

Technical Specification

**Transport and Main Roads Specifications
MRTS251 Motor Vehicle Traffic Counter / Classifier**

March 2025



**Queensland
Government**

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1 Introduction

This Technical Specification applies to the design, supply, installation, testing and commissioning, performance, documentation, training and maintenance requirements for traffic counter / classifier. Manual counting is out of scope.

In this Technical Specification, the terms Traffic Counter and Traffic Classifier specifically refer to Motor Vehicle Counter and Motor Vehicle Classifier respectively.

A traffic counter is used to automatically collect traffic volume counts. A classifier is used to classify vehicle classification type and collect speed data. Data collected by a traffic counter / classifier resides locally within the device until the device is interrogated to transfer data to a Transport and Main Roads database.

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.

Table 2 – Definition of terms

Term	Definition
AEST	Australian Eastern Standard Time.
Axle Group	A group of vehicle axles where adjacent axles are less than 2.1 m apart.
Axle Spacing	Distance between adjacent axles of a vehicle. Maximum axle spacing of a vehicle is 10 m.
ELV	Extra low voltage, not exceeding 50 V a.c. or 120 V ripple free d.c.
FTP	File transfer protocol.
ICMP	Internet Control Message Protocol.
IPv4	Internet Protocol version 4.
Ipv6	Internet Protocol version 6.
NTPv4	Network Time Protocol version 4.
QTDF	Queensland Traffic Data Format.
Qualified technical person	As defined in Part 1 Section 7 of the <i>Electrical Safety Regulation 2013</i> .
ROAR	Road Operation Asset Register.
TCP / IP	Transmission Control Protocol / Internet Protocol.
USB	Universal Serial Bus.

3 Reference documents

The requirements of the referenced documents listed in Table 3 of MRTS201 *General Equipment Requirements* and Table 3 below apply to work performed under this Technical Specification. Where there are inconsistencies between this Technical Specification and 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
AGTM03-20	<i>Austroads Guide to Traffic Management Part 3: Transport Studies and Analysis Methods</i>
AP-T60/06	<i>Austroads Technical Report – Automatic Vehicle Classification by Vehicle Length</i>
MRTS201	<i>General Equipment Requirements</i>
MRTS204	<i>Vehicle Detectors</i>
MRTS226	<i>Telecommunications Field Cabinets</i>
MRTS257	<i>Feeder Cable and Loop Cable for Vehicle Detector</i>
MRTS263	<i>Standalone Solar (PV) Power Systems</i>
QTDF	<i>Queensland Traffic Data Format</i>
SD1916	<i>ITS – Axle-based Vehicle Classifier Sensor Installation Details</i>
SD1917	<i>ITS – Axle-based Vehicle Classifier Sensor Configuration Loop-Piezo-Loop</i>
SD1918	<i>ITS – Axle-based Vehicle Classifier Sensor Configuration Piezo-Loop-Piezo</i>
SD1919	<i>ITS – Axle-based Vehicle Classifier Sensor Configuration Piezo-Piezo</i>
SD1920	<i>ITS – Length-based Vehicle Classifier Sensor Configuration Loop-Loop</i>
SD1921	<i>ITS – Axle-based Vehicle Classifier Sensor Configuration Tube-Tube</i>
SD1922	<i>ITS – Vehicle Classifier Cabinet Details Solar Powered</i>
SD1923	<i>ITS – Vehicle Classifier Cabinet Details Mains Powered</i>
SD1924	<i>ITS – Vehicle Classifier Cabinet Installation Solar Powered</i>
SD1925	<i>ITS – Vehicle Classifier Cabinet Installation Mains Powered</i>
TRUM Volume 4 Part 5	<i>Traffic and Road Use Management Manual, Volume 4, Part 5: Configuration and Placement of Traffic Sensors</i>

4 Quality system requirements

The quality system requirements defined in MRTS201 *General Equipment Requirements* apply to work performed under this Technical Specification. Additional quality system requirements relevant to this Technical Specification are defined in Table 4.1.

