Technical Specification

Transport and Main Roads
MRTS249 Transportable Changeable Message Signs

March 2023

Queensland Government

Copyright

Licence

CC BY licence summary statement

Translating and interpreting assistance

The Queensland Government is committed to providing accessible services to Queenslanders from all cultural and linguistic backgrounds. If you have difficulty understanding this publication and need a translator, please call the Translating and Interpreting Service (TIS National) on 13 14 50 and ask them to telephone the Queensland Department of Transport and Main Roads on 13 74 68.

Disclaimer

While every care has been taken in preparing this publication, the State of Queensland accepts no responsibility for decisions or actions taken as a result of any data, information, statement or advice, expressed or implied, contained within. To the best of our knowledge, the content was correct at the time of publishing.

Feedback

Please send your feedback regarding this document to: tmr.techdocs@tmr.qld.gov.au

Contents

1 Introduction 1

2 Definitions of terms 1

3 Referenced documents 2

4 Quality system requirements 3

4.1 Hold Points, Witness Points and Milestones 3

4.2 Design acceptance 4

4.3 Warranty 4

5 Functional requirements 4

5.1 General operation 4

5.2 Key TCMS components and function 4

5.2.1 Hand-held device (HHD) 5

5.2.2 Remote Monitoring system 5

5.3 Control methods 5

6 Mechanical, structural and display requirements 6

6.1 General 6

6.2 Design life 6

6.3 Mounting requirements 6

6.3.1 General 6

6.3.2 Pole support 6

6.4 Exterior finish and surfaces 6

6.5 TCMS Display 6

6.5.1 TCMS motor actuator 7

6.5.2 TCMS message appearance 7

6.6 Enclosures 7

7 Operation and Control requirements 7

7.1 General 7

7.2 Short-range Hand-held device (HHD) 7

7.3 System diagnostics 8

7.4 Global Positioning System (GPS) 8

7.5 Directional compass capability 8

7.6 Labelling and identification 8

7.7 TCMS logs 8

7.7.1 General 8

7.7.2 Real time TCMS status logging and monitoring 9

7.7.3 Historical logging of TCMS operations 9

7.7.4 Critical faults 9

8 Telecommunications requirements 9

8.1 Local site communications 10

8.1.1 Between TCMS and HHD 10

8.2 Remote site communications 10

8.3 Communications timeout 10

9 Software requirements 10
9.1 General 10
9.2 HHD-TCMS configuration and Monitoring software 11
9.3 Remote TCMS monitoring software 11
10 Electrical requirements 12
10.1 General 12
10.2 Power 12
10.3 Electrical Design documentation 12
11 Documentation requirements 13
11.1 Operations and maintenance manual 13
12 Product approval checklist 13
Appendix A – Product Approval Compliance Checklist 14

1 Introduction

This Technical Specification defines the design, functionality and documentation requirements for Transportable Changeable Message Sign (TCMS) and their associated devices. TCMS covered by this Technical Specification are only temporary traffic management signage for use as part of an approved Traffic Guidance Scheme for roadworks or construction projects adjacent to roads.

A TCMS defined in this Technical Specification is used for temporary traffic management and/or driver information for the purpose of improving the safety of workers and the safe and efficient movement of road users at a work site. A TCMS uses on-site operated, mechanical change system of displaying up to a maximum of three different pre-set messages on the sign using a triangular prism mechanism.

The key differences between a CMS sign covered under MRTS227 *Changeable Message Signs* and a TCMS covered under this Technical Specification are that:

a) TCMS is a system for the display of temporary traffic management signs

b) TCMS operation is through the use of a handheld short range device (HHD). A TCMS shall not be remotely controlled from off-site. An optional off-site remote sign monitoring system may be provided.

c) TCMS are battery powered and, where desired, the batteries are recharged via solar panels, and

d) TCMS can be pole-mounted, mounted on a vehicle or trailer so that they can be relocated when required for traffic control staging.

TCMS complying with this Technical Specification shall only be used to display temporary traffic management signs in accordance with the operational requirements of the *Queensland Guide to Temporary Traffic Management* (QGTTM) and *Austroads Guide to Temporary Traffic Management* (AGTTM) and Queensland *Manual of Uniform Traffic Control Devices* (Queensland MUTCD) Part 3 and AS 1742.3.

All TCMS used in safety related applications shall only be deployed following the appropriate risk analysis undertaken to ensure safety in the event of sign failure.

This Technical Specification shall be read in conjunction with MRTS01 *Introduction to Technical Specifications*, MRTS50 *Specific Quality System Requirements*, MRTS201 *General Equipment Requirements*, MRTS227 *Changeable Message Signs*, the *Queensland Guide to Traffic Management* Part 10 *Transport Control – Types of Devices* and other Technical Specifications as appropriate.

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

2 Definitions of terms

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

Table 2 – Definitions of terms

Term	Definition
ACMA	Australian Communications and Media Authority
Configuration software	Control / diagnostic software that runs on a HHD and can control, interrogate and program the TCMS

Term	Definition
CMS	Changeable Message Signs
Event	Sign status change, message change, occurrence of a fault in TCMS
FAT	Factory Acceptance Test (see MRTS201 *General Equipment Requirements*)
GPS	Global Positioning System
HHD	A short range mobile Hand-Held Device used to control the TCMS on site
IP	Ingress Protection
Message	Any stable state displayed by a TCMS on its display at any one instance of time that is preceded and followed by a change of state
NATA	National Association of Testing Authorities
RPEQ	Registered Professional Engineer of Queensland
RSMS software	Remote sign monitoring system software – this is the software system used to remotely monitor the TCMS for example, from a Traffic Control Company's Premises
TCMS	Transportable Changeable Message Sign
TGS	Traffic Guidance Scheme
TMP	Traffic Management Plan

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 referenced MRTS documents, the requirements specified in this Technical Specification take precedence.

