of the display, annulus, numerals, or traffic control signs.

The effect of a command by the remote management system to the signs shall be realised within 10 seconds.

The majority of the VAS will be standalone installations and hence the availability of built-in 4G/5G connectivity is mandatory for connection to the Principal's private telecommunications network / IPRT. Connectivity via optical fibre and ADSL is desirable.

The radar and sign control shall provide functionality for setting and changing the activation speed remotely. The sign control system shall also log speeds in data bins.

The data bins shall be remotely adjustable with minimum bin widths of 1 km/h.

9.4 VAS management software

9.4.1 Security and compatibility

The software shall:

- a) request passwords as part of the access and configuration authorisation process
- b) be compatible with Microsoft Windows® operating system environment, Windows 10 or more recent version and those industry standards current at the time of delivery
- c) any software provided shall be capable of operating on all such operating systems
- d) it is highly desirable that the Sign support Simple Network Management Protocol (SNMPv2c) to allow centralised (remote) device monitoring and management, and
- e) it is desirable for security reasons, that the sign support SNMPv3 or support an upgrade path to SNMPv3 (e.g. via firmware update).

9.4.2 Diagnostic software

Diagnostic software shall be supplied with the sign for the purpose of sign configuration, commissioning and maintenance activities.

The diagnostic software shall fully implement all the sign functions required for the commissioning and maintenance of the sign. The Diagnostic Software shall be configured to request passwords as part of the sign access and configuration authorisation process.

If required, the diagnostic software shall be capable of suggesting ranges for each parameter as applicable when programming and not allow these limits to be exceeded. The diagnostic software shall have the capability to save and upload sign configurations to and from the respective VAS.

A desirable feature of the diagnostic software is a test program. This would facilitate testing of all the essential sign features including ability to activate, deactivate all pixels, select the number of the annulus inner rings to flash and to vary LED brightness.

The software shall allow the request of a full log of events and querying of events according to set criteria such as by sign(s), time, date, event type, or by duration.

9.4.3 Remote Sign Management System

Vehicle Activated Signs (VAS) will be connected to the department's Principal's private telecommunications network / IPRT. As a result, detailed protocol information and command set documentation must be provided for the development of device interfacing application and the department's own Remote Sign Management System. The provision of these detailed protocol information and command set documentation is a mandatory requirement for tender evaluation purpose and for assessment of the product against this MRTS.

It is highly desirable that the contractor supply a Remote Sign Management System software which shall perform the following functions as a minimum:

- allow multiple concurrent real time point-to-point connections from the Sign Management System to VAS in the field
- detail the location and current status of all signs (operational, idle, fault condition)
- show signs on a map-based GUI
- implement multiple levels of user access such as:
 - administrator
 - maintenance
 - standard user, and
 - read only.
- allow querying of events according to set criteria such as by sign(s), time, date, event type, or by duration
- poll the signs in the field every hour to verify the communications link and that the sign has not failed. Failure of the sign management system to gain a response from the sign, in a usual time-frame, over three consecutive polls shall result in an event being logged in the system that highlights that the sign status is unknown and possibly failed or damaged
- allow updating and programming of each sign
- backup / export / import of sign configuration, and
- allow for a daily download of all applicable data listed in Clause 7.9.

10 Environmental requirements

The environmental requirements defined in MRTS51 *Environmental Management* and MRTS201 *General Equipment Requirements* apply to this Technical Specification.

11 Electrical requirements

11.1 Mains power

Where mains power is required, the relevant electrical requirements defined in Clause 10 of MRTS201 *General Equipment Requirements* apply to this Technical Specification.

The sign shall be able to operate normally for voltage variation of between - 13% and + 25% of normal supply voltage.

11.2 Battery power

Where mains power is required, also provide a battery power supply in accordance with Clause 10 of MRTS201 *General Equipment Requirements* for the real time clock and processor to allow orderly power down in the case of loss of power supply.

11.3 Solar power

Where solar power is specified, the requirements defined in MRTS263 *Standalone Solar (PV) Power Systems* apply to this Technical Specification.

12 ITS network telecommunications

The telecommunications requirements defined in MRTS201 *General Equipment Requirements* apply to this Technical Specification.

13 Installation requirements

The installation requirements defined in MRTS201 *General Equipment Requirements* apply to this Technical Specification.

Additional installation requirements relevant under this Technical Specification are described below.

The general layout, positions, reduced level for the footing (where applicable), and speed zones for the sign and details of the barrier and other mounting requirements shall be as shown on the design documentation.

The position of in-ground mounting structures shall comply with the requirements of the MUTCD. Before installation, the Contractor shall confirm the final sign location and the type, location and positioning of the mounting arrangements and/or protection barrier as shown in the design documentation to the Verifier. **Witness Point 1**

The positioning of sign shall provide sight distances as described in the TRUM Manual.

The sign location shall be verified by site inspection and shall be shown on the design documentation. The design documentation shall be submitted to the Verifier not less than seven days prior to the commencement of civil works for the sign foundations. **Milestone**

14 Testing and commissioning

The testing and commissioning requirements defined in MRTS201 *General Equipment Requirements* apply to this Technical Specification.

Additional testing and commissioning requirements relevant under this Specification are described below.

14.1 Test sign sample for acceptance

Where specified in the tender documentation, a test sign complete with accessories shall be provided to the Principal as part of the Acceptance Test Plan for testing of software components used to control signs within the Principal's private telecommunications network / IPRT. It is preferred that the test sample is the largest size in the standard drawing, however, any size compliant with the standard will be acceptable. Provision of the test sign will not be necessary if a test sign has previously passed an acceptance test.