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.

Table 4.1 – Hold Points, Witness Points and Milestones

Clause	Hold Point	Witness Point	Milestone
9.1	1. Source of power 2. Power budget calculations for sites powered by solar system		
10.1	3. Telecommunications requirements		
11.2		1. The final location and site conditions must be approved by the Principal	Confirmation of selection of site location
12.1	4. Factory acceptance test		
12.2	5. Installation acceptance test		
12.3		2. Commissioning test	Completion of commissioning test
13	6. Documentation		
16			Completion of handover requirements

5 Functional requirements

5.1 General

The traffic counter and classifier shall detect, collect, process and store traffic information related to the counting and speed monitoring of all vehicles, and shall make the data available for transfer from site to data processing centre on demand.

The traffic counter shall automatically collect and record traffic volume count of motorised vehicles at pre-determined intervals.

The classifier shall be able to detect individual motor vehicle speed, length and/or axle configuration to classify the vehicles. With this information, the classifier shall be able to provide vehicle count summary by vehicle length, vehicle type, and speed categories during a recording interval. Alternatively, the classifier shall be able to timestamp every vehicle event on a vehicle-by-vehicle basis.

Traffic counting sites and vehicle classification sites can be permanent installations for long-term continuous data collection purposes, or temporary setups to support regular but infrequent traffic survey exercises.

The traffic counter and classifier for motor vehicles shall capture data from vehicles and vehicle combinations up to 53.5 m in length with 25 axles. It shall be capable of operating on roads carrying peak volumes of 2400 vehicles per hour per lane with individual vehicle speeds between 20 km/h and 110 km/h.

In addition, the device shall be capable of operating from a minimum of 2 traffic lanes with the option of expansion to 8 traffic lanes.

5.2 Sensor technologies

The sensor technologies presented in Table 5.2 are mandated to suit the purpose of the site. Refer to Standard Drawings 1916, 1917, 1918, 1919, 1920 and 1921 for details of each sensor configuration on site.

All sensor technologies shall comply with the relevant Transport and Main Roads standards, including Standard Drawings, and be approved by the Principal.

Loops used in traffic counters / classifiers shall comply with the requirements of MRTS204 *Vehicle Detectors* and associated documents.

Piezo used in traffic counters / classifiers shall be in accordance with Standard Drawing 1916 *ITS – Axle-Based Vehicle Classifier Sensor Installation Details*.

Pneumatic tubes are used in temporary traffic counter/classifier sites and shall be in accordance with Standard Drawing 1921 *ITS – Axle-Based Vehicle Classifier Sensor Configuration Tube-Tube*.

Further details on the configuration and placement of all traffic sensors described in this Technical Specification can be found in the *Traffic and Road Use Management (TRUM)* manual Volume 4 Part 5.

Table 5.2 – Sensor technologies

Site type	Permanent	Temporary
Motor vehicle counter	Single Loop, Loop-Loop	Single Loop, Twin pneumatic tubes, Loop-Loop
Motor vehicle classifier (by length)	Loop-Loop, Loop-Piezo-Loop, Radar, Infrared light beams	Loop-Loop, Radar, Infrared light beams
Motor vehicle classifier (by axle configuration)	Loop-Piezo-Loop, Piezo-Loop-Piezo, Infrared light beams	Loop-Piezo-Loop, Piezo-Loop-Piezo, Twin pneumatic tubes, Infrared light beams

5.3 Internal clock

The traffic counter / classifier shall be provided with an internal clock in accordance with Technical Specification MRTS201 *General Equipment Requirements*. The internal clock shall automatically be synchronised with a remote Network Time Protocol (NTPv4) time server and have an accuracy better than ± 1 sec within a one week period.