Table 3 – Referenced documents

Reference	Title
AGTTM	*Austroads Guide to Temporary Traffic Management*
AS 1742	*Manual of uniform traffic control devices*
AS 1743	*Road signs – Specifications*
AS 1744	*Standard alphabets for road signs*
AS 2700	*Colour standards for general purposes*
AS 60529	*Degrees of protection provided by enclosures (IP Code)*
AS/NZS 1170.1	*Structural design actions, Part 1: Permanent, imposed and other actions*
AS/NZS 1170.2	*Structural design actions, Part 2: Wind actions*
AS/NZS 1664.1	*Aluminium structures, Part 1: Limit state design*
AS/NZS 1664.2	*Aluminium structures, Part 2: Allowable stress design*
AS/NZS 1665	*Welding of aluminium structures*
AS/NZS 1734	*Aluminium and Aluminium Alloys – Flat sheet, coiled sheet and plate*
AS 1768	*Lightning protection*
AS/NZS 1906.1	*Retroreflective materials and devices for road traffic control purposes, Part 1: Retroreflective sheeting*

Reference	Title
AS/NZS 1906.2	*Retroreflective materials and devices for road traffic control purposes, Part 2: Retroreflective devices (non-pavement application)*
AS/NZS 1906.3	*Retroreflective materials and devices for road traffic control purposes, Part 3: Raised pavement markers (retroreflective and non-retroreflective)*
AS/NZS 1906.4	*Retroreflective materials and devices for road traffic control purposes, Part 4: High-visibility materials for safety garments*
AS/NZS 3000	*Electrical installation (known as the Australian / New Zealand Wiring Rules)*
IS18	*QGCIO Information Security Policy*
MRTS01	*Introduction to Technical Specifications*
MRTS02	*Provision for Traffic*
MRTS14	*Road Furniture*
MRTS50	*Specific Quality System Requirements*
MRTS200	*General Requirements for (ITS) Infrastructure*
MRTS201	*General Equipment Requirements*
MRTS227	*Changeable Message Signs*
MRTS263	*Standalone Solar (PV) Power Systems*
Queensland MUTCD	*Queensland* Manual of Uniform Traffic Control Devices
Prof. Eng Act	*Professional Engineers Act 2002*
QGTM	*Queensland Guide to Traffic Management*
QGTTM	*Queensland Guide to Temporary Traffic Management*
TRUM Vol 3 Part 5	TRUM Manual, Volume 3, Part 5: *Design Guide for Roadside signs*

4 Quality system requirements

4.1 Hold Points, Witness Points and Milestones

The quality system requirements defined in MRTS201 *General Equipment Requirements* apply to this Technical Specification. Additional quality system requirements relevant under this Technical Specification are defined in Table 4.1. There are no Witness Points or Milestones defined.

Table 4.1 – Hold Points, Witness Points and Milestones

Clause	Hold Point	Witness Point	Milestone
4.2	1. Detailed design documentation to be provided prior to manufacture		
6.3.2	2. Mounting requirements		
6.5.1	3. Compliance with MUTCD, TGS and retroreflective material		

4.2 Design acceptance

The requirements of MRTS201 *General Equipment Requirements* apply to this Technical Specification. Detailed designs of the sign layout, fabrication and assembly drawings, calculations, specifications and certifications of the TCMS components shall be submitted to the Principal for verification, in accordance with the objects of the Professional Engineers Act, prior to manufacture. These components include the TCMS controller, hand-held device, sign face configurations, motor actuator, power supply (including solar power, surge protection and backup batteries), power budget calculations, communication ports, cable termination, enclosure and mounting accessories. **Hold Point 1**

4.3 Warranty

For TCMS supplied to Transport and Main Roads, the warranty requirements in MRTS201 *General Equipment Requirements* apply.

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

5 Functional requirements

5.1 General operation

The use of the TCMS shall be in accordance with the *Queensland Guide to Temporary Traffic Management* (QGTTM) and the Queensland MUTCD, and have the capability of operating as follows.

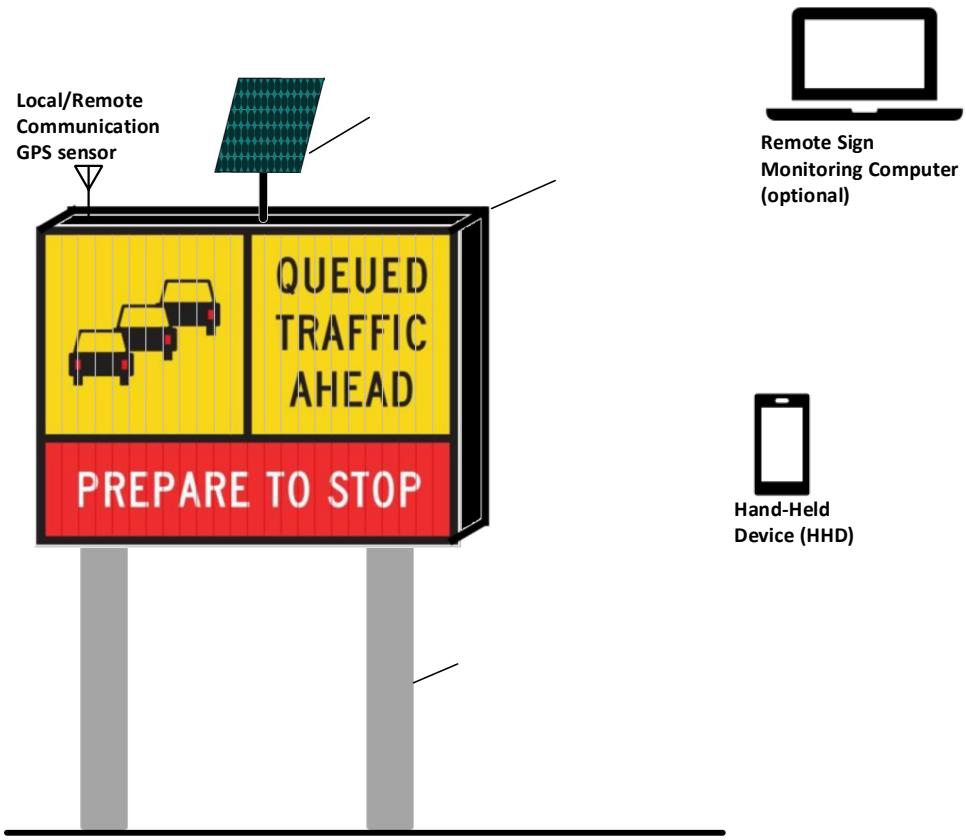
- when installed in groups each TCMS shall display the sign message in accordance with the planned sequence and the applicable TGS
- the hand-held device requesting the TCMS message, shall have a mechanism to confirm the requested message is displayed, and
- the TCMS shall monitor the current displayed message and if different to the requested message, shall issue an alarm after the specified switching time has elapsed.

