

Superseded

**Technical Specification**

# **MRTS217 Motorway Ramp Information Signs**

**March 2022**

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## 1 Introduction

This Technical Specification defines the requirements of electronic message signs for motorway ramp controlling, metering and providing information on the condition of motorway. These signs are intended to provide the motorists with the information on the condition of motorway prior to entry. The signs will be placed on arterial roads leading to motorway and at motorway ramps.

This Technical Specification covers three types of electronic message signs. These signs are classified as Ramp Information Sign 1 (RIS1), Ramp Information Sign 2 (RIS2) and Ramp Information Sign 3 (RIS3). These signs use LEDs as illuminating technology and display messages in four colours Red, Yellow, Green and White. RIS3 uses LED matrix technology. The signs shall be remotely operated from Traffic Management Centre using Principal's Traffic Management System.

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 Definitions of terms

The terms defined in MRTS01 *Introduction to Technical Specifications* apply to this Technical Specification. Additional terminology relevant to this Technical Specification is defined in Table 2 below.

**Table 2 – Definitions of terms**

Term	Definition
FAT	Factory Acceptance Testing
LED	Light Emitting Diodes
NATA	National Association of Testing Authorities
PHCS	Product Host Control System
RIS1	Ramp Information Sign 1 – An electronic variable message sign typically placed near the entrance of an on-ramp of a motorway
RIS2	Ramp Information Sign 2 – An electronic variable message sign typically placed on the on-ramp of a motorway
RIS3	Ramp Information Sign 3 – An electronic variable message sign typically placed in an arterial road advising motorists about roadworks, incidents, travel time or closure of the motorway
RPEQ	Registered Professional Engineer Queensland
TMS	Traffic Management System
SAT	STREAMS Acceptance Test
STREAMS	Transport and Main Roads Traffic Management System
VMS	Variable Message Sign

### 3 Referenced documents

The requirements of the referenced documents listed in 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 shall take precedence.

**Table 3 – Referenced documents**

Reference	Title
AS 1743	<i>Road signs - Specifications</i>
AS 4852.1	<i>Variable Message Signs – Part 1: Fixed Signs</i>
AS/NZS 3000	<i>Electrical Installations – Construction and Demolition Sites</i>
AS/NZS 3100	<i>Approval and test specification – General requirements for electrical equipment</i>
AS/NZS 61000.6.1	<i>Electromagnetic compatibility (EMC) – Generic standards – Immunity for residential, commercial and light-industrial environments</i>
AS/NZS 61000.6.3	<i>Electromagnetic Compatibility – General Standards – Emission</i>
MRTS01	<i>Introduction to Technical Specifications</i>
MRTS50	<i>Specific Quality System Requirements</i>
MRTS61	<i>Gantries and Support Structures for Road Signs, Tolling Systems and ITS Devices</i>
MRTS201	<i>General Equipment Requirements</i>
MRTS202	<i>Variable Message Signs</i>
MRTS226	<i>Telecommunication Field Cabinets</i>
MRTS245	<i>ITS Telecommunications Network (ITS TN)</i>
TC 2290	<i>LED Lamp control signs</i>
QGTM Part 9	<i>Queensland Guide to Traffic Management, Part 9</i>
TSI-SP-003 / NSW RMS	<i>Communication Protocol for Roadside Devices</i>

### 4 Quality system requirements

#### 4.1 Hold Points, Witness Points and Milestones

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

The Hold Points, Witness Points and Milestones applicable to this Technical Specification are summarised in Table 4.1. There are no 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 2. Optical performance test results to be provided prior to delivery to site		
13.2		1. Factory acceptance test	

#### 4.2 Sample signs

Requirements of MRTS201 *General Equipment Requirements* apply to this Technical Specification. Detailed design of the sign layout, fabrication and assembly drawings, calculations, specifications and certifications of the Ramp Information Sign components (signed by the Contractor's RPEQ) shall be submitted to the Principal for verification prior to manufacture.

