

Master Specification

Part RD-ITS-S7

Supply and Installation of Motorway Vehicle Detection Systems

September 2024



Government of South Australia
Department for Infrastructure
and Transport

Build.
Move.
Connect.

Document Information

Document Information	
K Net Number:	13508277
Document Version:	1
Document Date:	30/09/2024

Document Amendment Record

Version	Change Description	Date
0	Initial issue	31/08/2023
1	Updated cover page	30/09/2024

Document Management

This document is the property of the Department and contains information that is confidential to the Department. It must not be copied or reproduced in any way without the written consent of the Department. This is a controlled document and it will be updated and reissued as approved changes are made.

Contents

Contents	3
RD-ITS-S7 Supply and Installation of Motorway Vehicle Detector Systems	4
1 General	4
2 Documentation	4
3 Equipment requirements	5
4 Electrical requirements	12
5 Environmental requirements	12
6 O&M Manuals	12
7 Warranty	13
8 Training	13
9 Testing and commissioning	13
10 Verification requirements and records	13

RD-ITS-S7 Supply and Installation of Motorway Vehicle Detector Systems

1 General

- a) This Master Specification Part sets out the requirements for the supply and installation of motorway vehicle detection systems, including:
 - i) the documentation requirements, as set out in section 2;
 - ii) the equipment requirements, as set out in section 3;
 - iii) the electrical requirements, as set out in section 4;
 - iv) the environmental requirements, as set out in section 5;
 - v) the O&M Manual requirements, as set out in section 6;
 - vi) the warranty requirements, as set out in section 7;
 - vii) the training requirements, as set out in section 8;
 - viii) the testing and commissioning requirements, as set out in section 9; and
 - ix) the verification requirements and records, as set out in section 10.
- b) The supply and installation of motorway vehicle detection systems must comply with the Reference Documents, including:
 - i) ANSI/NEMA TS1 Traffic Control Systems;
 - ii) ANSI/NEMA TS2 Traffic Controller Assemblies with NTCIP Requirements;
 - iii) AS 2703 Vehicle detector systems;
 - iv) AS 60038 Standard voltages;
 - v) AS 60529 Degrees of protection provided by enclosures (IP Code);
 - vi) AS 60068.2.29 Environmental testing, Part 2.29: Tests — Test Eb and guidance: Bump;
 - vii) AS/NZS 2276.2 Cables for traffic signal installations, Part 2: Feeder cable for vehicle detectors;
 - viii) AS/NZS 3000 Electrical installations (known as the Australian/New Zealand Wiring Rules);
 - ix) AS/NZS 3100 Approval and test specification - General requirements for electrical equipment;
 - x) AS/NZS 61000.6.1 Electromagnetic compatibility (EMC), Part 6.1: Generic standards - Immunity for residential, commercial and light-industrial environments;
 - xi) AS/NZS CISPR 22 Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement; and
 - xii) AS/NZS ISO 9001 Quality management systems - Requirements.

2 Documentation

2.1 Construction Documentation

In addition to the requirements of PC-CN3 “Construction Management”, the Construction Documentation must include:

- a) all documentation required by RD-ITS-D1 “Design for Intelligent Transport Systems (ITS)” as relevant to the motorway vehicle detection systems;
- b) evidence of the motorway vehicle detection systems’ compatibility with STREAMS as required by:
 - i) RD-ITS-D1 “Design for Intelligent Transport Systems (ITS)”;
 - ii) RD-ITS-S1 “General Requirements for the Supply of ITS Equipment”;
- c) manufacturer’s specifications (catalogue extracts) of all major components forming part of the motorway vehicle detection systems, detailing compliance with the requirements specified in AS 2703 Vehicle detector systems;
- d) all layout, fabrication, interconnection assembly and installation drawings and diagrams relevant to the motorway vehicle detector systems;
- e) acceptance test plans which are compliant with:
 - i) RD-ITS-C1 “Installation and Integration of ITS Equipment”;
 - ii) PC-CN1 “Testing and Commissioning”;
- f) a statement of compliance, as required by section 3.1b).

2.2 Quality Management Records

In addition to the requirements of PC-QA1 “Quality Management Requirements” or PC-QA2 “Quality Management Requirements for Major Projects” (as applicable), the Quality Management Records must include the verification requirements and records set out in section 10.