The TCMS is operated on the basis that after the signage is placed/displayed, drive-throughs and visual inspections of the worksite are conducted including all signs and devices in accordance with the Traffic Management Plan (TMP) and Traffic Guidance Scheme (TGS).

5.2 Key TCMS components and function

The following figure of a pole-mounted TCMS shows the key components associated with the TCMS. Other mounting options include trailer mount or vehicle mount.

Figure 5.2 – Key TCMS components (using pole mount for illustration)



Note: Control of vehicle mounted TCMS shall conform to the requirements of the Queensland MUTCD Part 3

5.2.1 Hand-held device (HHD)

A hand-held device shall be provided for the selection of messages from the TCMS and to perform control and configuration of the TCMS or group of connected TCMS on-site. The HHD shall provide a mechanism to confirm that each TCMS display the intended message.

5.2.2 Remote Monitoring system

An off-site remote monitoring system may be provided as part of the TCMS solution. The purpose of the monitoring system is to log operational and historical information for later retrieval. Records shall be retained for the period defined by the Principal.

5.3 Control methods

The TCMS shall be controlled by the following means:

a) Locally at the TCMS, to select the display message manually.

b) On-site via a short-range hand-held device (HHD) to select a display message on all connected signs within the roadwork site, and to monitor the status of each sign. This is the normal mode of control.

The local TCMS operating system shall have a minimum of 99.9% operating reliability.

6 Mechanical, structural and display requirements

6.1 General

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

6.2 Design life

The TCMS shall be suited to the intended operational environment. Unless otherwise specified, the design life of the TCMS components including the panels, motor and the mechanical drive system shall be 10 years.

6.3 Mounting requirements

6.3.1 General

The display enclosure shall be capable of being mounted on a support structure in a location consistent with QGTTM / AGTTM requirements. The mounting structures supporting the TCMS shall be designed for the site conditions in which they are intended to be used. Calculations for wind loading shall be in accordance with the requirements of TRUM Manual, Volume 3, Part 5: *Design Guide for Roadside signs*

6.3.2 Pole support

The sign support shall be designed in accordance with TRUM Manual, Volume 3, Part 5: *Design Guide for Roadside signs* when installed with all supporting hardware and accessories used to operate the sign, including the solar panels, where fitted.

The design documentation showing compliance with this Technical Specification and certified by a RPEQ, shall be submitted to the Principal's representative for review and acceptance. **Hold Point 2**

6.4 Exterior finish and surfaces

All internal and external surfaces shall be free from sharp edges or protrusions.

The front facing surface colour apart from the rotating elements shall be matt black. Other surfaces should be a lighter colour, preferably matt grey, to reduce internal enclosure temperature.

6.5 TCMS Display

The TCMS shall consist of fabricated triangular elements mounted in a display enclosure.

The fabricated triangular elements shall rotate and align to display one of three faces.

Messages shall be displayed using a motor actuator to effect the change and each message shall be displayed directly.

The rotation of the triangular elements shall be bi-directional such that messages requested by the HHD is displayed with one-third (1/3) of a full rotation in the appropriate direction.

This will ensure the requested message is displayed directly without going through an intermediate message.

In the event of power loss, the TCMS shall continue to display the last message shown just prior to electric power loss. The TCMS shall have a mechanism for manually changing the display in the event of power loss or loss of communication with the HHD.

The fabricated triangular elements may be mounted in either the vertical or horizontal plane.

6.5.1 TCMS motor actuator

The motor actuator and all necessary mechanical linkages and electrical circuitry shall be installed in the display enclosure.

The motor actuator shall be able to withstand mechanical stresses arising from the expected number of message rotations for the life of the sign.

6.5.2 TCMS message appearance

The dimensions of the signs and each message shall comply with the MUTCD requirements for static signs. Message combinations used on site shall be in accordance with approved Traffic Guidance Scheme (TGS) and not create contradictory advice. The retroreflective message stickers shall adhere to the triangular prism for the duration of the project.

The retroreflective material for each message shall comply with the requirements for retro- reflective sheeting described in MRTS14 and AS/NZS 1906 **Hold Point 3**

6.6 Enclosures

All telecommunications equipment, the TCMS control unit, the battery charger/regulator and the batteries shall be installed in an integral enclosure, or display enclosure, complying with the requirements of MRTS201 *General Equipment Requirements.* The sign enclosure shall be made of marine-grade aluminium alloy 5251 H32 to conform to AS/NZS 1734.

The display enclosure shall provide a degree of protection of not less than that required for the classification of IP65 in accordance with AS 60529 in normal service.

7 Operation and Control requirements

7.1 General

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

Additional control system requirements for equipment provided under this Technical Specification are described below.

The normal method of TCMS operation and control is via a local hand-held device (HHD). Where the HHD fails or is temporarily unavailable the TCMS shall provide a mechanism for manually displaying or changing to the desired message.

7.2 Short-range Hand-held device (HHD)

The following requirements shall apply to the use of the HHD:

- it shall be a Mobile phone or tablet using industry standard Mobile technology.
- it shall host an operating system platform such as Android® operating system or iOS, which are industry standards at the time of application of this Technical Specification, and
- the application software shall be available to operate in either of the two platforms above.