14.2 Factory acceptance tests

Compliance with the optical performance requirements shall be determined by measurement under laboratory conditions as detailed in Clause 8 for each type and size of sign provided by the contractor.

The performance of the sign displays shall meet or exceed the optical requirements specified in AS 5156. The testing shall be based upon the contract specified and expected number of activations.

Witness Point 2

The Factory Acceptance Tests for battery autonomy maybe conducted on the first test with continuous operation of the sign without recharge, for the equivalent period of activation time. The performance shall be monitored with the use of a data logger acceptable to Transport and Main Roads.

Unless specified in contract the expected load shall be the radar and control system continuous current draw plus a minimum of 7000 activations of the sign per day at full brightness with each test activation of five seconds in length. **Witness Point 3**

Each and every radar unit shall be tested and calibrated for speed and reaction time triggering for each possible speed increment. The test and calibration report shall be traceable to a NATA testing laboratory and shall be included in the documentation submitted during the commissioning tests.

14.3 Site acceptance test

All equipment shall be subject to production testing and each commissioned sign shall be functionally tested before the handover to customer. The test shall, as a minimum, include the following procedures.

Simulation of all fault conditions, including:

- total power failure / sign knockdown
- removal of solar panel
- communications failure, and
- LED Fault, both annulus and each displayed speed increment.

The Contractor shall provide a test report with the results of the witnessed tests. **Witness Point 4**

14.4 VAS configuration

Setting of the time, display duration and activation speed shall be performed as part of the commissioning process. The Principal will provide the set speed for vehicle activation and the active display duration time.

14.5 System acceptance test

After all sites pass a site acceptance test, the system shall be tested, by visual verification of each sign site. The contractor shall verify the correct operation of each sign, with the parameters observed in sign management system. The test report shall be included in the documentation submitted during the commissioning tests. **Witness Point 5**

15 Documentation

An Operations and Maintenance Manual shall be provided with each sign.

The documentation requirements defined in MRTS201 *General Equipment Requirements* apply to this Technical Specification.

15.1 Asset data

Once each ITS asset type being installed is known, this shall be communicated to the Principal at first opportunity. This is required to ensure assets are recorded in ROAR and have appropriate Asset IDs and Site IDs.

16 Training

The training requirements defined in MRTS201 *General Equipment Requirements* apply to this Technical Specification.

Training shall include appropriate methods of checking the calibration and alignment of the Radar insitu.

17 Maintenance

The maintenance requirements defined in MRTS201 *General Equipment Requirements* apply to this Technical Specification.

Maintenance shall include appropriate methods of checking the calibration and alignment of the Radar insitu.

18 Handover

The handover requirements defined in MRTS201 *General Equipment Requirements* apply to this Technical Specification.

Handover shall include all documentation from the design, construction, installation, and maintenance of the VAS before installation.

19 Product approval checklist

The checklist for the product approval evaluation is published as Appendix A to this Technical Specification.

Appendix A – Product Approval Compliance Checklist

Type Approval Compliance Checklist row #	MRTS218 – Product Approval Requirement	Reference Clause	Verification Method					Compliance (Y, TBC, N, N/A)
			Visual Inspection	NATA Certification	Field / Bench Test	Detailed Drawings	Other records (Datasheets, internal testing, RPEQ)	
4 Quality system requirements								
1	The detailed designs of the sign, equipment layout, fabrication and assembly drawings, calculations, specifications of component parts and certifications shall be submitted and approved by the Principal or their delegate for verification prior to manufacture.	4.1				X	X	
2	Drawings shall specify the sign face, enclosure, solar module(s), radar unit posts and mounting accessories.	4.1				X	X	
3	The sign face drawings shall detail pixel rings, LED pixel arrangements showing horizontal and vertical pitch and character strokes as appropriate.	4.1				X	X	
4	The Contractor's specifications shall include the manufacturer and model of all component parts or subsystems used in the VAS. That may include but not restricted to, the LEDs to be used, power supply (charge controller and batteries), modems, communication ports, cable terminations, enclosure types and mounting accessories and conspicuity devices as appropriate.	4.1				X	X	
5	Unless specified otherwise, a sample of the sign complete with software and hardware necessary for configuration, fabrication and assembly drawings, calculations, specifications, user manuals and certifications shall be submitted to the Principal for acceptance.	4.1				X	X	
6	NATA optical performance certificates shall be submitted before delivery to site.	4.1		X				

Type Approval Compliance Checklist row #	MRTS218 – Product Approval Requirement	Reference Clause	Verification Method					Compliance (Y,TBC,N, N/A)
			Visual Inspection	NATA Certification	Field / Bench Test	Detailed Drawings	Other records (Datasheets, internal testing, RPEQ)	
7	The contractor installing the Vehicle Activated Sign shall warrant the installation against defects for a minimum of five years in accordance with the requirements of MRTS201 <i>General Equipment Requirements</i> .	4.2					X	
5 Functional requirements								
8	The VAS shall be deployed in speed zones with maximum posted speed of up to 100 km/h.	5.1					X	
9	The VAS shall detect and then display the message such that the driver of any target vehicle exceeding the posted speed limit by up to 20 km/h will have sufficient time to be able to read and comprehend the message.	5.1			X	X	X	
10	The VAS may display: <ul style="list-style-type: none"> • the posted speed • warning message, or • vehicles travelling speed. 	5.1	X			X	X	
11	The VAS shall only activate when a vehicle exceeding the pre-set speed limit is detected.	5.1	X			X	X	
12	Vehicle speed detection shall be through use of a radar unit.	5.1	X			X	X	
13	The radar unit shall be mounted such that it is vandal proof and able to be aimed in different directions independently of the sign face.	5.1	X		X		X	
14	Speed threshold settings, detection distance and range of the radar unit shall be configurable values adjusted to suit the intended location of the sign.	5.1			X		X	