These components include the RIS controller, sign face, LEDs, LED matrix boards, pixel arrangements showing horizontal and vertical pitch and total number of pixels, power supply (including surge protection and back-up batteries), communication ports, cable termination, enclosure and mounting accessories. **Hold Point 1**

Test certificates from a NATA accredited laboratory or NATA endorsed by Mutual Recognition, shall be submitted confirming that optical performance requirements of the RIS specified in this Technical Specification are complied with. Test certificates shall be submitted before the RIS is delivered to site. Test certificate shall have reference to the version of the optical module tested and shall be issued to the current version of the optical modules used in the RIS. Modifications of design of the optical modules such as change of LEDs, LED drivers requires the optical performance be retested.

#### **Hold Point 2**

As specified in MRTS201 *General Equipment Requirements*, a sample RIS shall be made available for the SAT.

#### 4.3 Warranty

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

### 5 Design

#### 5.1 General

The sign shall be designed in compliance with the requirements of the AS 4852.1. The sign shall withstand the atmospheric and site conditions prevailing in state of Queensland for the design life defined in this Technical Specification.

#### 5.2 Design life

The sign shall be designed to have an operating life as per the AS 4852.1 *Design life*.

#### 5.3 Markings and Labels

Markings and labels shall be provided as per the AS 4852.1 *Markings and labels*.

## **6 Mechanical requirements**

### **6.1 Sign enclosure**

#### **6.1.1 Construction material**

The sign enclosure shall be constructed with materials in compliance with the requirements of AS 4852.1.

#### **6.1.2 Surface finish**

The surface finishes shall be compliant to Section 3.1.2 of AS 4852.1 with external front face matt black and other external surfaces matt grey. Any interior surfaces that may be visible from outside the sign shall be matt black.

#### **6.1.3 Viewing area**

Viewing area shall be compliance to the requirements of AS 4852.1.

#### **6.1.4 Access doors**

RIS1 and RIS2 signs shall not have any access doors. RIS3 signs shall be provided with the access doors in compliance with AS 4852.1 *Access doors*.

#### **6.1.5 Socket outlets**

Socket outlets shall not be provided unless specifically required by the contract.

#### **6.1.6 Mounting**

Mounting shall be complied with the requirements of AS 4852.1 *Mounting*.

#### **6.1.7 Border**

RIS1 and RIS2 signs shall have a minimum of 175 mm border. The RIS3 border shall be complied with the requirements of AS 4852.1 *Border*. Conspicuity devices shall not be provided.

### **6.2 Roadside cabinet**

Where required a roadside cabinet complying to MRTS226 *Telecommunications Field Cabinets* shall be provided.

#### **6.2.1 Facility Switch**

RIS1 and RIS2 signs shall not have a facility switch.

Facility switch complied to AS 4852.1 *Facility Switch*, shall be provided for RIS3 signs. Facility switch shall mount inside the sign enclosure or field cabinet.

## **7 Electrical requirements**

### **7.1 Conformance to standards**

The sign electrical system shall conform to AS/NZS 3000 and AS/NZS 3100.

### **7.2 Operating Voltage**

The input supply of the sign shall be complied to the requirements of AS 4852.1 *Operating voltage*.

### **7.3 Battery backup**

A battery backup system shall be complying with AS 4852.1 *Battery backup*.



#### 7.4 Lightning Protection

Lightning and surge protection shall be complying with AS 4852.1 *Lightning protection*.

#### 7.5 Electromagnetic compatibility (EMC)

Immunity and electromagnetic emissions shall be conformed to AS /NZS 61000.6.1 and AS/NZS 61000.6.3.

### 8 Display and Optical requirements

#### 8.1 Display requirements

##### 8.1.1 General

##### 8.1.1.1 Display characteristics

RISs shall be LED display. RIS1 and RIS2 signs shall be generating traffic control messages as per QGTM Part 9. The dimensions of the characters are shown in the respective TC sign. These signs shall have combination of messages as referred to in the Table 8.1.1.1. The LEDs of RIS1 and RIS2 shall have a maximum spacing of two times the diameter of individual pixels.