Refer to Clause 9 for further requirements on the software application on the HHD.

7.3 System diagnostics

Each TCMS and HHD shall be able to detect system error or failure arising from network disruption or power failure. This can be implemented by employing a watchdog.

Once such failure is detected and resolved, the TCMS or HHD shall take corrective action to restore normal operation.

The occurrence of such intermittent faults shall not compromise the overall system operational reliability specified in Clause 5.3.

7.4 Global Positioning System (GPS)

Where required, each TCMS shall be fitted with a GPS receiver. The onboard GPS receiver shall monitor the location in three dimensions (latitude, longitude and altitude) of each sign and also synchronise the TCMS internal clock. The TCMS shall provide an alarm to the HHD if a sign is moved beyond a specified perimeter. This may be achieved using a virtual perimeter or 'geo-fence'.

7.5 Directional compass capability

Each TCMS may have the ability to discern the installed directional orientation and tilt, and whether any subsequent change in direction or tilt has been detected, through the use of inertial type sensor such as gyroscopes and/or accelerometers.

> The GPS receiver, directional compass and gyroscope facility will allow greater visibility of how the site layout is set out and whether any subsequent changes have occurred due to any number of scenarios.

7.6 Labelling and identification

Each HHD and TCMS shall each have a unique alphanumeric communications ID.

A physical label displaying TCMS ID must be clearly visible on the TCMS.

7.7 TCMS logs

7.7.1 General

The TCMS system shall make provision for:

- real-time monitoring and logging of the sign status (see Clause 7.7.2), and
- Historical logging of TCMS operations (see Clause 7.7.3)

All logs shall be grouped by the sign (through its respective sign ID) and include the date and time stamp for all entries and may be exported in a readily acceptable format, such as comma delimited text file (.csv), Microsoft Excel (.xls) or other formats as agreed with the project representative.

The log storage shall be sufficient to allow at least 200 hours of continuous logging without overwriting. The oldest event record shall be overwritten first when the log file storage capacity has been exceeded.

Where a HHD connection is in session, the HHD software shall be synchronised and receive updates dynamically from the respective TCMS as well as upload log data to the remote server.

7.7.2 Real time TCMS status logging and monitoring

The real-time TCMS logging and monitoring to be displayed on the HHD while it is connected to the sign network shall as a minimum show:

- TCMS unique ID and group ID/name
- TCMS GPS location on map
- Currently displayed message and the set of available messages on each TCMS
- Whether the message request to the TCMS was implemented or not
- Battery level
- Network connectivity between TCMS and HHD
- Network connectivity between HHD and remote server (refer to 9.3 for details of remote monitoring application)), where required, and
- Other feedback status items during sign activation process.

7.7.3 Historical logging of TCMS operations

In addition to the real time status logging, the HHD shall capture time-stamped historical logging and monitoring information and make available for upload to a remote server for retrieval by the administrator. As a minimum the logged information for display by the remote server shall include:

- User login activity including HHD message requests, the unique identifier of the HHD requesting message change and the username under which the request was made and the nature of the requested change (previous and current display)
- device activation logs including initialisation of TCMS (power up and restarts)
- loss of communication between HHD and TCMS
- device update including all configuration changes (for example, made through HHD configuration software), and
- change activity including clearance of faults, replacement of batteries, TCMS re-location.

7.7.4 Critical faults

Where critical faults occur:

a) if the sign is connected to the HHD, an alarm shall also be generated on the user alarm monitoring interface, and

b) the TCMS shall display the latest face prior to failure.

A critical fault is one that causes complete failure of the TCMS system and/or causes the TCMS not to operate as intended

8 Telecommunications requirements

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

Wireless communication shall be compliant to Australian Communications and Media Authority (ACMA) requirements. Each sign shall be durably marked internally to show sign type, serial number, date of manufacture, Regulatory Compliance Mark (RCM) and firmware release version. The details shall allow traceability of the sign manufacture, according to the Contractor's quality system.

The use of the RCM for products subject to ACMA arrangements (e.g. EMC, radiocommunications, telecommunications, EME) are set out in ACMA regulatory arrangements.

8.1 Local site communications

8.1.1 Between TCMS and HHD

Wireless connection between the TCMS and the HHD shall use local encrypted wireless communication technology. The HHD shall be as specified in Clause 7.2.

Communications messages between the TCMS and HHD shall include a checksum unique to each TCMS site and shall be computed based on the message information exchanged to ensure integrity of the communication is upheld.

The checksum shall be available for confirmation by the HHD and recomputed each time the message frames is changed and/or that the TCMS is reset / rebooted.

The message transition time, for any sign, shall be less than 10s.

Any radio frequency communications antennas shall be positioned at the highest point on the TCMS to make effective use of available signal gain and avoid line of sight signal attenuation by objects such as concrete barriers and shrubs.

8.2 Remote site communications

Where required, TCMS historical system information shall be made available to a remote monitoring system. This can be implemented via a secure wireless connection between the HHD and a remote server using a third party 4G/5G mobile service provider.

All communication over third party communications network shall provide adequate privacy and integrity of data to the satisfaction of the Principal.

The carrier selected shall have sufficient and reliable coverage at the project site.

8.3 Communications timeout

The HHD shall make provision for setting time-out periods which will prompt the user to log-in once it has expired. For any HHD or TCMS communications, the periodic timeout check shall be ignored, and the display shall remain on indefinitely until requested otherwise. All time-out periods shall be software configurable with ranges suited to the operating environment.

9 Software requirements

9.1 General

TCMS software mainly comprises of the following:

- TCMS device software

- HHD software application used for operation, control and monitoring, and
- Optionally, a remote web-based software used for monitoring and logging.

The security requirements defined in MRTS201 *General Equipment Requirements* apply to software used as part of this Technical Specification.

