

**Technical Specification**

**Transport and Main Roads Specifications  
MRTS231 Road Weather Monitor (RWM) Systems**

**July 2023**



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## 1 Introduction

This Technical Specification defines the design, supply, installation, testing and commissioning, performance, documentation, training and maintenance requirements for Road Weather Monitors (RWM). The RWM shall be capable of providing data from the Principal's chosen combination of weather variables for each RWM location. These may include wind speed, wind direction, rainfall intensity, visibility, surface friction indicator, temperature and humidity, and other weather sensors as specified.

The data collated from RWMs shall be made available to STREAMS via the Principal's telecommunications network.

Flood sensors are not part of this Technical Specification. For flood monitoring systems, refer to MRTS233 *Roadway Flood Monitoring Systems*.

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 terms defined in Clause 2 of MRTS01 *Introduction to Technical Specifications* and MRTS201 *General Equipment Requirements* apply to this Technical Specification. Additional terminology relevant under this Technical Specification is defined in Table 2 below.

**Table 2 – Definitions of terms**

Term	Definition
ADSL	Asynchronous Digital Subscriber Line
BoM	Bureau of Meteorology
FAT	Factory Acceptance Testing
IPRT	Internet Protocol Remote Telemetry (Transport and Main Roads ITS Network system supplied by Telstra)
ITS	Intelligent Transport System
MOR	Meteorological Optical Range
Principal	Queensland Department of Transport and Main Roads
ROAR	Road Operations Asset Register (Transport and Main Roads asset management system)
RPEQ	Registered Professional Engineer – Queensland
RH	Relative Humidity
RWM	Road Weather Monitors
SI	Système international (d'unités) – International Unit System
STREAMS	Transport and Main Roads Traffic Management System. (Primary user interface to ITS field devices)
TMC	Traffic Management Centre

### 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 MRTS (including those referenced in MRTS201 *General Equipment Requirements*), the requirements specified in this Technical Specification shall take precedence.

**Table 3 – Referenced documents**

Reference	Title
AS/NZS 3000	<i>Electrical installations (known as Australian / New Zealand Wiring Rules)</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>
MRTS232	<i>Provision of Field Processors</i>
MRTS233	<i>Roadway Flood Monitoring Systems</i>
MRTS245	<i>ITS Telecommunications Network (ITS TN)</i>
MRTS263	<i>Standalone Solar (PV) Power Systems</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 and Witness Points applicable for this Technical Specification are summarised in Table 4.1.

There are no Milestones defined.

Quality system requirements for this Contract shall be in accordance with this Technical Specification, MRTS01 *Introduction to Technical Specifications*, MRTS50 *Specific Quality System Requirements* and MRTS201 *General Equipment Requirements*.

**Table 4.1 – Hold Points, Witness Points and Milestones**

Clause	Hold Point	Witness Point
10	1. Installation Requirements: Inspection of mounting structures	1. Installation Requirements: After installation of the cables, the conduits shall be sealed to prevent vermin entry
13	2. Testing and Commissioning	
14	3. Documentation	

## 5 Functional requirements

The RWM shall measure the specified weather parameters. Some of the main weather parameters required by the Principal, and their units, include:

- wind speed (km/hr)
- wind direction (degrees (°) bearing relative to geographic North)
- rainfall intensity (mm/hr)
- visibility (metres)
- surface friction indicator (dimensionless)
- Temperature (°C), and
- Humidity (%RH).

The RWM shall be able to accommodate additional sensors that collect weather parameters other than those specified above where required by the Principal. Measured data shall be transmitted to STREAMS via the Principal's telecommunications network.

Where in addition to the above, the RWM functions as a water level sensor, it shall also meet the requirements of MRTS233 *Roadway Flood Monitor Systems*, in addition to this Technical Specification.

The RWM equipment shall interface with STREAMS for real time data monitoring remotely from the TMC. It shall also be capable of providing configurable alarms / events to alert the TMC operator and/or provide direct input to enable / disable other ITS systems.

## 6 Equipment components

A road weather monitor shall consist of the following components:

- a) specified road weather sensors (refer Clause 7)
- b) all associated electronics
- c) mounting structure
- d) configuration and diagnostic software
- e) STREAMS Field Processor and associated device driver, and
- f) power supply, telecommunications field cabinet, and associated infrastructure and accessories.