5.4 Data collection accuracy

The accuracy requirements of a traffic counter / classifier are determined by the application of the site and the technology used. Unless otherwise specified by the Principal, the traffic counter / classifier for a specific site type shall deliver the following accuracy levels as shown in Table 5.4(a).

Table 5.4(a) – Accuracy requirements

Site type	Permanent	Temporary
Motor vehicle traffic counter	Level A	Level B
Motor vehicle classifier (12-bin)	Level A	Level B
Motor vehicle classifier (4-bin)	Level B	Level B

Accuracy tolerance levels A, B and C are defined in Table 5.4(b).

Table 5.4(b) – Accuracy Level definitions

Metrics	Applicable equipment	Accuracy tolerance requirement		
		Level A	Level B	Level C
Traffic volume	Counter and Classifier	± 2%	± 5%	± 10%
Vehicle classification	Classifier	> 95%	> 90%	> 85%
Speed	Classifier	± 2%	± 5%	± 10%
Axle spacing	Classifier	± 30 mm	± 40 mm	± 50 mm
Vehicle length	Classifier	± 100 mm for L ≤ 5 m	± 250 mm for L ≤ 5 m	± 500 mm for L ≤ 5 m
		± 2% for L > 5 m	± 5% for L > 5 m	± 10% for L > 5 m
Time	Counter and Classifier	± 10 msec offset from time server	± 100 msec offset from time server	± 1000 msec offset from time server

Where L = vehicle length

5.5 Data resolutions and format

Data from the traffic counter / classifier shall be recorded in the resolutions as shown in Table 5.5 or higher.

Table 5.5 – Data resolution

Parameters	Resolution requirements
Vehicle length	0.1 m
Time stamp	1 msec
Speed	1 km/h
Axle spacing	0.01 m
Count	1 unit

Reported data shall be in accordance with the format specified in QTDF version 1.04. Time stamping of data shall be in Australian Eastern Standard Time (AEST) all year round, that is, daylight savings time is not applicable.

5.6 Internal memory

The traffic counter / classifier shall store data in industrial-grade, non-volatile, solid-state memory.

There shall be enough internal memory to store collected traffic data for a period of 90 days or minimum 5 million detection records on a circular buffer so that the oldest data is overwritten when memory is full.

5.7 Recording interval

The traffic counter / classifier shall allow the user to set the recording interval for summary reports. The programmable recording interval options shall be 15 minutes, 30 minutes and 60 minutes, with the following settings for the end-time shown in Table 5.7.

Table 5.7 – End-time settings for intervals

Interval option	End-time of the recording interval
15 minutes	Moment just before hh:00:00, hh:15:00, hh:30:00 or hh:45:00
30 minutes	Moment just before hh:00:00 or hh:30:00
60 minutes	Moment just before hh:00:00

For a classifier that reports detections on a vehicle-by-vehicle basis, each vehicle event shall be time-stamped in real time without delay.

5.8 Vehicle classification

The classifier shall be capable of classifying vehicles according to axle configuration or by vehicle length. The supplier shall incorporate classification schemes within the system for determining the vehicle type. The classification scheme shall be user-selectable and configurable.

5.8.1 Classification by axle configuration

Refer to Austroads Vehicle Types defined in the AGTM03-20 Austroads *Guide to Traffic Management Part 3: Transport Studies and Analysis Methods* for detailed definitions and parameters used in this Technical Specification.

Transport and Main Roads adopts Austroads' vehicle classification systems Level 3 definition for 12-bin classification scheme with some variation, namely the use of 2-digit Type code for reporting the vehicle class and a Transport and Main Roads-specific length-based classification scheme (discussed in Section 5.8.2).

The use of the 2-digit Type code is to align with the QTDF format, where a field length of 2 is reserved for vehicle class.

The classified vehicle type shall be indicated by the 2-digit Type code as shown in Table 5.8.1.

The classification scheme used for this process shall be readily viewable by the Principal's operator.