Type Approval Compliance Checklist row #	MRTS218 – Product Approval Requirement	Reference Clause	Verification Method					Compliance (Y,TBC,N, N/A)
			Visual Inspection	NATA Certification	Field / Bench Test	Detailed Drawings	Other records (Datasheets, internal testing, RPEQ)	
15	Where the carriageway has more than one lane, the radar unit shall be capable of detecting approaching vehicles (including motorcycles and the like) in two lanes.	5.1			X		X	
16	The sign shall remain blank at all times when not triggered by radar detection of a vehicle travelling above the sign's set speed.	5.1			X		X	
17	The sign's set speed shall be a configurable parameter ranging from 35 km/h to 105 km/h in 1 km/h increments.	5.1			X		X	
18	Upon detection of a speeding vehicle, all pixels constituting annulus, the numerals, warning message signs and the words "slow down" shall be activated simultaneously.	5.1			X		X	
19	The sign display shall remain active for a set duration once activated.	5.1			X		X	
20	This duration shall be a configurable parameter with a range of 2 to 8 seconds.	5.1			X		X	
21	The sign shall remain active while the approaching vehicle remains at or over the speed threshold.	5.1			X		X	
22	The signs shall be capable of autonomous operation and allow for remote configuration.	5.1			X		X	
23	Provision shall be made for connection of the signs to the ITS Platform nominated by the Principal.	5.1			X		X	
24	Three types of VAS are described in this Technical Specification, broadly categorised by whether they display posted speed, warning message or travelling speed. Examples of these types are shown in Figure 5.2.	5.2	X		X		X	

Type Approval Compliance Checklist row #	MRTS218 – Product Approval Requirement	Reference Clause	Verification Method					Compliance (Y,TBC,N, N/A)
			Visual Inspection	NATA Certification	Field / Bench Test	Detailed Drawings	Other records (Datasheets, internal testing, RPEQ)	
25	For sign detail see the relevant TC reference signs at https://www.tmr.qld.gov.au/business-industry/Technical-standards-publications/TC-signs .	5.2						
26	All sizes are required.	5.2				X	X	
27	The desired speed shall be as per the terms of contract.	5.2					X	
28	Type 1: The general Vehicle activated speed limit sign shall be as outlined in TC1787.	5.3	X			X		
29	Type 1: The display will only be activated when a vehicle travelling above a set speed is registered.	5.3			X			
30	Type 1: In this case, all pixels constituting annulus, the numerals and the words “slow down” shall switch on simultaneously.	5.3	X		X		X	
31	Type 1: The sign display shall remain active for a set duration, which is configurable, once activated.	5.3	X		X		X	
32	Type 1: The sign shall remain active while the approaching vehicle remains at or over the speed threshold and in any case shall be visible to the driver of the speeding vehicle for at least three seconds.	5.3	X		X		X	
33	Type 2: The VAS displays warning messages and is made up of two components: 1) An LED Supplementary warning sign showing “SLOW DOWN” as per TC1790_1, and 2) An LED warning sign selectable from 11 options as per TC1790_2 to TC1790_12.	5.2.2	X		X		X	
34	Type 2: Both LED displays will only be activated when a vehicle travelling above a set speed is registered.	5.2.2	X		X		X	

Type Approval Compliance Checklist row #	MRTS218 – Product Approval Requirement	Reference Clause	Verification Method					Compliance (Y,TBC,N, N/A)
			Visual Inspection	NATA Certification	Field / Bench Test	Detailed Drawings	Other records (Datasheets, internal testing, RPEQ)	
35	Type 2: all pixels constituting the warning signs and the words “slow down” shall switch on simultaneously.	5.2.2	X		X		X	
36	Type 2: The LED displays for both components (i) and (ii) shall remain active for a set duration once activated.	5.2.2	X		X		X	
37	Type 2: The set duration shall be a configurable parameter between 2 to 8 seconds with a default value of three seconds.	5.2.2	X		X		X	
38	Type 2: The LED “curve” sign shown in Figure 5.2 is one of 11 signs designated Type 2, namely, Type 2a.	5.2.2	X		X		X	
39	All Type 2 VAS are as listed in Table 5.2.2.	5.2.2	X		X		X	
40	Type 3: The speed indicator signs are mainly used for control of speed in roadworks environments.	5.2.3					X	
41	Type 3: The speed indicator sign shall be as outlined in TC1833.	5.2.3	X			X		
42	Type 3: Unless advised otherwise, the speed indicator sign shall be used in accordance with the <i>Traffic Management at Works on Roads</i> guideline.	5.2.3	X			X	X	
6 Mechanical and physical requirements								
43	The mechanical and physical requirements defined in MRTS201 <i>General Equipment Requirements</i> apply to this Technical Specification.	6.1					X	
44	Additional mechanical and physical requirements for equipment provided under this Technical Specification are described below.	6.1						