In addition, software used for TCMS operation, control and monitoring shall:

- Adhere to all policy requirements of the Queensland Government's information security policy (IS18:2018)
- request passwords as part of the access and configuration authorisation process
- provide two access levels, namely, Administrator and Standard user, as a minimum
- be capable of operating on all applicable industry standard operating systems
- be backward compatible with existing TCMS purchased from the same manufacturer, and
- Use secure communication protocols in all communications with the TCMS.

The factory default user credentials shall not be used, and these shall be changed prior to any operation of the TCMS.

9.2 HHD-TCMS configuration and Monitoring software

The TCMS shall have provisions for initial programming through the use of configuration software from the local HHD.

The primary functions of this software will be to:

a) allow the required initial setup of a TCMS (including, but not limited to, configuration of messages, HHD administration functions, such as removing lost HHD units and replacing with other HHD)

b) request messages to be displayed on the TCMS during normal operation, and

c) perform any periodic maintenance and diagnostic functions required during the life of the product (including, but not limited to, reporting and extraction of event logs listed in Clause 7).

In addition, the local HHD software shall:

- be an application suitable for operation on a phone or tablet hosting an operating system platform such as Android® operating system or iOS, which are industry standards at the time of application of this Technical Specification
- display the location of the managed TCMS on a GIS layer which has up-to-date maps and associated geographic or spatial information
- when restarted, commence from the last displayed page, and
- meet all the requirements listed in Clause 9.1 above.

9.3 Remote TCMS monitoring software

Where a remote TCMS monitoring software is provided as part of the operation, the remote software:

- shall meet all the requirements listed in Clause 9.1 above

- shall be web-based and display the location of the managed TCMS on a GIS layer which has up-to-date maps and associated geographic or spatial information
- shall be hosted on a Microsoft Windows operating system environment, from Windows 7 to the industry standard current at the time of use. Any software provided must be capable of operating on all such operating systems, and
- may be used on site or via a location which is remote to the roadwork site such as a Traffic Management agency's business premises.

10 Electrical requirements

10.1 General

The Electrical components and the designs used in the TCMS shall be in accordance with the requirements of AS/NZS 3000 and AS/NZS 3100.

In addition, the electrical design requirements defined in Clause 6 of MRTS263 *Standalone Solar (PV) Power Systems* apply to this Technical Specification.

10.2 Power

TCMS shall be solar powered and battery-backed in accordance with the requirements of MRTS263 *Standalone Solar (PV) Power Systems.* The solar PV system shall utilise a voltage of 12V or 24V DC.

The required minimum autonomy for the TCMS, defined as the number of 24 hour days without solar input and no loss of functionality, is 10 days.

Each TCMS shall also have the facility to be energised from an external source including battery packs, and mains power. The mains power inlet shall include a mains battery charger. The TCMS shall also include an IP65 rated locking connector to enable the external power supply to be easily connected and disconnected from the sign so the existing batteries can be charged before being deployed to site or while at site.

Lightning protection compliant with AS 1768 shall be provided.

Duration of TCMS deployment may vary, and that will determine the long-term power requirements, as well as whether surge protection is required.

10.3 Electrical Design documentation

The complete electrical design and implementation specified in this document, shall be shown to meet the main objects of the *Professional Engineers Act*. This shall be provided as part of the design acceptance requirements detailed in Clause 4.1

11 Documentation requirements

11.1 Operations and maintenance manual

Each TCMS shall be supplied with an operations and maintenance manual detailing how to safely use the TCMS to display temporary traffic management signs in accordance with a TGS.

12 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	MRTS249 Transportable Changeable Message Signs Requirements	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 requirements of MRTS201 *General Equipment Requirements* apply to this Technical Specification.	4.1	**X**			**X**	**X**	
2	Detailed designs of the sign layout, fabrication and assembly drawings, calculations, specifications and certifications of the TCMS components shall be submitted to the Principal for verification, in accordance with the objects of the Professional Engineers Act, prior to manufacture.	4.1				**X**	**X**	
3	These components include the TCMS controller, hand-held device, sign face configurations, motor actuator, power supply (including solar power, surge protection and backup batteries), power budget calculations, communication ports, cable termination, enclosure and mounting accessories.	4.1	**X**			**X**		
4	For TCMS supplied to TMR, the warranty requirements in MRTS201 *General Equipment Requirements* apply.	4.2					**X**	
5 Functional requirements								
5	The use of the TCMS shall be in accordance with the Queensland Guide to Temporary Traffic Management and the Queensland MUTCD and have the capability of operating as follows.	5.1	**X**			**X**		
6	When installed in groups each TCMS shall display the sign message in accordance with the planned sequence and the applicable TGS.	5.1	**X**		**X**	**X**		

Type Approval Compliance Checklist row	MRTS249 Transportable Changeable Message Signs Requirements	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 hand-held device requesting the TCMS message, shall have a mechanism to confirm the requested message is displayed.	5.1	**X**				**X**	
8	The TCMS shall monitor the current displayed message and if different to the requested message, shall issue an alarm after the specified switching time has elapsed.	5.1	**X**		**X**	**X**		
9	Key components associated with the TCMS are as shown in the figure showing pole-mounted TCMS.	5.2	**X**			**X**		
10	Other mounting options include trailer mount or vehicle mount.	5.2	**X**			**X**		
11	A hand-held device shall be provided for the selection of messages from the TCMS and to perform control and configuration of the TCMS or group of connected TCMS on-site.	5.2.1	**X**			**X**		
12	The HHD shall provide a mechanism to confirm that each TCMS display the intended message.	5.2.1	**X**		**X**			
13	An off-site remote monitoring system may be provided as part of the TCMS solution.	5.2.2	**X**		**X**			
14	The purpose of the monitoring system is to log operational and historical information for later retrieval.	5.2.2	**X**		**X**			
15	Records shall be retained for the period defined by the Principal.	5.2.2					**X**	
16	The TCMS shall be controlled by the following means: a) Locally at the TCMS, to select the display message manually.	5.3	**X**		**X**			