All other display characteristics of RIS1 and RIS2 signs shall be complied to AS 4852.1 *Display characteristics*.

Display characteristics of RIS3 signs shall be complied with AS 4852.1 *Display characteristics*.

It is pertinent to note that RIS3's LEDs forms a uniform matrix design, whilst RIS1 and RIS2 may not necessarily be of uniform matrix structure.

**Table 8.1.1.1 – RIS Type, Enclosure and Messages Summary**

Sign Name	Minimum Enclosure Size		Minimum Character Height for Text Display Frames	Operation	Text Display Frames	Graphic Display Frames
	Height	Width				
RIS1	600 mm	900 mm	120 mm	Ramp Metering	Traffic control messages as per QGTM Part 9 <u>and</u> Text / graphics and spacing shall be compliant to TC2290 as applicable	N/A
				Ramp Control	Traffic control messages as per QGTM Part 9 <u>and</u> Text / graphics and spacing shall be compliant to TC2290 as applicable	Traffic control messages as per QGTM Part 9 <u>and</u> Text / graphics and spacing shall be compliant to TC2290, TC2273 and TC2210 as applicable

Sign Name	Minimum Enclosure Size		Minimum Character Height for Text Display Frames	Operation	Text Display Frames	Graphic Display Frames
	Height	Width				
RIS2	600 mm	900 mm	120 mm	Ramp Metering	Traffic control messages as per QGTM Part 9 and Text / graphics and spacing shall be compliant to TC2290 as applicable	N/A
RIS3	3 Lines of Characters	18 Characters	200mm	Road condition information	Text and spacing of Information Messages shall be compliant to AS 4852.1	N/A

#### 8.1.1.2 Luminance output

Luminance output shall be complied to AS 4852.1 *Luminance output*.

#### 8.1.1.3 Pixel arrangement

Pixel arrangement shall be complied to AS 4852.1 *Pixel arrangement*.

#### 8.1.1.4 Pixel element service life

Pixel element service life shall be complied to AS 4852.1 *Pixel Element Service Life*.

#### 8.1.1.5 Maintainability

RIS1 and RIS2 signs shall have easily detachable mounting mechanism with quick disconnect from the power and communication connection for the ease of maintenance. RIS1 and RIS2 signs shall have integrated sign controllers located within the sign enclosure. RIS1 and RIS2 signs shall be field replaceable units and shall only be serviced at the manufacturer's factory. All other maintainability requirements shall comply to AS 4852.1 for RIS1 and RIS2 signs.

RIS3 signs shall consist of modular replaceable sub systems such as display boards, power supplies, and sign controllers. These subsystems shall be field replaceable in a shorter duration not more than five minutes. All other maintainability requirements of RIS3 signs shall be complied to AS 4852.1 *Maintainability*.

### 8.1.2 Display dimensional requirements

#### 8.1.2.1 Text and spacing

RIS1 and RIS2 signs shall be according to the TC2290.

RIS3 sign shall be complied to AS 4852.1 *Text and spacing*.

#### 8.1.2.2 Pixel lit area

Pixel lit area shall be complied to AS 4852.1 *Pixel lit area*.

#### 8.1.3 Light axis

RIS1 and RIS2 signs shall have maximum light output in line with the mechanical axis of sign display panel.

RIS3 signs shall have maximum light output complied to AS 4852.1 *Light axis*.

#### **8.1.4 Character formats**

##### **8.1.4.1 General**

RIS1 and RIS2 signs shall have character formats as per the TC2290.

RIS3 sign font types shall be complied with AS 4852.1 *Character formats*.

##### **8.1.4.2 Font shapes**

RIS1 and RIS2 font shapes shall be according to TC2290.

RIS3 sign font shapes shall be complied with AS 4852.1.