Type Approval Compliance Checklist row #	MRTS218 – Product Approval Requirement	Reference Clause	Verification Method					Compliance (Y, TBC, N, N/A)
			Visual Inspection	NATA Certification	Field / Bench Test	Detailed Drawings	Other records (Datasheets, internal testing, RPEQ)	
45	The signs shall comply with the requirements of MRTS14 <i>Road Furniture</i> and the <i>Design Guidelines for Roadside Signs</i> .	6.1				X	X	
46	Where required, pits and conduits to accommodate power and communication cables shall be supplied and installed according to the requirements of MRTS91 <i>Conduits and Pits</i> .	6.1						
47	The materials and methods of construction of the materials, equipment and enclosures shall be such that they have the strength and durability to withstand expected conditions of transportation, installation and operation when installed in the intended environment.	6.1				X	X	
48	Physical LED protection shall be such that optical performance of the sign is unaffected.	6.1					X	
49	In addition, the VAS shall be fitted with anti-vandal features to reduce and deter vandalism to the whole system.	6.1	X				X	
50	The signs shall be capable of continuous, normal operation in the environmental conditions described in MRTS201 <i>General Equipment Requirements</i> .	6.2					X	
51	The equipment and enclosures shall be of suitable design to protect against vandalism and prevent infestation by vermin.	6.2	X				X	
52	Ingress Protection (IP) rating for enclosures shall be no less than IP55 as per the IP rating scale defined in AS 60529.	6.2		X			X	
53	This includes all cable penetrations and that may be located external to the enclosure.	6.2	X				X	

Type Approval Compliance Checklist row #	MRTS218 – Product Approval Requirement	Reference Clause	Verification Method					Compliance (Y,TBC,N, N/A)
			Visual Inspection	NATA Certification	Field / Bench Test	Detailed Drawings	Other records (Datasheets, internal testing, RPEQ)	
54	The Ingress Protection (IP) rating for all internal electronic circuit board assembly enclosures shall be IP67.	6.2					X	
55	The printed circuit board assemblies shall be cleaned of solder flux, dried, and then be coated with a conformal coating suitable to protect the components and conductive tracks.	6.2	X				X	
56	Sign placement shall be as directed by the Principal in accordance with requirements of the contract and the MUTCD.	6.3						
57	In addition, placement of signs shall be such that sighting distance requirements and the distance to allow the proper function of the radar unit are met.	6.3					X	
58	Associated sign control electronics shall be housed in an enclosure and in a manner which allows access for maintenance.	6.4	X		X			
59	Doors shall be capable of being hinged from either the left or right, but unless specified otherwise, shall be hinged from the left.	6.4	X			X		
60	The enclosure shall be fitted with a door switch to indicate if the enclosure door is open or improperly closed.	6.4	X				X	
61	All doors accessible to the public shall be lockable.	6.4	X			X	X	
62	Venting and air circulation arrangements shall be such that the thermal ratings of the electronics are not exceeded.	6.4					X	
63	The use of air filters and forced air cooling by the use of fans is not allowed.	6.4	X				X	
64	Peltier devices or other similar means may be used for moisture control.	6.4	X				X	

Type Approval Compliance Checklist row #	MRTS218 – Product Approval Requirement	Reference Clause	Verification Method					Compliance (Y,TBC,N, N/A)
			Visual Inspection	NATA Certification	Field / Bench Test	Detailed Drawings	Other records (Datasheets, internal testing, RPEQ)	
65	Door seals are to ensure sustained ingress protection for the service life of the sign.	6.4	X				X	
66	Any component part of this system which weighs more than 14 kg shall have approved attachment points for mechanical lifting apparatus to be connected.	6.5	X				X	
67	Instructions on the correct use shall be provided with the installation documentation.	6.5					X	
68	Any component part weighing 14 kg or less shall be fitted with approved hand holds to aid human lifting.	6.5					X	
69	Any sub-system component part like the display box or control box that could be lifted by a human being but is less than 14 kg in gross weight shall be fitted with approved hand holds to aid human lifting.	6.5					X	
70	Unless otherwise specified, the design life of components shall be as follows:	6.6						
71	• LEDs / pixels: a minimum of 10 years	6.6					X	
72	• door switch: 50,000 operations	6.6					X	
73	• other electrical systems: a minimum of 10 years	6.6					X	
74	• sign enclosure: a minimum of 20 years, and	6.6					X	
75	• footings and Structural supports: a minimum of 40 years.	6.6					X	
76	Static and wind design loads shall be in accordance with AS 1170.1 and AS 1170.2.	6.7					X	

Type Approval Compliance Checklist row #	MRTS218 – Product Approval Requirement	Reference Clause	Verification Method					Compliance (Y,TBC,N, N/A)
			Visual Inspection	NATA Certification	Field / Bench Test	Detailed Drawings	Other records (Datasheets, internal testing, RPEQ)	
77	The footings shall be compliant with MRTS92 <i>Traffic Signal and Road Lighting Footings and Traffic and Road Use Management (TRUM) Manual</i> , Volume 3, Part 5: <i>Design Guide for Roadside Signs</i> and the associated Standard Drawings.	6.7					X	
78	Final footing, support structure design and locations as shown in design documentation, shall be submitted to the Principal's representative for acceptance before fabrication.	6.7					X	
79	Each sign and associated equipment shall be capable of being pole mounted on a standard Transport and Main Roads slip base pole compliant to <i>Traffic and Road Use Management (TRUM) Manual</i> , Volume 3, Part 5: <i>Design Guide for Roadside Signs</i> and the associated Standard Drawings.	6.8				X	X	
80	Depending upon the road side safety assessment the system may use a separate support pole for the PV modules from that supporting the sign.	6.8				X	X	
81	Slip base construction may be used in high speed environments.	6.8				X	X	
82	The decision to use a slip base pole or barriers shall be made by an Engineer with the appropriate RPEQ qualification.	6.8				X	X	
83	Mounting hardware shall provide means to adjust the vertical and/or horizontal alignment of each sign and of solar panel(s) during commissioning and subsequent maintenance activities.	6.8				X	X	