Type Approval Compliance Checklist row	MRTS249 Transportable Changeable Message Signs Requirements	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)	
17	b) On-site via a short-range hand-held device (HHD) to select a display message on all connected signs within the roadwork site, and to monitor the status of each sign. This is the normal mode of control.	5.3	X		X			
18	The local TCMS operating system shall have a minimum of 99.9% operating reliability.	5.3	X			X	X	
6 Mechanical, structural and display requirements								
19	The mechanical and physical requirements defined in MRTS201 *General Equipment Requirements* apply to work provided under this Technical Specification.	6.1					X	
20	The TCMS shall be suited to the intended operational environment.	6.2				X	X	
21	Unless otherwise specified, the design life of the TCMS components including the panels, motor and the mechanical drive system shall be 10 years.	6.2				X	X	
22	The display enclosure shall be capable of being mounted on a support structure in a location consistent with QGTTM/AGTTM requirements.	6.3.1	X			X	X	
23	The mounting structures supporting the TCMS shall be designed for the site conditions in which they are intended to be used.	6.3.1				X	X	
24	Calculations for wind loading shall be in accordance with the requirements of TRUM Manual, Volume 3, Part 5: *Design Guide for Roadside signs.*	6.3.1				X	X	
25	The sign support shall be designed in accordance with TRUM Manual, Volume 3, Part 5: *Design Guide for Roadside signs* when installed with all supporting hardware and accessories used to operate the sign, including the solar panels, where fitted.	6.3.2				X	X	

Type Approval Compliance Checklist row	MRTS249 Transportable Changeable Message Signs Requirements	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)	
26	The design documentation showing compliance with this Technical Specification and certified by a RPEQ, shall be submitted to the Principal's representative for review and acceptance. Hold Point 2.	6.3.2				X	X	
27	All internal and external surfaces shall be free from sharp edges or protrusions.	6.4	X			X		
28	The front facing surface colour apart from the rotating elements shall be matt black.	6.4	X				X	
29	Other surfaces should be a lighter colour, preferably matt grey, to reduce internal enclosure temperature.	6.4	X			X	X	
30	The TCMS shall consist of fabricated triangular elements mounted in a display enclosure.	6.5	X			X	X	
31	The fabricated triangular elements shall rotate and align to display one of three faces.	6.5	X				X	
32	Messages shall be displayed using a motor actuator to effect the change and each message shall be displayed directly.	6.5				X	X	
33	The rotation of the triangular elements shall be bi-directional such that messages requested by the HHD is displayed with one-third (1/3) of a full rotation in the appropriate direction.	6.5	X			X		
34	In the event of power loss, the TCMS shall continue to display the last message shown just prior to electric power loss.	6.5	X					
35	The TCMS shall have a mechanism for manually changing the display in the event of power loss or loss of communication with the HHD.	6.5	X			X	X	

Type Approval Compliance Checklist row	MRTS249 Transportable Changeable Message Signs Requirements	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)	
36	The fabricated triangular elements may be mounted in either the vertical or horizontal plane.	6.5	**X**			**X**	**X**	
37	The motor actuator and all necessary mechanical linkages and electrical circuitry shall be installed in the display enclosure.	6.5.1	**X**			**X**	**X**	
38	The motor actuator shall be able to withstand mechanical stresses arising from the expected number of message rotations for the life of the sign.	6.5.1					**X**	
39	The dimensions of the signs and each message shall comply with the MUTCD requirements for static signs.	6.5.2	**X**			**X**		
40	Message combinations used on site shall be in accordance with approved Traffic Guidance Scheme (TGS) and not create contradictory advice.	6.5.2	**X**				**X**	
41	The retroreflective message stickers shall adhere to the triangular prism for the duration of the project.	6.5.2	**X**				**X**	
42	The retroreflective material for each message shall comply with the requirements for retro- reflective sheeting described in MRTS14 and AS/NZS 1906 Hold Point 3.	6.5.2	**X**				**X**	
43	All telecommunications equipment, the TCMS control unit, the battery charger/regulator and the batteries shall be installed in an integral enclosure, or display enclosure, complying with the requirements of MRTS201 *General Equipment Requirements*.	6.6	**X**			**X**		
44	The sign enclosure shall be made of marine-grade aluminium alloy 5251 H32 to conform to AS/NZS 1734.	6.6	**X**				**X**	

Type Approval Compliance Checklist row	MRTS249 Transportable Changeable Message Signs Requirements	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 display enclosure shall provide a degree of protection of not less than that required for the classification of IP65 in accordance with AS 60529 in normal service.	6.6		**X**				
7 Operation and Control requirements								
46	The control system requirements defined in MRTS201 *General Equipment Requirements* apply to this Technical Specification.	7.1					**X**	
47	The normal method of TCMS operation and control is via a local hand-held device (HHD).	7.1	**X**				**X**	
48	Where the HHD fails or is temporarily unavailable the TCMS shall provide a mechanism for manually displaying or changing to the desired message.	7.1	**X**				**X**	
49	The HHD shall be a Mobile phone or tablet using industry standard Mobile technology.	7.2	**X**				**X**	
50	The HHD shall host an operating system platform such as Android operating system or iOS, which are industry standards at the time of application of this technical specification.	7.2	**X**		**X**		**X**	
51	The application software (of the HHD) shall be available to operate in either of the two platforms above.	7.2	**X**		**X**		**X**	
52	Each TCMS and HHD shall be able to detect system error or failure arising from network disruption or power failure. This can be implemented by employing a watchdog.	7.3	**X**				**X**	
53	Once such failure is detected and resolved, the TCMS or HHD shall take corrective action to restore normal operation.	7.3	**X**				**X**	