##### **8.1.4.3 Justification**

Signs shall be justified as per the AS 4852 *Justification*.

#### **8.1.5 Display changes**

Signs shall have capability of display changes complied with AS 4852.1 *Display changes*.

#### **8.1.6 Display changes due to facility switch operations**

RIS1 and RIS2 signs shall not be provided with facility switches.

RIS3 signs shall comply with AS 4852.1 *Display changes due to facility switch operations*.

#### **8.1.7 Display changes due to external inputs**

External inputs shall be provided and functioned complied with AS 4852.1 *Display changes due to external inputs* for RIS3 signs.

#### **8.1.8 Graphic requirements**

RIS1 signs shall display graphics NO RIGHT TURN, NO LEFT TURN and NO ENTRY as per AS 1743 R4-6 signs.

#### **8.1.9 Sign dimming control**

##### **8.1.9.1 General**

Sign shall have two light sensors mounted in the front and back. The sign dimming shall be controlled by the higher value of the two light sensors. All other requirements of the sign dimming system shall comply with AS 4852.1 *General*.

##### **8.1.9.2 Monitoring of automatic dimming control**

Sign dimming monitoring system shall comply to AS 4852.1 monitoring of automatic dimming control with following amendment of the sub clause (a) (iii).

(a) (iii) The reported sign illuminance of the light-sensing device does not have a variation greater than 600lx over a period of 48h.

Additionally, the 1 minute and 15 minute average light sensor values shall be stored in the sign controller for a period of 12 months to be downloadable from the PHCS. Light levels and associated time shall be configurable parameters from the PHCS.

#### **8.1.9.3 Time based dimming control**

Sign dimming control system shall have time-based dimming control complied with AS 4852.1 *Time-based dimming control*.

#### **8.1.9.4 Fixed dimming control**

Sign dimming control system shall have a fixed dimming control complied with AS 4852.1 *Fixed dimming control*.

#### **8.1.10 Conspicuity devices**

Conspicuity devices shall not be provided.

#### **8.1.11 Display flicker**

Display flicker shall be complied with AS4852.1 *Display flicker*.

### **8.2 Optical requirements**

#### **8.2.1 Luminance and luminance ratio**

Sign's luminance and luminance ratio shall be complied with the AS 4852.1 *Luminance and luminance ratio*.

#### **8.2.2 Luminance matching of colours**

Sign's luminance matching of colours shall be complied with AS 4852.1 *Luminance matching of colours*.

#### **8.2.3 Luminance intensity uniformity**

Luminance intensity uniformity shall be complied with AS 4852.1 *Luminous intensity uniformity*.

#### **8.2.4 Colours**

Colours shall be complied with AS 4852.1.

The RIS display shall be able to display individual pixels in either Yellow or White or Red or Green colours, against a matt Black background. LEDs shall be used within pixels to generate output colours. The individual pixels may generate colour with either discrete LED/s for each of the 4 colours or via a colour mixing arrangement with RGB LEDs or equivalent technologies. In the event of the use of colour mixing or equivalent technology, any non-compliant colours to AS 4852.1 shall neither be configurable nor displayed under any circumstances.

The VMS display's colours shall remain within their corresponding chromaticity coordinates, as specified in the Section 5.2.4 of AS 4852.1, for every configurable brightness level. The sign's display colours shall remain within their corresponding specified chromaticity coordinates for at least 10 years of pixel service life specified in the Section 5.1.1.4 of AS 4852.1. It should be noted that this requirement is additional to the warranty requirements outlined in the Clause 4.3.

## **9 Operation and control requirements**

### **9.1 General**

Signs shall be capable of connection to STREAMS, principal's TMS. Signs shall be provided with Product Host Control System (PHCS) complied with AS 4852.1.

PHCS shall also provide network diagnostic through looping back of the interfacing ports to isolate the faults to a specific system.