Type Approval Compliance Checklist row #	MRTS218 – Product Approval Requirement	Reference Clause	Verification Method					Compliance (Y,TBC,N, N/A)
			Visual Inspection	NATA Certification	Field / Bench Test	Detailed Drawings	Other records (Datasheets, internal testing, RPEQ)	
84	Unless otherwise specified the pole material and galvanised finish shall be consistent with <i>Traffic and Road Use Management (TRUM) Manual</i> , Volume 3, Part 5: <i>Design Guide for Roadside Signs</i> and its referenced documents.	6.8				X	X	
85	Poles shall be designed and approved by a structural RPEQ.	6.8				X	X	
86	All footings shall be consistent with MRTS92 <i>Traffic Signal and Road Lighting Footings</i> but shall be designed and approved by a structural RPEQ.	6.8				X	X	
87	The location and type of mounting structure to be provided for each sign and solar panel shall be shown on the design documentation.	6.8				X	X	
88	Unless otherwise specified, no telecommunication field cabinets are required.	6.9						
89	If specified, provision for connection to field cabinets shall be made by way of ducts and pits if so specified in the design documents.	6.9				X	X	
90	Pits and ducts shall be installed in accordance with MRTS91 <i>Conduits and Pits</i> .	6.9						
91	Each sign shall be durably marked internally to show sign type, serial number, date of manufacture, RCM, and firmware release version.	6.10	X			X	X	
92	The details shall allow traceability of the sign manufacture according to the Contractor's quality system.	6.10	X			X	X	

Type Approval Compliance Checklist row #	MRTS218 – Product Approval Requirement	Reference Clause	Verification Method					Compliance (Y,TBC,N, N/A)
			Visual Inspection	NATA Certification	Field / Bench Test	Detailed Drawings	Other records (Datasheets, internal testing, RPEQ)	
93	The rear of each sign shall be affixed with a unique identification number as nominated by the Principal and a phone number to call in the event of a fault or damage to the sign.	6.10	X			X	X	
94	The label shall be designed to last 10 years in the range of environmental conditions described in MRTS201 <i>General Equipment Requirements</i> .	6.10	X			X	X	
95	The label shall be clearly legible from 1.5 metres above ground level, a distance of five metres from the base of the sign.	6.10	X				X	
7 Operational requirements of VAS								
96	The operational requirements defined in MRTS201 <i>General Equipment Requirements</i> apply to this Technical Specification. Additional operational requirements for equipment provided under this Technical Specification are described below.	7.1						
97	The apparent width of all displayed elements including text shall match the respective sign display defined in the MUTCD.	7.1	X			X	X	
98	The minimum activated sign legibility (sight) distance shall be sufficient for the posted speed limit before the sign.	7.1	X			X	X	
99	The display technology shall be Light Emitting Diode (LED).	7.2					X	
100	To achieve the required sign luminance levels, the display pixels may be formed by arranging one or more LEDs in a cluster.	7.2	X			X		
101	The optical and technical performance of the LED sign shall comply with those specified in Clause 8 below.	7.2						

Type Approval Compliance Checklist row #	MRTS218 – Product Approval Requirement	Reference Clause	Verification Method					Compliance (Y,TBC,N, N/A)
			Visual Inspection	NATA Certification	Field / Bench Test	Detailed Drawings	Other records (Datasheets, internal testing, RPEQ)	
102	Only fonts accepted by the Principal's Representative shall be used.	7.3	X			X	X	
103	The annulus shall not be less in size than that required for an equivalent static sign.	7.3	X			X	X	
104	Numerals and warning messages for either sign type shall be as per the appropriate TC sign indicated in Clause 5.	7.3	X			X	X	
105	There shall be no discernible flickering of the displayed numerals or static portion of the annulus.	7.4	X		X		X	
106	Background flickering as a result of checking the 'on' and 'off' pixel status shall not be visible.	7.4	X		X		X	
107	The LED and background colours for each sign type shall be as per the appropriate TC sign indicated in Clause 5.	7.5	X			X	X	
108	The red, yellow and white colours for all sign types shall fall within the chromaticity coordinates specified in AS 5156.	7.5		X			X	
109	Facilities shall be included to detect failures within the display control system with the sign blanking the display when major faults are detected.	7.6			X		X	
110	All VAS shall be able to detect LED failure even if the LEDs may be required to be 'off' at the time of the periodic check.	7.6			X		X	
111	The display shall be blanked upon failure of 2% of contiguous pixels for the displayed image or failure of more than 20% of total LEDs.	7.6			X		X	