Type Approval Compliance Checklist row	MRTS249 Transportable Changeable Message Signs Requirements	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 occurrence of such intermittent faults shall not compromise the overall system operational reliability specified in Clause 5 . 3.	7.3	X		X		X	
55	Where required, each TCMS shall be fitted with a GPS receiver.	7.4	X				X	
56	The onboard GPS receiver shall monitor the location in three dimensions (latitude, longitude and altitude) of each sign and also synchronise the TCMS internal clock.	7.4	X				X	
57	The TCMS shall provide an alarm to the HHD if a sign is moved beyond a specified perimeter. This may be achieved using a virtual perimeter or 'geo-fence'.	7.4	X		X		X	
58	Each TCMS may have the ability to discern the installed directional orientation and tilt, and whether any subsequent change in direction or tilt has been detected, through the use of inertial type sensor such as gyroscopes and/or accelerometers.	7.5	X				X	
59	Each HHD and TCMS shall each have a unique alphanumeric communications ID.	7.6	X			X	X	
60	A physical label displaying TCMS ID must be clearly visible on the TCMS.	7.6	X				X	
61	The TCMS system shall make provision for real-time monitoring and logging of the sign status (see Clause 7.7.2), and	7.7.1	X				X	
62	The TCMS system shall make provision for Historical logging of TCMS operations (see Clause 7.7.3).	7.7.1	X				X	

Type Approval Compliance Checklist row	MRTS249 Transportable Changeable Message Signs Requirements	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)	
63	All logs shall be grouped by the sign (through its respective sign ID) and include the date and time stamp for all entries and may be exported in a readily acceptable format, such as comma delimited text file (.csv), Microsoft Excel (.xls) or other formats as agreed with the project representative.	7.7.1	X				X	
64	The log storage shall be sufficient to allow at least 200 hours of continuous logging without overwriting.	7.7.1	X				X	
65	The oldest event record shall be overwritten first when the log file storage capacity has been exceeded.	7.7.1	X		X			
66	Where a HHD connection is in session, the HHD software shall be synchronised and receive updates dynamically from the respective TCMS as well as upload log data to the remote server.	7.7.1	X		X		X	
67	The real-time TCMS logging and monitoring to be displayed on the HHD while it is connected to the sign network shall as a minimum show:	7.7.2						
68	•TCMS unique ID and group ID / name.	7.7.2	X		X		X	
69	•TCMS unique ID and group ID / name.	7.7.2	X		X		X	
70	•Currently displayed message and the set of available messages on each TCMS.	7.7.2	X		X		X	
71	•Whether the message request to the TCMS was implemented or not.	7.7.2	X		X		X	
72	•Battery level.	7.7.2	X		X		X	
73	•Network connectivity between TCMS and HHD.	7.7.2	X		X		X	
74	•Network connectivity between HHD and remote server (refer to Clause 9.3 for details of remote monitoring application), where required.	7.7.2	X		X		X	

Type Approval Compliance Checklist row	MRTS249 Transportable Changeable Message Signs Requirements	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)	
75	•Other feedback status items during sign activation process.	7.7.2	X		X		X	
76	•In addition to the real time status logging, the HHD shall capture time-stamped historical logging and monitoring information and make available for upload to a remote server for retrieval by the administrator.	7.7.3	X		X		X	
77	As a minimum the logged information for display by the remote server shall include:	7.7.3						
78	•User login activity including HHD message requests, the unique identifier of the HHD requesting message change and the username under which the request was made and the nature of the requested change (previous and current display),	7.7.3	X		X		X	
79	•Device activation logs including initialisation of TCMS (power up and restarts),	7.7.3	X		X		X	
80	•Loss of communication between HHD and TCMS,	7.7.3	X		X		X	
81	•Device update including all configuration changes (for example, made through HHD configuration software), and	7.7.3	X		X		X	
82	•Change activity including clearance of faults, replacement of batteries, TCMS re-location	7.7.3			X			
83	Where critical faults occur:	7.7.4						
84	a) if the sign is connected to the HHD, an alarm shall also be generated on the user alarm monitoring interface, and	7.7.4	X		X		X	
85	b) the TCMS shall display the latest face prior to failure.	7.7.4	X		X		X	

Type Approval Compliance Checklist row	MRTS249 Transportable Changeable Message Signs Requirements	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)	
8 Telecommunications requirements								
86	The telecommunications requirements defined in MRTS201 *General Equipment Requirements* apply to work provided under this Technical Specification.	8					**X**	
87	Wireless communication shall be compliant to Australian Communications and Media Authority (ACMA) requirements.	8	**X**				**X**	
88	Each sign shall be durably marked internally to show sign type, serial number, date of manufacture, Regulatory Compliance Mark (RCM) and firmware release version.	8	**X**				**X**	
89	The details shall allow traceability of the sign manufacture, according to the Contractor's quality system.	8	**X**				**X**	
90	Wireless connection between the TCMS and the HHD shall use local encrypted wireless communication technology.	8.1.1	**X**				**X**	
91	The HHD shall be as specified in Clause 7.2.	8.1.1	**X**				**X**	
92	Communications messages between the TCMS and HHD shall include a checksum unique to each TCMS site and shall be computed based on the message information exchanged to ensure integrity of the communication is upheld.	8.1.1	**X**				**X**	
93	The checksum shall be available for confirmation by the HHD and recomputed each time the message frames is changed and/or that the TCMS is reset / rebooted.	8.1.1	**X**				**X**	
94	The message transition time, for any sign, shall be less than 10s.	8.1.1	**X**		**X**		**X**	

Type Approval Compliance Checklist row	MRTS249 Transportable Changeable Message Signs Requirements	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)	
95	Any radio frequency communications antennas shall be positioned at the highest point on the TCMS to make effective use of available signal gain and avoid line of sight signal attenuation by objects such as concrete barriers and shrubs.	8.1.1	X				X	
96	Where required, TCMS historical system information shall be made available to a remote monitoring system.	8.2	X				X	
97	This can be implemented via a secure wireless connection between the HHD and a remote server using a third party 4G / 5G mobile service provider.	8.2					X	
98	All communication over third party communications network shall provide adequate privacy and integrity of data to the satisfaction of the Principal.	8.2					X	
99	The carrier selected shall have sufficient and reliable coverage at the project site.	8.2					X	
100	The HHD shall make provision for setting time-out periods which will prompt the user to log-in once it has expired.	8.3	X		X		X	
101	For any HHD or TCMS communications, the periodic timeout check shall be ignored, and the display shall remain on indefinitely until requested otherwise.	8.3	X		X		X	
102	All time-out periods shall be software configurable with ranges suited to the operating environment.	8.3	X				X	
9 Software requirements								
103	TCMS software mainly comprises of the following:	9.1	X					
104	•TCMS device software	9.1	X				X	
105	•HHD software application used for operation, control and monitoring and	9.1	X				X	