Table 5.8.1 – Vehicle types by axle configuration (12-bin)

Type code	Brief description	Axles	Axle groups
01	Short sedan, wagon, 4WD, utility, light van, bicycle, motorcycle, and so on	2	1 or 2
02	Short-towing trailer, caravan, boat, and so on	3, 4 or 5	3
03	2-axle truck or bus	2	2
04	3-axle truck or bus	3	2
05	4-axle truck	> 3	2
06	3-axle articulated or rigid vehicle and trailer	3	3
07	4-axle articulated or rigid vehicle and trailer	4	> 2
08	5-axle articulated or rigid vehicle and trailer	5	> 2
09	6-axle (or more) articulated or rigid vehicle and trailer	6	> 2
		> 6	3
10	B-double or heavy truck and trailer	> 6	4
11	Double road train or heavy truck and 2 trailers	> 6	5 or 6
12	Triple road train or heavy truck and 3 trailers	> 6	> 6

5.8.2 Classification by vehicle length

The classified vehicle type shall be indicated by the 2-digit Type code as shown in Table 5.8.2.

The classification scheme shall be readily viewable and configurable by the Principal's operator.

Transport and Main Roads adopts Austroads Technical Report AP-T60/06 *Automatic Vehicle Classification by Vehicle Length*. The only variation is the use of 2-digit Type code for the numbering of the bin as shown in Table 5.8.2.

The use of the 2-digit Type code is to align with the QTDF format, where a field length of 2 is reserved for vehicle class.

Table 5.8.2 – Transport and Main Roads Vehicle type by length (4-bin)

Type code	Transport and Main Roads criteria
01	Less than or equal to 6 m (length < 6 m)
02	Greater than 6 m but less than or equal to 13 m ($6\text{ m} \leq \text{length} < 13\text{ m}$)
03	Greater than 13 m but less than or equal to 21 m ($13\text{ m} \leq \text{length} < 21\text{ m}$)
04	Greater than 21 m (length $\geq 21\text{ m}$)

6 Equipment

6.1 General

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

6.2 Components

The traffic counter / classifier shall consist of the following components:

- a) sensors and sensor cables
- b) all associated electronics to process sensor data and log vehicle information
- c) configuration and diagnostics software
- d) an IP-67 rated enclosure on mounting structure, and
- e) power supply and associated infrastructure and accessories to make an operational system.

The type of sensors and cables used shall be in accordance with Standard Drawings 1916, 1917, 1918, 1919, 1920, 1921, 1922, 1923, 1924 and 1925, except the sites where radar or infrared light beam technology is used.

7 Operational requirements

7.1 General

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

Permanent sites shall be capable of continuous operation, 24 hours per day, 7 days per week, in varying weather conditions.

Temporary sites shall be capable of continuous operation in varying weather condition for the period when the site is in operation.

The traffic counter / classifier shall continue to detect and store data for all relevant traffic while transferring data or being accessed for real-time view or software upgrade.

7.2 Environmental conditions

The environmental requirements defined in MRTS201 *General Equipment Requirements* apply to work performed under this Technical Specification. Additional requirements are defined below.

The enclosure that houses the traffic counter / classifier shall comply with MRTS226 *Telecommunications Field Cabinets*.

If the traffic counter / classifier is not fitted within an enclosure, it shall be protected by a UV-stabilised rugged case with a lockable lid. The case shall have an Ingress Protection rating of IP67 or better.

The traffic counter / classifier shall have an operating temperature range between -10°C and 60°C.

8 Control system

The control system is also sometimes known as 'Supervisor'.

A control system shall be provided as part of the traffic counter / classifier.

The control system of the traffic counter / classifier performs the following functions:

- facilitates interrogation of the traffic counter / classifier

- communication, configuration and setup of the traffic counter / classifier
- data transfer
- monitoring of the traffic counter / classifier
- software / firmware upgrades, and
- diagnostics and fault logging.