## 7 Operational requirements

### 7.1 General

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

In addition, the RWM sensors shall be installed as per the manufacturer's mandatory specifications and shall be non-intrusive, namely, shall not be installed in the roadway pavement itself.

The components of the RWM including the sensors shall not incorporate mechanical moving parts. However, sensors with mechanical moving parts may be permissible under certain conditions to align

with specific project requirements to be confirmed by the Principal. All RWM sensors must be provided with their associated calibration and accuracy information.

The preference for sensors without moving parts is to ensure the longevity of the RWM since moving parts will accelerate degradation and thus require more maintenance. In some instances, however, due to operational requirements and integration with other systems, rainfall sensors with moving parts may be used. See Clause 7.4 below.

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

### **7.2 Wind speed sensors**

Wind speed sensors shall be capable of measuring wind speed in units of kilometres per hour (km/hr). The wind speed sensor shall be capable of operation when mounted up to 10 m above the roadway and/or bridge structure. The range, resolution and accuracy requirements for wind speed sensors are shown in Table 7.9.

### **7.3 Wind direction sensors**

Unless otherwise specified, wind direction sensors shall be capable of measuring the wind direction as degrees (°) deviation from true North (0°).

Wind direction is usually determined with reference to true north rather than magnetic north.

The wind direction sensor shall be capable of operation when mounted up to 10 m above the roadway and/or bridge structure. The range, resolution and accuracy requirements for wind direction sensors are as shown in Table 7.9.

### **7.4 Rainfall sensors**

Where rainfall data is required solely for the control of other traffic management equipment such as traveller information systems of variable speed limit signs via STREAMS, it is preferred the rainfall sensor have no moving parts.

Where in addition to control of traffic management equipment, integration with Bureau of Meteorology (BoM) systems is essential, rainfall sensors shall be of tipping bucket type. Bucket capacity shall be 0.2 mm unless otherwise specified.

The department sends roadway flood level data collected from ITS Field sites to BoM and receive selected relevant flood data from BoM (refer to MRTS233 *Roadway Flood Monitoring Systems*). Since flood data and rainfall data are closely linked, it is expected that the departmental rainfall sensors match those used by BoM for consistency where they are to be integrated.

All rainfall data shall be provided real-time and provide instantaneous rainfall intensity in mm/hr as well as discrete events, peak and average precipitation rates, and accumulated rainfall over a period.

The range, resolution and accuracy requirements for rainfall sensors are as shown in Table 7.9.

### 7.5 Visibility sensors

Unless otherwise specified, visibility sensors shall be of a laser transmissometer type or the infrared forward scatter visibility sensor type and report the visibility in metres. The range, resolution and accuracy requirements for visibility sensors are as shown in Table 7.9.

### 7.6 Surface friction indicators

Unless otherwise specified, surface friction indicators shall be of the infrared (IR) beam type. The sensor must be calibrated in accordance with manufacturer recommendations. The range resolution and accuracy requirements for surface friction indicators are as shown in Table 7.9.

The IR surface friction indicator is useful where it is not possible to measure the surface friction directly, such as in areas with heavy traffic. It uses pavement surface temperature as a surrogate to surface friction. The sensor must be calibrated in accordance with manufacturer recommendations so that the output can then be used as input to weather algorithms to control speed on managed motorways.

### 7.7 Temperature sensors

The sensing element of the temperature sensor shall be a semiconductor integrated circuit. The response time shall be less than five minutes in air. The range, resolution and accuracy requirements for temperature sensors are as shown in Table 7.9.

### 7.8 Humidity sensors

The sensing element of the humidity sensor shall be a semiconductor integrated circuit. The response time shall be less than five minutes in air. The range, resolution and accuracy requirements for humidity sensors are as shown in Table 7.9.

### 7.9 Other sensors

The road weather monitor shall allow additional weather sensors (for other weather conditions) to be added to the installation in future, by others. Such weather parameters may include, but not limited to, pavement surface moisture and solar radiation.