Type Approval Compliance Checklist row #	MRTS218 – Product Approval Requirement	Reference Clause	Verification Method					Compliance (Y,TBC,N, N/A)
			Visual Inspection	NATA Certification	Field / Bench Test	Detailed Drawings	Other records (Datasheets, internal testing, RPEQ)	
112	The sign shall blank the display for the following conditions: <ul style="list-style-type: none"> • a sign processor fault • battery voltage lower than the set threshold, and • failure of 20% of LEDs of the annulus and/or any digit or when displayed digit cannot be readily recognised. 	7.6			X		X	
113	Ambient light sensor failure should not result in blanking of the display.	7.6			X		X	
114	Upon failure of the ambient light sensor, the sign should fall back to time-of-day brightness levels.	7.6	X		X		X	
115	The annulus for the Type 1 sign shall comply with the requirements of TC1787.	7.7	X				X	
116	For Type 1 VAS, the red annulus shall consist of suitably constructed, evenly spaced pixel rings with at least three pixel rings.	7.7	X				X	
117	The annulus rings in all cases shall be constructed so that LEDs connected in series are separated by at least three LEDs from other circuits.	7.7	X				X	
118	LEDs will only be enabled and become activated when a vehicle travelling above a set speed in the designated zone is registered.	7.7	X		X		X	
119	When activated by a speeding vehicle, the LEDs of the annulus, the numerals and the "Slow Down" message shall not flash, but shall remain ON for a duration that would be visible to the driver of the speeding vehicle for at least five consecutive seconds.	7.7	X		X		X	

Type Approval Compliance Checklist row #	MRTS218 – Product Approval Requirement	Reference Clause	Verification Method					Compliance (Y,TBC,N, N/A)
			Visual Inspection	NATA Certification	Field / Bench Test	Detailed Drawings	Other records (Datasheets, internal testing, RPEQ)	
120	The sign shall be provided with a 24-hour internal clock.	7.8					X	
121	The clock shall be able to be synchronised with the TMS system clock or other appropriate time source as determined by the Principal.	7.8					X	
122	Time error shall be no more than one second over a period of one week.	7.8					X	
123	Three types of data are maintained in VAS, namely Production Data, Event Logs and Configuration Settings.	7.9					X	
124	All these data shall be kept in non-volatile memory.	7.9					X	
125	Production Data and Event Logs which involve reporting time of occurrence shall adopt Australian Eastern Standard Time (AEST).	7.9	X				X	
126	Detection of every approaching vehicle shall be in accordance with format prescribed in QTDF, which includes detected speed and time of the detection, alongside with file header and checksum.	7.9.1	X				X	
127	The speed data shall be reported at the resolution of 1 km/h.	7.9.1			X		X	
128	The sign shall log all operational and fault events, including the date and time that the event occurs.	7.9.2	X				X	
129	Details of these events shall be available via the Remote Sign Management System.	7.9.2	X		X		X	
130	The logging capacity shall be such that the logged data is retained for a minimum of one month duration.	7.9.2	X				X	
131	The logged data shall be stored in a removable storage device.	7.9.2					X	

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132	The events to be logged include, but are not limited to: <ul style="list-style-type: none"> • lower energy alarm (sign will not work in 24 hours if the battery does not receive charge in that time) • loss of power (main and auxiliary) • power restoration (main and auxiliary) • high or low battery voltage occurrence • any access panel opening • daily power consumption • failure to communicate with the remote control centre • LED failure • light sensor failure • radar tilt • sign tilt • enclosure tilt • dimming level • loss of solar module • high enclosure temperature (adjustable set point between 40° and 80°) • local or remote connection, commencement and termination, and • sign enclosure temperature on each minute. 	7.9.2	X		X		X	
133	VAS configuration parameters can be set up locally or remotely.	7.9.3			X		X	
134	When set up remotely, the sign control shall provide a foolproof mechanism to avoid losing connection unintentionally.	7.9.3			X		X	
135	The VAS will have sufficient storage capacity to accommodate future firmware upgrades during the lifetime of the Product.	7.9.3					X	

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136	Storage capacity wise, no further hardware upgrades will be required to accommodate ongoing firmware changes / upgrades.	7.9.3					X	
137	In addition, the parameters shall be completely protected against software / firmware upgrade.	7.9.3					X	
138	No conspicuity devices or lanterns are required for the signs in this Technical Specification.	7.10	X			X	X	
139	However, the signs shall allow conspicuity devices to be added in future if desired.	7.10	X			X	X	
140	<p>Where specified, a three-position key operated facility switch that complies with MRTS201 <i>General Equipment Requirements</i>, shall be provided to enable selection of the following three display functions:</p> <ul style="list-style-type: none"> • OFF – display blank, control via all communications ports inhibited, status and diagnostic commands via all communications ports remain functional • Test Mode – display active, control via all communications ports inhibited, status and diagnostic commands via all communications ports remain functional, and • Normal – display active, displayed message selected via the maintenance communications port and/or the control communications port. 	7.11	X		X		X	
141	Radar detection shall comply with the relevant requirements of AS 2898.	7.12					X	
142	The radar unit shall detect only approaching vehicles travelling at speeds ranging from at least 20 km/h up to 120 km/h.	7.12			X		X	

