

**Technical Specification**

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

**July 2017**

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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
3G	Third 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
DoD	Depth of Discharge, of a secondary battery bank
Event	Any operation of the sign signifying a change of state, occurrence of a fault or change in mode of operation of the sign
Field Processor	An industrial computer complying with requirements of MRTS232 <i>Provision of Field Processors</i>
ITS	Intelligent Transport Systems
LED	Light Emitting Diode
NATA	National Association of Testing Authorities
PHCS	Product Host Control System: control/diagnostic software that runs on a laptop/handheld device and can control, interrogate and program the signs
Pixel	The smallest discretely controlled light emitting component of the sign display
Principal	Agency responsible for the contract (e.g. TMR/Local Govt)
PV	Photovoltaic
QTDF	Queensland Traffic Data Format
Sign	Vehicle Speed Activated Sign, also VAS
STREAMS	The Principal's traffic management system and primary user interface to ITS field devices

Term	Definition
TMC	Traffic Management Centre
TMS	Traffic Management System nominated by the Principal but maybe the supplier sign management system, if so specified in the contract
TSDM	Traffic Surveys and Data Management (Network)
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.

**Table 3 – References summary**

Document	Document Name / Description
AS/NZS 1170.1:2002	<i>Structural Design Actions, Permanent, imposed and other actions</i>
AS/NZS 1170.2:2011	<i>Structural Design Actions, Wind Actions</i>
AS 2898	<i>Radar Speed Detection</i>
AS 4086.1-1993	<i>Secondary batteries for use with stand-alone power systems - General requirements</i>
AS 4086.2-1997	<i>Secondary batteries for use with stand-alone power systems - Installation and maintenance</i>
AS 4509.1:2009	<i>Stand-alone power systems - Safety and installation</i>
AS 4509.2:2010	<i>Stand-alone power systems - System design</i>
AS 5156:2010	<i>Electronic speed limit signs</i>
AS/NZS 5033:2005	<i>Installation of photovoltaic (PV) arrays</i>
MRTS01	<i>Introduction to Technical Specifications</i>
MRTS50	<i>Specific Quality System Requirements</i>
MRTS14	<i>Road Furniture</i>
MRTS61	<i>Mounting Structures for ITS devices</i>
MRTS91	<i>Conduits and Pits</i>
MRTS201	<i>General Equipment Requirements</i>
MRTS232	<i>Provision of Field Processors</i>
MUTCD	<i>Queensland Manual of Uniform Traffic Control Devices</i>
QTDF1.03	<i>Queensland Traffic Data Format Version 1.03</i>
TRUM Manual	<i>Traffic and Road Use Management Manual</i>

### 4 Quality system requirements

The quality system requirements defined in MRTS01, MRTS50 and MRTS201 apply to this Technical Specification. Additional quality system requirements relevant under this Technical Specification are defined in Table 4.

**Table 4 – Hold Points, Witness Points and Milestones**

Clause	Hold Point	Witness Point	Milestone
4.1	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 9001:2008 and this Technical Specification.

**4.1 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**

**4.2 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.

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 either a posted speed or warning message. 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.

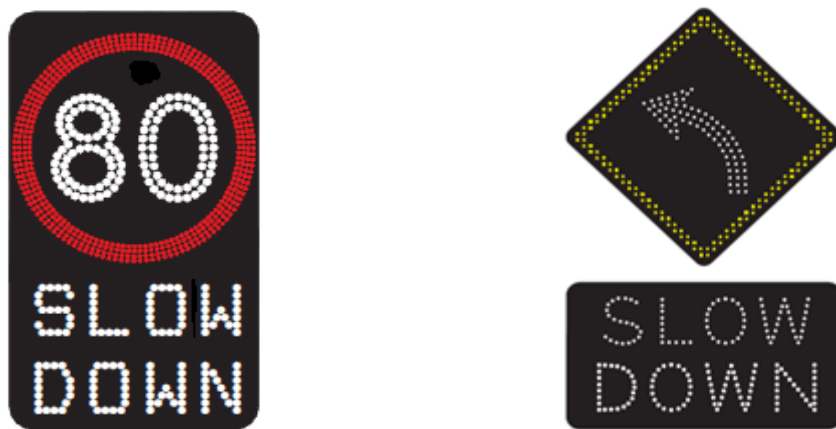
The signs shall be capable of autonomous operation and allow for remote configuration. Provision shall be made for connection of the signs to the ITS Platform nominated by the Principal.

### **5.2 Sign types**

Two types of VAS are described in this Technical Specification, broadly categorised by whether they display either posted speed or warning message. Examples of these types are shown in Figure 5.2. For sign detail see the relevant TC reference signs at <http://www.tmr.qld.gov.au/business-industry/Technical-standards-publications/TC-signs.aspx>. All sizes are required.



**Figure 5.2 - Examples of VAS types**



General Vehicle Activated Speed Limit Sign – TC1787

An LED Warning Sign “Curve” with Supplementary “Slow Down” Speed Activated Signs – TC1790-1 and TC1790-2

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

## 6 Mechanical and physical requirements

### 6.1 Compliance to other departmental Technical Specifications

The mechanical and physical requirements defined in MRTS201 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 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.

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.

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 IP55 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 like Solar panel or battery bank which weighs in excess of 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 aide 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, where the definition of service life is as per
- AS 5156-2010 Clause 2.1.3.1
- 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 and MRTS61 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 MRTS61 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.