8.1 Operating system

The control system shall operate on a laptop computer running the Principal-approved operating system current at the time of use. Any software provided by the Contractor shall be capable of operating on all such operating systems.

Microsoft Windows® 7 Professional, Microsoft Windows® 10 and Ubuntu® are a few examples of systems currently used.

8.2 Hardware

The control system shall be equipped with hardware such as indicators, preferably LED, to show power connectivity and other operational parameters such as traffic activations. The hardware shall also provide a mechanism to visually identify faults whenever there is a failure of sensors or the control system.

8.3 Communications

The communications module of the control system shall include the applications listed in Clauses 8.3.1 to 8.3.4 of this Technical Specification.

8.3.1 Real-time view

The real-time view application must support online monitoring of traffic. The display shall depict the key reported parameters after each vehicle passes the site. The real-time view shall provide the users with the option to select an individual lane or all lanes to display.

8.3.2 System parameters configuration

The control system shall support online modification to the configuration parameters of the traffic counter / classifier.

8.3.3 Data transfer

The control system must support the secure transfer of data files from the traffic counter / classifier to the remote Transport and Main Roads data centre. The communications module shall only respond to data transfer request, presumably from the head-end; the communications module must not initiate data transfer.

8.3.4 Firmware upgrade

The control system must support both local and remote firmware upgrade. Provision of firmware rollback mechanism is preferable.

9 Electrical

9.1 Source of power

The traffic counter / classifier equipment shall be powered by an ELV direct current (DC) power supply of 6 Vdc, 12 Vdc, 24 Vdc or 48 Vdc.

Power sources for a traffic counting / vehicle classification site can be mains, solar or battery with suitable converters to suit individual site conditions and the purpose of the installation. Transport and Main Roads' preference is in the order of mains, solar and battery. **Hold Point 1**

Permanent sites powered by a solar system shall conform to MRTS263 *Standalone Solar (PV) Power Systems*, excluding Clause 5.5 *Inverters* for sites where equipment operates at ELV dc. In addition, 3 days' autonomy shall be achieved. The Contractor is required to submit to the Principal their power budget calculation and assumptions prepared and verified by qualified technical persons.

Hold Point 2

Temporary sites powered by battery shall have enough energy reserve to sustain a continuous operation for a minimum of 7 days without needing to change battery.

10 Telecommunication requirements

10.1 General

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

Additional telecommunications requirements for equipment provided under this Technical Specification are specified below.

The traffic counter / classifier shall support remote connectivity via the Principal's telecommunications network which comprises Transport and Main Roads-owned cables and leased virtual private network. The traffic counter / classifier shall implement a secure access control system (for example, username and password) acceptable to the Principal, and have session management or a similar method to protect the system, configuration parameters, and stored data against unauthorised access. In addition, the traffic counter / classifier shall have a time-out mechanism to automatically close the session due to inactivity.

During the design stage, the Contractor shall determine with the Principal a suitable connection of the traffic counter / classifier to the Principal's telecommunications network as described in MRTS201 *General Equipment Requirements*. The telecommunications network connection must be confirmed by the Principal prior to procurement. **Hold Point 3**

10.2 Ethernet

The traffic counter / classifier, when offered by the supplier as a networked device, shall be implemented with industry-standard Ethernet (IEEE 802.3).

10.2.1 Physical Layer

The traffic counter / classifier shall implement 100BASE-TX and 1000BASE-T.

10.2.2 Connectors

The physical interconnections shall be RJ45.

10.2.3 TCP / IP

The traffic counter / classifier, when offered by the supplier as a networked device, shall implement industry-standard TCP / IP.

IPv4 shall be implemented. Port number shall be user configurable.

A list of implemented protocols shall be provided to the Principal.

Full protocol implementations are desirable. Deviations / omissions from the respective protocol standard(s) shall be brought to the attention of the Principal in writing.

10.2.4 FTP

The traffic counter / classifier shall implement industry-standard FTP protocol (RFC959 and RFC1123).