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143	The detection range shall be adjustable with a maximum detection range of no less than 140 m.	7.12			X		X	
144	Speed detection accuracy shall be better than 3%.	7.12					X	
145	The radar unit shall be adjustable such that there is no interference with other radar units within the same carriageway.	7.12					X	
8 Optical performance								
146	Unless otherwise specified the optical performance of the sign shall comply with the relevant Australian Standards below.	8						
147	The luminance and luminance ratio of the LEDs, when measured under laboratory conditions shall comply with the requirements of AS 5156.	8.1		X				
148	The colour emitted by each LED shall be as defined by the colour boundaries in AS 5156.	8.1		X				
149	The LED intensity must be controlled to provide constant apparent brightness and maximum legibility distance for the range of the ambient light under which the sign must operate.	8.2		X				
150	The levels of brightness, the number of light sensors, and the automatic dimming control functionality shall be in accordance with the LED intensity control requirements in AS 5156.	8.2		X				
151	Each individual LED shall be driven with a continuous current with no peak and/or magnitudes exceeding 70% of the LED manufacturer's maximum continuous rating.	8.3		X				

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			Visual Inspection	NATA Certification	Field / Bench Test	Detailed Drawings	Other records (Datasheets, internal testing, RPEQ)	
152	For LEDs in a 5 mm or smaller diameter package, peak magnitudes of the LED current shall not exceed 20 mA.	8.3					X	
153	For each LED, the off-axis angle at which the output luminous intensity of the LED is half that of the value measured on the reference axis (the mechanical axis) of the LED, shall be no less than 15°.	8.4		X				
154	The effect of sunlight or other light sources shining on the optical elements shall be controlled such that inactive pixels do not appear active.	8.5		X			X	
155	Provision shall be made for each sign to be fitted with a visor to minimize sun-phantom, veiling illuminance effects or to reduce the possibility of a flashing signal being seen by traffic for which it is not intended, or all three.	8.5	X				X	
156	The visor shall be sufficiently rigid to withstand distortion due to wind and extreme weather conditions including temperature and heavy rain.	8.5	X				X	
157	The interior surface of visors shall be finished so as to minimize reflections of the illuminated signal.	8.5	X				X	
9 Sign control system								
158	The control system requirements defined in MRTS201 <i>General Equipment Requirements</i> apply to this Technical Specification.	9					X	
159	Additional sign control system requirements for equipment provided under this Technical Specification are described below.	9						

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160	The sign shall be capable of autonomous operation and allow local as well as remote access by diagnostic software and remote sign management software respectively.	9.1			X		X	
161	Each sign shall be uniquely identifiable electronically for use by the remote sign management software for this purpose.	9.1			X		X	
162	The sign shall allow local control via a maintenance communications port using a laptop or a handheld device.	9.2			X		X	
163	Local control shall be gained using the diagnostic software.	9.2			X		X	
164	The system shall provide secure access to the signs to prevent unauthorised access to the signs.	9.2			X		X	
165	All sign diagnostics and configuration parameters able to be changed in the field shall be accessible when the sign is selected for local control.	9.2			X		X	
166	Remote control of the sign shall be disabled when the sign is selected for local control.	9.2			X		X	
167	Disconnection of a laptop or handheld device shall cause the sign to revert to autonomous operation.	9.2			X		X	
168	Ending of the maintenance session shall not require further interaction from the user, nor in anyway interrupt operation or require rebooting of the sign but immediately let the sign to revert to autonomous operation.	9.2			X		X	
169	Each sign control shall be capable of being accessed remotely via a communications port.	9.3			X		X	
170	The sign shall allow for remote synchronisation of time with the remote sign management software.	9.3			X		X	

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			Visual Inspection	NATA Certification	Field / Bench Test	Detailed Drawings	Other records (Datasheets, internal testing, RPEQ)	
171	The sign control shall be able to service requests by the remote sign management software including status reports and a log of events.	9.3			X		X	
172	The sign control shall be able to send unsolicited status message / alarm to the remote sign management software should an event occur that requires blanking of the display, annulus, numerals or traffic control signs.	9.3			X		X	
173	The effect of a command by the remote management system to the signs shall be realised within 10 seconds.	9.3			X		X	
174	The majority of the VAS will be standalone installations and hence the availability of built-in cellular	9.3					X	
175	4G/5G connectivity is mandatory for connection to the Principal's private telecommunications network / IPRT.	9.3					X	
176	Connectivity via optical fibre and ADSL is desirable.	9.3					X	
177	The radar and sign control shall provide functionality for setting and changing the activation speed remotely.	9.3			X		X	
178	The sign control system shall also log speeds in data bins.	9.3	X		X		X	
179	The data bins shall be remotely adjustable with minimum bin widths of 1 km/h.	9.3	X		X		X	
180	The software shall: a) request passwords as part of the access and configuration authorisation process	9.4.1	X		X		X	

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181	b) be compatible with Microsoft Windows® operating system environment, Windows 10 or more recent version and those industry standards current at the time of delivery	9.4.1	X				X	
182	c) any software provided shall be capable of operating on all such operating systems	9.4.1	X				X	
183	d) it is highly desirable that the Sign support Simple Network Management Protocol (SNMPv2c) to allow centralised (remote) device monitoring and management, and	9.4.1	X				X	
184	e) it is desirable for security reasons, that the sign support SNMPv3 or support an upgrade path to SNMPv3 (e.g. via firmware update).	9.4.1	X				X	
185	Diagnostic software shall be supplied with the sign for the purpose of sign configuration, commissioning and maintenance activities.	9.4.2	X		X		X	
186	The diagnostic software shall fully implement all the sign functions required for the commissioning and maintenance of the sign.	9.4.2	X		X		X	
187	The Diagnostic Software shall be configured to request passwords as part of the sign access and configuration authorisation process.	9.4.2	X		X		X	
188	If required, the diagnostic software shall be capable of suggesting ranges for each parameter as applicable when programming and not allow these limits to be exceeded.	9.4.2	X		X		X	
189	The diagnostic software shall have the capability to save and upload sign configurations to and from the respective VAS.	9.4.2	X		X		X	