**Table 7.9 – RWM parameter specification**

Parameter	Minimum specification	
<b>wind speed (km/hr)</b>	range	0-216 km/hr
	resolution	1.8 km/hr
	accuracy	+/- 1.8 km/hr
<b>wind direction (degrees (°) bearing relative to geographic North)</b>	range	0-359
	resolution	5°
	accuracy	± 5°
<b>rainfall intensity (mm/hr)</b>	range	0-200 mm/hr
	resolution	0.5 mm/hr
	accuracy	± 5% for 0-120 mm/hr



Parameter		Minimum specification
rainfall (mm)	range	0-400 mm
	resolution	0.1 <sup>1</sup>
	accuracy	± 0.1 mm for 5 mm ± 4% for > 5 mm
visibility (m)	range (MOR)	10-2000 m
	resolution	50 m
	accuracy	± 50% for 50 m ± 20% for > 50 m
surface friction indicator (dimensionless)	range	0-1
	resolution	0.01
	accuracy	± 0.02
Temperature (°C)	range	- 20 to 60
	resolution	0.3°C
	accuracy	± 0.3
Humidity (%RH)	range	0-100%
	resolution	0.5%rh
	accuracy	± 2% for 10-90RH ± 4% for 90-100RH

<sup>1</sup> A resolution of 0.2 mm is permissible for tipping bucket rain gauges such as those used by BoM. Refer to Clause 7.4.

### 7.10 Deterrent mechanism for birds

RWM shall be provided with a deterrent mechanism for stopping birds from resting on the RWM equipment and damaging the equipment including the sensors. The deterrent mechanism shall be maintenance free.

## 8 Control system

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

### 8.1 General

- a) It shall be possible to retrieve equipment data and status information remotely from STREAMS, or directly from the hardware item (datalogger or sensor interface) via the Principal's telecommunications network.
- b) It shall be possible to retrieve data and status 'on demand' via a STREAMS request, and automatically on a pre-determined interval.
- c) It shall be possible to remotely retrieve via STREAMS, operating characteristics and errors that may adversely impact the reliability or credibility of the reported weather measurements.
- d) Where the equipment performs local calculations based on sensor inputs, it shall be possible to extract both raw data and calculated data via STREAMS.

- e) Unless otherwise specified, a minimum of two configurable digital outputs shall be provided for each RWM controller.
- f) Have one EIA/ RS-232 or EIA/ RS-422 serial port to connect the Principal's Telecommunications System using an ethernet TCP/IP connection or via a Field Processor.
- g) Have one EIA/ RS-232 serial port, USB or Ethernet connection interface to allow for the configuration of the station locally or remotely.
- h) Upon restoration of power after a power loss and/or reset, the RWM controller shall operate normally and show no signs of damage, impairment or loss of data or configuration settings.

## **8.2 STREAMS device driver**

Where the device is not capable of Modbus communication, the contractor shall engage Transmax at the contractor's cost and provide a device driver compatible with interfacing with the STREAMS field processor.

## **8.3 Internal clock**

An internal clock shall be provided in accordance with MRTS201 *General Equipment Requirements*.

## **9 Mounting infrastructure requirements**

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

In addition, the sensor equipment shall be capable of being installed on a post that is mounted onto a bridge structure or on to a concrete footing and rag-bolt assembly.

The post shall be of the hinged type to allow ease of maintenance. The mounting structure shall comply with the requirements of MRTS201 *General Equipment Requirements* and MRTS61 *Gantries and Support Structures for Road Signs, Tolling Systems and ITS Devices*.

## **10 Installation requirements**

The sensors and associated infrastructure shall be installed at locations shown on the design documentation. The contractor shall allow access for inspection of all mounting structures by the Administrator prior to installation. **Hold Point 1**

After installation of the cables, the conduits shall be sealed to prevent vermin entry. **Witness Point 1**

## **11 Electrical**

### **11.1 Mains power**

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

### **11.2 Battery power**

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

### **11.3 Solar power**

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

### **11.4 Protection against electrical transients and over-voltage**

Provide protection against electrical transients and over-voltage in accordance with Clause 10 of MRTS201 *General Equipment Requirements*.

## **12 Telecommunications requirements**

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

In addition, the equipment shall be compatible with the control system defined in Clause 8 and be capable of sending weather data from each sensor every 10 seconds.

Remote departmental RWM sites need to communicate data within STREAMS back to Transport and Main Roads.

In order of priority, the telecommunications backhaul links from RWM sites to head-end monitoring sites should be implemented as listed below:

1. Connection via the department's own existing private telecommunications networks using copper, fibre or point to point, or point to multipoint wireless systems back to the department's TMC's.
2. Connection via the department's default ITS network using departmental IPRT Network to connect to the department's TMC's using IPRT ADSL, Next G (3G) or 4G if available.