Type Approval Compliance Checklist row	MRTS249 Transportable Changeable Message Signs Requirements	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)	
106	•Optionally, a remote web-based software used for monitoring and logging	9.1	**X**				**X**	
107	The security requirements defined in MRTS201 General Equipment Requirements apply to software used as part of this Technical Specification.	9.1					**X**	
108	Software used for TCMS operation, control and monitoring shall Adhere to all policy requirements of the Queensland Government's information security policy (IS 18:2018).	9.1					**X**	
109	Software used for TCMS operation, control and monitoring shall request passwords as part of the access and configuration authorisation process.	9.1	**X**		**X**		**X**	
110	Software used for TCMS operation, control and monitoring shall provide two access levels, namely, Administrator and Standard user, as a minimum.	9.1	**X**		**X**		**X**	
111	Software used for TCMS operation, control and monitoring shall be capable of operating on all applicable industry standard operating systems.	9.1	**X**				**X**	
112	Software used for TCMS operation, control and monitoring shall be backward compatible with existing TCMS purchased from the same manufacturer, and	9.1	**X**				**X**	
113	Software used for TCMS operation, control and monitoring shall Use secure communication protocols in all communications with the TCMS.	9.1					**X**	
114	The factory default user credentials shall not be used, and these shall be changed prior to any operation of the TCMS.	9.1	**X**				**X**	
115	The TCMS shall have provisions for initial programming through the use of configuration software from the local HHD.	9.2	**X**		**X**		**X**	

Type Approval Compliance Checklist row	MRTS249 Transportable Changeable Message Signs Requirements	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)	
116	The primary functions of this software will be to:	9.2						
117	a) allow the required initial setup of a TCMS (including, but not limited to, configuration of messages, HHD administration functions, such as removing lost HHD units and replacing with other HHD),	9.2	**X**				**X**	
118	b) Request messages to be displayed on the TCMS during normal operation, and	9.2	**X**				**X**	
119	c) perform any periodic maintenance and diagnostic functions required during the life of the product (including, but not limited to, reporting and extraction of event logs listed in Clause 7).	9.2	**X**				**X**	
120	In addition, the local HHD software shall be an application suitable for operation on a phone or tablet hosting an operating system platform such as Android operating system or iOS, which are industry standards at the time of application of this technical specification,	9.2	**X**				**X**	
121	The local HHD software shall display the location of the managed TCMS on a GIS layer which has up-to-date maps and associated geographic or spatial information,	9.2	**X**		**X**		**X**	
122	The local HHD software shall when restarted, commence from the last displayed page, and	9.2	**X**		**X**		**X**	
123	The local HHD software shall meet all the requirements listed in section 9.1 above.	9.2	**X**		**X**		**X**	
124	Where a remote TCMS monitoring software is provided as part of the operation, the remote software	9.3						
125	•shall meet all the requirements listed in section 9.1 above.	9.3	**X**		**X**		**X**	

Type Approval Compliance Checklist row	MRTS249 Transportable Changeable Message Signs Requirements	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)	
126	• shall be web-based and display the location of the managed TCMS on a GIS layer which has up-to-date maps and associated geographic or spatial information.	9.3	**X**				**X**	
127	•shall be hosted on a Microsoft Windows operating system environment, from Windows 7 to the industry standard current at the time of use. Any software provided must be capable of operating on all such operating systems.	9.3	**X**				**X**	
128	• may be used on site or via a location which is remote to the roadwork site such as a Traffic Management agency's business premises.	9.3	**X**		**X**		**X**	
10 Electrical requirements								
129	The Electrical components and the designs used in the TCMS shall be in accordance with the requirements of AS/NZS 3000 and AS/NZS 3100.	10.1	**X**			**X**	**X**	
130	In addition, the electrical design requirements defined in Clause 6 of MRTS263 *Standalone Solar (PV) Power Systems* apply to this specification.	10.1	**X**				**X**	
131	TCMS shall be solar powered and battery-backed in accordance with the requirements of MRTS263 *Standalone Solar (PV) Power Systems*.	10.2	**X**				**X**	
132	The solar PV system shall utilise a voltage of 12 or 24 Volts DC.	10.2	**X**				**X**	
133	The required minimum autonomy for the TCMS, defined as the number of 24-hour days without solar input and no loss of functionality, is 10 days.	10.2	**X**				**X**	
134	Each TCMS shall also have the facility to be energised from an external source including battery packs, and mains power.	10.2	**X**				**X**	

Type Approval Compliance Checklist row	MRTS249 Transportable Changeable Message Signs Requirements	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)	
135	The mains power inlet shall include a mains battery charger.	10.2	**X**				**X**	
136	The TCMS shall also include an IP65rated locking connector to enable the external power supply to be easily connected and disconnected from the sign so the existing batteries can be charged before being deployed to site or while at site.	10.2	**X**				**X**	
137	Lightning protection compliant with AS 1768 shall be provided, where required.	10.2					**X**	
138	The complete electrical design and implementation specified in this document, shall be shown to meet the main objects of the Professional Engineers Act.	10.3					**X**	
139	This shall be provided as part of the design acceptance requirements detailed in section 4.1.	10.3					**X**	
11 Documentation requirements								
140	Each TCMS shall be supplied with an operations and maintenance manual detailing how to safely use the TCMS to display temporary traffic management signs in accordance with a TGS.	11.1					X	