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190	A desirable feature of the diagnostic software is a test program.	9.4.2	X		X		X	
191	This would facilitate testing of all the essential sign features including ability to activate, deactivate all pixels, select the number of the annulus inner rings to flash and to vary LED brightness.	9.4.2	X		X		X	
192	The software shall allow the request of a full log of events and querying of events according to set criteria such as by sign(s), time, date, event type or by duration.	9.4.2	X		X		X	
193	Vehicle Activated Signs (VAS) will be connected to the department's Principal's private telecommunications network / IPRT.	9.4.3			X		X	
194	As a result, detailed protocol information and command set documentation must be provided for the development of device interfacing application and the department's own Remote Sign Management System.	9.4.3					X	
195	The provision of these detailed protocol information and command set documentation is a mandatory requirement for tender evaluation purpose and for assessment of the product against this MRTS.	9.4.3					X	
196	It is highly desirable that the contractor supply a Remote Sign Management System software which shall perform the following functions as a minimum:	9.4.3					X	
197	<ul style="list-style-type: none"> allow multiple concurrent real time point-to-point connections from the Sign Management System to VAS in the field 	9.4.3			X		X	
198	<ul style="list-style-type: none"> detail the location and current status of all signs (operational, idle, fault condition) 	9.4.3			X		X	
199	<ul style="list-style-type: none"> show signs on a map-based GUI 	9.4.3			X		X	

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200	<ul style="list-style-type: none"> implement multiple levels of user access such as: <ul style="list-style-type: none"> administrator maintenance standard user, and read only. 	9.4.3			X		X	
201	<ul style="list-style-type: none"> allow querying of events according to set criteria such as by sign(s), time, date, event type, or by duration 	9.4.3			X		X	
202	<ul style="list-style-type: none"> poll the signs in the field every hour to verify the communications link and that the sign has not failed. Failure of the sign management system to gain a response from the sign, in a usual time-frame, over three consecutive polls shall result in an event being logged in the system that highlights that the sign status is unknown and possibly failed or damaged 	9.4.3			X		X	
203	<ul style="list-style-type: none"> allow updating and programming of each sign 	9.4.3			X		X	
204	<ul style="list-style-type: none"> backup / export / import of sign configuration, and 	9.4.3			X		X	
205	<ul style="list-style-type: none"> allow for a daily download of all applicable data listed in Clause 7.9. 	9.4.3			X		X	
10 Environmental requirements								
206	The environmental requirements defined in MRTS51 <i>Environmental Management</i> and MRTS201 <i>General Equipment Requirements</i> apply to this Technical Specification.	10					X	

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11 Electrical requirements								
207	Where mains power is required, the relevant electrical requirements defined in Clause 10 of MRTS201 <i>General Equipment Requirements</i> apply to this Technical Specification.	11.1					X	
208	The sign shall be able to operate normally for voltage variation of between - 13% and + 25% of normal supply voltage.	11.1					X	
209	Where mains power is required, also provide a battery power supply in accordance with Clause 10 of MRTS201 <i>General Equipment Requirements</i> for the real time clock and processor to allow orderly power down in the case of loss of power supply.	11.2					X	
210	Where solar power is specified, the requirements defined in MRTS263 <i>Standalone Solar (PV) Power Systems</i> apply to this Technical Specification.	11.3					X	
12 ITS network telecommunications								
211	The telecommunications requirements defined in MRTS201 <i>General Equipment Requirements</i> apply to this Technical Specification.	12					X	
212	It is preferred that the test sample is the largest size in the standard drawing, however, any size compliant with the standard will be acceptable.	14.1	X			X	X	
213	Provision of the test sign will not be necessary if a test sign has previously passed an acceptance test.							

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214	Compliance with the optical performance requirements shall be determined by measurement under laboratory conditions as detailed in Clause 8 for each batch of signs provided by the contractor.	14.2		X				
215	The performance of the sign displays shall meet or exceed the optical requirements specified in AS 5156.	14.2		X				
216	The testing shall be based upon the contract specified and expected number of activations.	14.2					X	
217	The Factory Acceptance Tests for battery autonomy maybe conducted on the first test with continuous operation of the sign without recharge for the equivalent period of activation time.	14.2			X		X	
218	The performance shall be monitored with the use of a data logger acceptable to Transport and Main Roads.	14.2			X		X	
219	Unless specified in contract the expected load shall be the radar and control system continuous current draw plus a minimum of 7000 activations of the sign per day at full brightness with each test activation of five seconds in length.	14.2	X		X		X	
220	Each and every radar unit shall be tested and calibrated for speed and reaction time triggering for each possible speed increment.	14.2					X	
221	The test and calibration report shall be traceable to a NATA testing laboratory and shall be included in the documentation submitted during the commissioning tests.	14.2		X			X	

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15 Documentation								
222	An Operations and Maintenance Manual shall be provided with each sign.	15					X	
223	The documentation requirements defined in MRTS201 <i>General Equipment Requirements</i> apply to this Technical Specification.	15					X	