## **13 Testing and commissioning**

The testing and commissioning requirements defined in MRTS201 *General Equipment Requirements* apply to equipment provided under this Technical Specification. In addition, test sheets shall be verified at commissioning and demonstrate compliance with the technical requirements of this Technical Specification. A calibration certificate shall be provided prior to the delivery of the equipment for installation on site. **Hold Point 2**

## **14 Documentation**

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

Additional documentation requirements relevant to this Technical Specification are defined below.

Prior to the commencement of manufacturing works, the Contractor shall prepare and request approval of the Principal / Administrator of three copies of the following documents: **Hold Point 3**

- a) fabrication and assembly drawings, detailing all the components to be installed
- b) manufacturer's specifications of the RWM and of all major components detailing ratings and performance characteristics
- c) a schematic layout of components, building details and interconnection diagrams

- d) system operating manual
- e) recommendations for routine maintenance tasks, and
- f) recommendations on spare parts.

#### **14.1 Asset data**

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

### **15 Training**

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

### **16 Maintenance**

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

### **17 Handover**

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

### **18 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**

Item#	MRTS231 Road Weather Monitors	MRTS Clause	VERIFICATION METHOD					Compliance (Y, TBC, N, N/A)
			Visual Inspection	NATA Certification	Field OR Bench Test	Detailed Drawings	Other records (Datasheets, internal testing, RPEQ)	
<b>5 Functional requirements</b>								
1	The RWM shall measure the specified weather parameters.	5					X	
2	Some of the main weather parameters required by the principal, and their units, include: <ul style="list-style-type: none"> <li>• wind speed (km/hr)</li> <li>• wind direction (degrees (°) bearing relative to geographic North)</li> <li>• rainfall intensity (mm/hr)</li> <li>• visibility (metres)</li> <li>• surface friction indicator (dimensionless)</li> <li>• Temperature (°C), and</li> <li>• Humidity (%RH).</li> </ul>	5					X	
3	The RWM shall be able to accommodate additional sensors that collect weather parameters other than those specified above where required by the Principal.	5					X	
4	Measured data shall be transmitted to STREAMS via the Principal's telecommunications network.	5			X		X	
5	Where in addition to the above, the RWM functions as a water level sensor, it shall also meet the requirements of MRTS233 <i>Roadway Flood Monitor Systems</i> , in addition to this Technical Specification.	5					X	
6	The RWM equipment shall interface with STREAMS for real time data monitoring remotely from the TMC.	5					X	
7	It shall also be capable of providing configurable alarms / events to alert the TMC operator and/or provide direct input to enable / disable other ITS systems.	5			X		X	

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			Visual Inspection	NATA Certification	Field OR Bench Test	Detailed Drawings	Other records (Datasheets, internal testing, RPEQ)	
<b>6 Equipment components</b>								
8	A road weather monitor shall consist of the following components: a) specified road weather sensors (refer Clause 7)	6					X	
9	b) all associated electronics	6				X	X	
10	c) mounting structure	6				X		
11	d) configuration and diagnostic software	6					X	
12	e) STREAMS Field Processor and associated device driver, and	6					X	
13	f) power supply, telecommunications field cabinet, and associated infrastructure and accessories.	6					X	
<b>7 Operational requirements</b>								
14	The operational requirements defined in MRTS201 <i>General Equipment Requirements</i> apply to this Technical Specification.	7.1					X	
15	In addition, the RWM sensors shall be installed as per the manufacturer's mandatory specifications and shall be non-intrusive, namely, shall not be installed in the roadway pavement itself.	7.1					X	
16	The components of the RWM including the sensors shall not incorporate mechanical moving parts.	7.1	X				X	
17	However, sensors with mechanical moving parts may be permissible under certain conditions to align with specific project requirements to be confirmed by the Principal.							
18	All RWM sensors must be provided with their associated calibration and accuracy information.	7.1					X	
19	Wind speed sensors shall be capable of measuring wind speed in units of kilometres per hour (km/hr).	7.2					X	