Solar module(s) shall be mounted above the top of the sign at a height of no less than 4.5 metres above the ground. The solar panel may be located on a separate pole if the selected sign location is obstructed from sun exposure. The solar module angle of elevation shall be suitably adjusted in order to optimise performance at the latitude where the sign is to be installed. The design of the solar modules shall include a deterrent mechanism for stopping birds from resting on the solar module structure.

Unless otherwise specified the pole material and galvanised finish shall be consistent with MRTS94 and its referenced documents. Poles shall be designed and approved by a structural RPEQ. All footings shall be consistent with MRTS92 but shall be designed and approved by a structural RPEQ.

There shall be a fitting which allows the swivel adjustment of the azimuth about the vertical of 360° without stops. The swivel point shall be designed and fitted with a method which will stop the subsequent rotation of the solar PV module.

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.

### **6.10 Marking**

Each sign shall be durably marked internally to show sign type, serial number, date of manufacture A-Tick and/or C-Tick compliance, 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. 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**

For Type 1 signs, the display shall be generated by red and white LED's on a matte black background.

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 QTDF1.03, 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 or batteries
- 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 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, 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. The radar unit shall be able to detect 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 Table 2.4 of AS 5156-2010 Clause 2.2.

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. For LEDs in a 5 mm or smaller diameter package, peak magnitudes of the LED current shall not exceed 20 mA.

### **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 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 3G connectivity is mandatory for connection to the TSDM IP VPN. 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 XP, Windows Vista, Windows 7, 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 TSDM network. 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 and MRTS201 apply to this Technical Specification.

## **11 Electrical requirements**

### ***11.1 Common electrical power options***

The preferred mode to energize the VAS is solar power. The electrical requirements defined in MRTS201 Clause 10, apply to this Technical Specification. Additional solar power requirements relevant under this Technical Specification are described below.

The sign shall be able to operate normally for voltage variation of between - 13% and + 25% of normal supply voltage. Battery back-up shall be provided for the real time clock and processor to allow orderly power down in the case of loss of power supply.

Power supply and control wiring connection/disconnection shall be designed without requirement for personnel to be holders of an electrical licence to perform this task. This will generally require the use of modular type connections.

Electrical Protection, Switching and Isolation and Lightning Protection shall be provided in accordance with AS 4509.2. High Rupture Capacity (HRC) fuses only shall be used for circuit protection. The switchboard shall be labelled with nominal voltage and current, DC or AC as well as the requirements of Fire Emergency Information required by AS 5033.

A laminated electrical wiring diagram shall be provided in each enclosure, with details specific to each installation.

Detailed designs of the electrical wiring including the solar power and charging assembly shall be reviewed and signed by the Contractor's RPEQ. They shall then be submitted and approved by the Principal or their delegate for verification and acceptance. The documentation shall include the calculations and circuit and block diagrams to be submitted to the ITS and Electrical unit.

### ***11.2 Solar power requirements***

The total warranty for the solar power system shall be at least five years.

The solar power system shall be capable of operating the sign autonomously without recharge for a minimum period of seven days throughout the entire warranty period.

### **11.2.1 Batteries and capacitors**

The selection of the batteries shall be consistent with AS 4086.1 and subject to the following additional conditions:

- the battery power system shall be capable of operating the sign autonomously without recharge for a minimum period of seven days throughout the entire warranty period
- the battery technology shall have a high cycle life (> 2000) and of a low-maintenance type
- the battery must be able to handle high levels of Depth of Discharge (DOD). The selection of battery shall be so that the designed Depth of Discharge shall be no more than 20% on any typical working day
- the battery shall be of the type suitable for charging by solar cells
- batteries with liquid electrolytes shall NOT be used, and
- capacitors maybe installed across the battery bank for additional storage.

All battery performance variables, including the charge and discharge cycle, shall be recorded in real time for later download.

Batteries (and capacitors) shall be installed to minimize risk of:

- impact by a motor vehicle
- theft or vandalism, and
- explosion.

The battery bank, Positive and Negative rail shall be fitted with double pole switch to allow the battery bank to be isolated if the sign is damaged. The switch is to only be accessible if the cover plate is removed.

### **11.2.2 PV module**

The choice, configuration, installation and testing of PV modules shall be consistent with AS 4509.1, AS 4509.2 and AS/NZS 5033.

All PV module fittings and adjustments shall be designed, manufactured and tested with appropriate and TMR approved theft prevention methods.

Solar modules shall have a deterrent mechanism for stopping birds from resting on the module.

## **12 ITS network telecommunications**

The telecommunications requirements defined in MRTS201 apply to this Technical Specification.

## **13 Installation requirements**

The installation requirements defined in MRTS201 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 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 TSDM Network. 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 batch of signs provided by the contractor.

The performance of the sign displays shall meet or exceed the parameters listed in table

AS 5156– 2010, Section 2.2.1 Optical Requirements Table 2.4. 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 ITS and Electrical unit.

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
- LED Fault, both annulus and each displayed speed increment, and
- commissioning tests defined in AS/NZS 5033.

For each individual PV solar panel the open circuit voltage must be confirmed, when connected to the cable loom.

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**

The Contractor shall provide, with each sign, specific details and calculations of the battery size, solar panel size and battery charger/regulator. This documentation shall contain all the applicable elements provided in the worked example of Appendix A of AS 4509.2. The manufacturer specification sheet of the PV array, batteries and battery charger/regulator shall be provided.

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

The documentation requirements defined in MRTS201 apply to this Technical Specification.

### **16 Training**

The training requirements defined in MRTS201 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 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 apply to this Technical Specification.

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