10.2.5 ICMP

The traffic counter / classifier shall implement industry-standard Internet Control Message Protocol version 4 (ICMPv4).

10.3 Maintenance communications port

It shall be possible to control and interrogate the traffic counter / classifier locally at site from a laptop computer via an industry-standard serial communications port. Acceptable industry standards are EIA/RS-232, EIA/RS-422 and USB. Any other communication ports / protocols, for example WiFi and Bluetooth, are subject to Principal's approval.

10.4 STREAMS field processor interfacing port

Where connection to STREAMS is required, the maintenance communications port shall be used to interface with the STREAMS field processor. In this case, the traffic counter / classifier shall possess STREAMS compatibility certification.

11 Installation requirements

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

The installation of loop and loop feeder shall conform to MRTS204 *Vehicle Detectors*, MRTS257 *Feeder Cable and Loop Cable for Loop Detector*, TRUM Volume 4 Part 5 *Configuration and Placement of Traffic Sensors* and the associated Standard Drawings.

The installation of piezo sensors shall be in accordance with TRUM Volume 4 Part 5 *Configuration and Placement of Traffic Sensors* and the associated Standard Drawings.

The installation of traffic counter / classifier equipment shall be as per the manufacturer's recommendations.

11.1 General

The Contractor must provide full-time on-site supervision during system installation, testing and commissioning.

11.2 Site selection

For the system to perform properly, the chosen site location must provide a suitable environment for the system's sensors and instruments to operate. In addition, constructability and maintainability are extremely important considerations.

Further site selection criteria and processes are detailed in TRUM Volume 4 Part 5 *Configuration and Placement of Traffic Sensors*.

The final location and site conditions must be approved by the Principal. **Witness Point 1 Milestone**

12 Testing and commissioning

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

Additional testing and commissioning requirements for equipment provided under this Technical Specification are specified below.

12.1 Factory acceptance test

Prior to installation, the Contractor must provide a manufacturer-supplied certificate showing that each supplied sensor has been factory tested.

Additionally, the Contractor must visually inspect the sensor for damage, and perform relevant tests to the Principal's satisfaction, including checking critical electrical characteristics against the manufacturer's specification. The record of the tests will be used as a benchmark for the installation acceptance test. **Hold Point 4**

12.2 Installation acceptance test

After installation but before connecting the sensors to the system, the Contractor shall perform the same tests on the sensors as being done in factory acceptance testing. The records of the tests shall be provided to the Principal in a format determined by the Principal. For sensors that fail the test, the cause of failure and a proposal to rectify must be discussed with the Principal before progressing any further. **Hold Point 5**

12.3 Commissioning test

The equipment shall be commissioned by integrating the operation, monitoring and control with other equipment and/or systems as appropriate. This shall include initialising performance parameters to suit the site-specific function of operation. The commissioning test shall prove the correct operation, monitoring and control to meet the requirements of the Contract. Additionally, where sites are connected to the Principal's telecommunications network, the Contractor must demonstrate that the system can reconnect successfully upon restarting in the event of a power failure or recovering from telecommunications network failure. **Witness Point 2 Milestone**

13 Documentation

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

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

In addition, the operations manuals and the maintenance manuals must detail all assets, including the traffic counter / classifier, sensor units and software. The manuals must include, as a minimum, the following items:

- Technical Specifications
- design characteristics
- general operation theory
- function of all controls
- signal responses and acceptable thresholds
- list of component parts with stock numbers
- manufacturers' certificates
- documentation for the control system
- documentation for all protocols used for communications with the traffic counter / classifier
- documentation for all data formats used by the traffic counter / classifier
- test reports, and
- As-Constructed drawings. **Hold Point 6**

14 Training

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

15 Maintenance

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

16 Handover

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

17 Product approval

The compliance evaluation form for this Technical Specification is published on the [Intelligent Transport Systems and Electrical Approved Products and Suppliers](#) webpage.