Item#	MRTS231 Road Weather Monitors	MRTS Clause	VERIFICATION METHOD					Compliance (Y, TBC, N, N/A)
			Visual Inspection	NATA Certification	Field OR Bench Test	Detailed Drawings	Other records (Datasheets, internal testing, RPEQ)	
20	The wind speed sensor shall be capable of operation when mounted up to 10 m above the roadway and/or bridge structure.	7.2			X		X	
21	The range, resolution and accuracy requirements for wind speed sensors are shown in Table 7.9.	7.2					X	
22	Unless otherwise specified, wind direction sensors shall be capable of measuring the wind direction as degrees (°) deviation from true North (0°).	7.3					X	
23	The wind direction sensor shall be capable of operation when mounted up to 10 m above the roadway and/or bridge structure.	7.3			X		X	
24	The range, resolution and accuracy requirements for wind direction sensors are as shown in Table 7.9.	7.3					X	
25	Where rainfall data is required solely for the control of other traffic management equipment such as traveller information systems of variable speed limit signs via STREAMS, it is preferred the rainfall sensor have no moving parts.	7.4					X	
26	Where in addition to control of traffic management equipment, integration with BoM systems is essential, rainfall sensors shall be of tipping bucket type.	7.4					X	
27	Bucket capacity shall be 0.2 mm unless otherwise specified.	7.4					X	
28	All rainfall data shall be provided real-time and provide instantaneous rainfall intensity in mm/hr as well as discrete events, peak and average precipitation rates, and accumulated rainfall over a period.	7.4					X	
29	The range, resolution and accuracy requirements for rainfall sensors are as shown in Table 7.9.	7.4					X	

Item#	MRTS231 Road Weather Monitors	MRTS Clause	VERIFICATION METHOD					Compliance (Y, TBC, N, N/A)
			Visual Inspection	NATA Certification	Field OR Bench Test	Detailed Drawings	Other records (Datasheets, internal testing, RPEQ)	
30	Unless otherwise specified, visibility sensors shall be of a laser transmissometer type or the infrared forward scatter visibility sensor type and report the visibility in metres.	7.5			X		X	
31	The range, resolution and accuracy requirements for visibility sensors are as shown in Table 7.9.	7.5					X	
32	Unless otherwise specified, surface friction indicators shall be of the infrared (IR) beam type.	7.6					X	
33	The sensor must be calibrated in accordance with manufacturer recommendations.	7.6			X		X	
34	The range resolution and accuracy requirements for surface friction indicators are as shown in Table 7.9.	7.6					X	
35	The sensing element of the temperature sensor shall be a semiconductor integrated circuit.	7.7					X	
36	The response time shall be less than five minutes in air.	7.7			X		X	
37	The range, resolution and accuracy requirements for temperature sensors are as shown in Table 7.9.	7.7					X	
38	The sensing element of the humidity sensor shall be a semiconductor integrated circuit.	7.8					X	
39	The response time shall be less than five minutes in air.	7.8			X		X	
40	The range, resolution and accuracy requirements for humidity sensors are as shown in Table 7.9.	7.8					X	
41	The road weather monitor shall allow additional weather sensors (for other weather conditions) to be added to the installation in future, by others.	7.9				X	X	



Item#	MRTS231 Road Weather Monitors	MRTS Clause	VERIFICATION METHOD					Compliance (Y, TBC, N, N/A)
			Visual Inspection	NATA Certification	Field OR Bench Test	Detailed Drawings	Other records (Datasheets, internal testing, RPEQ)	
42	Such weather parameters may include, but not limited to, pavement surface moisture and solar radiation.	7.9					X	
43	RWM shall be provided with a deterrent mechanism for stopping birds from resting on the RWM equipment and damaging the equipment including the sensors.	7.10					X	
44	The deterrent mechanism shall be maintenance free.	7.10					X	
<b>8 Control system</b>								
45	The control system requirements defined in MRTS201 <i>General Equipment Requirements</i> apply to this Technical Specification.	8					X	
46	Additional control system requirements for RWM equipment provided under this Technical Specification are described below.	8						
47	a) It shall be possible to retrieve equipment data and status information remotely from STREAMS, or directly from the hardware item (datalogger or sensor interface), via the Principal's telecommunications network.	8.1			X		X	
48	b) It shall be possible to retrieve data and status 'on demand' via a STREAMS request, and automatically on a pre-determined interval.	8.1			X		X	
49	c) It shall be possible to remotely retrieve via STREAMS, operating characteristics and errors that may adversely impact the reliability or credibility of the reported weather measurements.	8.1			X		X	
50	d) Where the equipment performs local calculations based on sensor inputs, it shall be possible to extract both raw data and calculated data via STREAMS.	8.1			X		X	
51	e) Unless otherwise specified, a minimum of two configurable digital outputs shall be provided for each RWM controller.	8.1				X	X	