### **9.2 Local control**

Signs shall have an Ethernet port for onsite control, operation and fault diagnostic functions. The control port shall also support the fault diagnostics using PHCS software when connected to a local computer.

For RIS1 and RIS2 signs, local control port shall locate outside either on the sign enclosure or via a nearby cable termination infrastructure. The external port shall have minimum ingress protection level of IP56.

Local control for RIS3 signs shall be accessible at the telecommunication field cabinet.

### **9.3 Remote control**

Signs shall be connected to Field Process for remote operations through RS422 interface. The communication parameters shall be configurable using the PHCS. All other requirements shall be complied with AS 4852.1 *Remote control*.

### **9.4 Non-volatile memory capacity**

RIS1 and RIS2 signs shall have memory capacity to store messages enough to display all the frames required for operation of RIS1 and RIS2 signs.

RIS3 sign shall have memory capacity complied with AS 4852.1 *Non-volatile memory capacity*.

In addition to requirements above, non-volatile memory shall be able to store the light sensor output data for minimum 12 month period.

### **9.5 Programming**

Sign shall have capability to program the frames or messages complied to AS 4852.1 *Programming*.

### **9.6 Communication protocol**

The signs shall be able to interface with Principals TMS, STREAMS through the field processor. STREAMS use RMS protocol TSI-SP-003 with compatibility to operate with colours.

### **9.7 Monitoring, fault logging and reporting**

The sign shall have monitoring, fault logging and reporting complied with AS 4852.1 *Monitoring, fault logging and reporting*.

### **9.8 Fall-back system**

The fall-back display shall be blank.

The sign fall-back system shall be complied with AS4852.1 *Fall-back system*.

### **9.9 Software development**

Any software for signs and PHCS shall be developed in compliance with AS 4852.1 *Software development*.

### **9.10 Operation and maintenance manual**

The sign shall be provided with an operation and maintenance manual complied with AS 4852.1 *Operation and maintenance manual*.

### **9.11 Real-time clock**

Signs shall have a real time clock with an accuracy within  $\pm 5$  s within a week. Real time clock shall periodically synchronize with the field processor through the communication protocol.

Realtime clock shall have backup battery system for uninterrupted operation.

### **9.12 Configuration**

Parameters in Appendix B shall be configurable using the PHCS

## **10 Environmental requirements**

### **10.1 Temperature and humidity**

Sign and supporting hardware shall be complied to environmental conditions as per MRTS201 *General Equipment Requirements*.

### **10.2 Enclosure protection**

The ingress protection of sign and control enclosures shall be complied with AS4852.1 *Enclosure protection*.

## **11 Installation requirements**

The installation requirements defined in MRTS201 *General Equipment Requirements* apply to this Technical Specification. Where the sign controller resides in separate roadside cabinet, it should be placed at a location where the sign face can be visible. Consequently, ground-mounted cabinets should be located on the same side of the carriageway as the sign. The cabinets shall comply with the requirements of MRTS201 *General Equipment Requirements* and MRTS226 *Telecommunication Field Cabinets*.

RIS1 sign shall be placed at the entry of the motorway ramp at a height no less than 2.1 m.

RIS2 sign shall be placed on an on-ramp at a height not less than 2.1 m.

RIS1 and RIS2 signs shall be typically attached to Transport and Main Roads standard 4.1 m pole. The finial cap shall be used for supplying power. If the site conditions are not suitable for a typical installation, a site-specific design shall be provided to Principal for the approval.

RIS3 signs shall be placed in the side of the arterial road on a suitable mounting structure.

## **12 Telecommunication requirements**

The telecommunications requirements defined in MRTS201 *General Equipment Requirements* and MRTS245 *ITS Telecommunications Network (ITS TN)* apply to work provided under this Technical Specification.

RIS1 and RIS2 signs shall connected to the same field processor that have the ramp metering controller connected.

Wireless communication technologies through cellular mobile systems shall not be used as communication channel unless approved by the Principle's representative.