Item#	MRTS231 Road Weather Monitors	MRTS Clause	VERIFICATION METHOD					Compliance (Y, TBC, N, N/A)
			Visual Inspection	NATA Certification	Field OR Bench Test	Detailed Drawings	Other records (Datasheets, internal testing, RPEQ)	
52	f) Have one EIA/ RS-232 or EIA/ RS-422 serial port to connect the Principal's Telecommunications System using an ethernet TCP/IP connection or via a Field Processor.	8.1				X	X	
53	g) Have one EIA/ RS-232 serial port, USB, or Ethernet connection interface to allow for the configuration of the station locally or remotely.	8.1				X	X	
54	h) Upon restoration of power after a power loss and/or reset, the RWM controller shall operate normally and show no signs of damage, impairment or loss of data or configuration settings.	8.1			X		X	
55	Where the device is not capable of Modbus communication, the contractor shall engage Transmax at the contractor's cost and provide a device driver compatible with interfacing with the STREAMS field processor.	8.2					X	
56	An internal clock shall be provided in accordance with MRTS201 <i>General Equipment Requirements</i> .	8.3					X	
<b>9 Mounting Infrastructure requirements</b>								
57	The mechanical and physical requirements defined in MRTS201 <i>General Equipment Requirements</i> apply to equipment provided under this Technical Specification.	9					X	
58	In addition, the sensor equipment shall be capable of being installed on a post that is mounted onto a bridge structure or on to a concrete footing and rag-bolt assembly.	9				X	X	
59	The post shall be of the hinged type to allow ease of maintenance.	9				X	X	
60	The mounting structure shall comply with the requirements of MRTS201 <i>General Equipment Requirements</i> and MRTS61 <i>Gantries and Support Structures for Road Signs, Tolling Systems, and ITS Devices</i> .	9					X	

Item#	MRTS231 Road Weather Monitors	MRTS Clause	VERIFICATION METHOD					Compliance (Y, TBC, N, N/A)
			Visual Inspection	NATA Certification	Field OR Bench Test	Detailed Drawings	Other records (Datasheets, internal testing, RPEQ)	
<b>10 Installation requirements</b>								
61	The sensors and associated infrastructure shall be installed at locations shown on the design documentation.	10						
62	The contractor shall allow access for inspection of all mounting structures by the Administrator prior to installation.	10						
63	After installation of the cables, the conduits shall be sealed to prevent vermin entry.	10						
<b>11 Electrical</b>								
64	Where mains power is required, the relevant electrical requirements defined in Clause 10 of MRTS201 <i>General Equipment Requirements</i> apply to this Technical Specification.	11.1					X	
65	Where mains power is required, also provide a battery power supply in accordance with Clause 10 of MRTS201 <i>General Equipment Requirements</i> to allow orderly power down for the real-time clock and processor in the case of loss of power supply.	11.2					X	
66	Where solar power is specified, the requirements defined in MRTS263 <i>Standalone Solar (PV) Power Systems</i> apply to this Technical Specification.	11.3			X		X	
67	Provide protection against electrical transients and over-voltage in accordance with Clause 10 of MRTS201 <i>General Equipment Requirements</i> .	11.4					X	
<b>12 Telecommunications requirements</b>								
68	The telecommunications requirements defined in MRTS201 <i>General Equipment Requirements</i> and MRTS245 <i>ITS Telecommunications Network (ITS TN)</i> apply to work under this Technical Specification.	12					X	

Item#	MRTS231 Road Weather Monitors	MRTS Clause	VERIFICATION METHOD					Compliance (Y, TBC, N, N/A)
			Visual Inspection	NATA Certification	Field OR Bench Test	Detailed Drawings	Other records (Datasheets, internal testing, RPEQ)	
69	In addition, the equipment shall be compatible with the control system defined in Clause 8 and be capable of sending weather data from each sensor every 10 seconds.	12				X	X	
70	Remote departmental RWM sites need to communicate data within STREAMS back to Transport and Main Roads.	12					X	
71	In order of priority, the telecommunications backhaul links from RWM sites to head-end monitoring sites should be implemented as listed below:	12					X	
72	1. Connection via the department's own existing private telecommunications networks using copper, fibre or point to point, or point to multipoint wireless systems back to the department's TMC's.	12					X	
73	2. Connection via the department's default ITS network using departmental IPRT Network to connect to the department's TMC's using IPRT ADSL, Next G (3G) or 4G if available.	12					X	