## **13 Testing and commissioning**

### **13.1 General**

The testing and commissioning requirements defined in MRTS201 *General Equipment Requirements* apply to work provided under this Technical Specification. The minimum additional testing and commissioning requirements for equipment provided under this Technical Specification are described below.

### **13.2 Factory acceptance testing**

FAT shall include all the testing that can be conducted at the factory to ensure the equipment functioning to according to the performance measures in this Technical Specification.

Photometric test reports issued by a NATA accredited laboratory or NATA endorsed by Mutual Recognition shall be submitted for the verification by the representative of the principal.

Ingress protection test reports issued by a NATA accredited laboratory NATA endorsed by Mutual Recognition shall be submitted for verification

STREAMS acceptance certificate issued by Transmax for the current firmware of the sign/site controller shall be submitted to the Principal.

## **14 Commissioning**

Commissioning shall include both individual sign commissioning and commissioning of the Ramp Metering System as a whole. Signs shall be demonstrated as operating correctly with Ramp Metering in Operation and also in a Motorway Closed situation.

## **15 Documentation**

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

## **16 Training**

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

## **17 Maintenance**

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

## **18 Handover**

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

The Contractor shall provide asset data for the installed VMS in the format prescribed in the QADF document. The Contractor will need to contact the Principal with regards to data requirements such as asset attributes specific to the project, as these requirements may change from project to project.

## Appendix A: Message IDs

The Table A outlines the current STREAMS Frames and Messages requirement for RIS1 and RIS2. QGTM Part 9 shall be referred for up to date Frames and Messages requirements.

**Table A – Message and Frame IDs**

Message ID	Message Name	Display Type	Applicable Sign Type	Comments
0	Blank	Nil	RIS1 and RIS2	1 Frame Message
1	Ramp Signals On	Text	RIS1 and RIS2	1 Frame Message
2	Prepare to Stop	Text	RIS2	1 Frame Message
3	Motorway Closed	Text	RIS1	1 Frame Message
4	No Left Turn	Graphic	RIS1	1 Frame Message
5	No Right Turn	Graphic	RIS1	1 Frame Message
6	No Entry	Graphic	RIS1	1 Frame Message
7	Ramp Signals On / Prepare to Stop	Text	RIS2	2 Frame Message
8	Motorway Closed / No Left Turn	Text / Graphic	RIS1	2 Frame Message
9	Motorway Closed / No Right Turn	Text / Graphic	RIS1	2 Frame Message
10	Motorway Closed / No Entry	Text / Graphic	RIS1	2 Frame Message



## Appendix B: Configuration Parameters

**Table B – Sign Configurable Parameters**

Description	Range of values	Factory default	Device(s), systems affected
TMS Communications Session Time-out (STO)	1 - 600 seconds	300 seconds	control unit/Configuration Software
Communications check frequency (Controller with sign display) (CST)	0 - 30 seconds	Once every 5 seconds	control unit/sign display
Communication Timeout Setting (Controller to Sign Display)	0 - 30 seconds	5 seconds	control unit/sign display
Enclosure Over-Temperature Setting (OTS)	0 – 70°C in increments of 1°C	Max Alarm set at 42°C	control unit/sign display/enclosure
Over Temperature Shutdown	0 – 70°C in increments of 1°C	50°C	control unit/sign display/enclosure
Sign processor fault blank time (PFBT)	0.5 – 3 seconds	1 second	sign display
Contiguous Pixel Failure (CPF)	0 - 10%	2%	control unit/sign display
Multi LED failure (MLEDF)	0 – 100%	20%	control unit/sign display
Power recovery delay time (PRDT)	1 - 600 seconds	60 seconds	control unit/sign display
Minimum blank time (MBT)	1 - 120 seconds	30 seconds	control unit/sign display
LED brightness level transition time	1 – 60 seconds	15	control unit/sign
Thermostat set Point (TSP)	10 – 60°C in increments of 1°C	ON at 40°C, OFF at 35°C	control unit/sign display/enclosure

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