3 Equipment requirements

3.1 General

- a) The Contractor must ensure that the motorway vehicle detector system complies with all relevant Laws, including all requirements of ACMA.
- b) The Contractor must provide a statement of compliance with AS 2703 Vehicle detector systems to the Principal as part of the Construction Documentation.
- c) The Contractor must ensure that the motorway vehicle detector system complies with all relevant requirements of RD-ITS-D1 “Design of Intelligent Transport Systems (ITS)”, particularly in relation to network architecture, network management and security.

3.2 Data transmission

The Contractor must ensure that the motorway vehicle detector system complies with the following data transmission requirements:

- a) the motorway vehicle detector system controller must provide at least one 100/1000Base-TX Ethernet interface;
- b) the motorway vehicle detector system controller Ethernet interface required by section 3.2a) must:
 - i) be used for data transmission and device configuration; and
 - ii) allow a minimum of 3 concurrent connections for data transmission; and
- c) the motorway vehicle detector system must transmit data required by this Master Specification Part to the Principal’s STREAMS ITS platform.

3.3 Time accuracy

The Contractor must ensure that the motorway vehicle detector system complies with the following with respect to time accuracy:

- a) the motorway vehicle detector system must be able to synchronise its internal clock with the Principal's NTP server via NTP protocol;
- b) any change to the motorway vehicle detector system's internal clock made pursuant to the synchronisation required by section 3.3a) must not affect the accuracy of any of the measurements made by the motorway vehicle detector system; and
- c) all data transmitted using the motorway vehicle detector system must be time stamped in milliseconds.

3.4 Administration and configuration tool

3.4.1 General

The Contractor must ensure that the motorway vehicle detector system complies with the following administration and configuration requirements:

- a) the motorway vehicle detector system controller must provide an interactive browser-based user interface using HTTP and HTTPS (with a transfer layer security of at least version 1.2) to provide monitoring, configuration and diagnostic related functions;
- b) all motorway vehicle detector system devices must support SSH when performing remote command line administration and configuration; and
- c) the motorway vehicle detector system software must provide for the display and monitoring of the motorway vehicle detector system configuration, including:
 - i) site name (adopting the Principal's required format);
 - ii) site location (adopting the Principal's required format);
 - iii) firmware version;
 - iv) current temperature of the motorway vehicle detector system controller;
 - v) mains power supply status;
 - vi) up time (since last reset);
 - vii) system time (local date and time);
 - viii) MAC address of all Ethernet ports; and
 - ix) for each sensor connected to the motorway vehicle detector system controller, the following information must be displayed:
 - A. sensor identification;
 - B. sensor operation state
 - C. detection zone measures (e.g. speed, length, presence) in real time; and
 - D. current sensor firmware version.

3.4.2 Configuration functions

The Contractor must ensure that the motorway vehicle detector systems comply with the following configuration function requirements:

- a) the motorway vehicle detector system software must allow a user to change the motorway vehicle detector system controller and sensor configurations using the browser-based user interface required by section 3.4.1a);

- b) all parameters and settings required for the motorway vehicle detector system to function correctly must only be configured via the motorway detector system software;
- c) all configuration changes made to the motorway vehicle detector system controller must be applied immediately and take effect without the need to restart or reset the motorway vehicle detector system controller;
- d) the following parameters of the motorway vehicle detector system must be configurable:
 - i) site name (text field with a minimum of 150 characters);
 - ii) site location (text field with a minimum of 300 characters); and
 - iii) detection zone configurations, including:
 - A. detection name;
 - B. detection zone identifier;
 - C. detection zone - lane mapping (for mainline detection zone only); and
 - D. detection zone - ramp location and lane mapping (for ramp detection zone only);
- e) the motorway vehicle detector system software must allow a user to change the following network configurations:
 - i) IP address allocation (dynamic host configuration protocol or static); and
 - ii) if the IP address allocation is static, the following parameters:
 - A. IP address;
 - B. subnet mask;
 - C. default gateway;
 - D. primary DNS; and
 - E. secondary DNS;
- f) the motorway vehicle detector system software must allow a user to change the following protocol and communications related configuration parameters for the connection between the motorway vehicle detection system controller and the Principal's backend system (such as STREAMS):
 - i) IP port used for TCP/IP connection;
 - ii) session time out for TCP/IP connection (in seconds);
 - iii) site number; and
 - iv) any other necessary parameter of the motorway vehicle detection system protocol;
- g) the motorway vehicle detector must support the ability to enable and disable protocols including TELNET and HTTP;
- h) the motorway vehicle detection system software must allow a user to change the current time, time zone, daylight saving option and whether to use an NTP server for time synchronisation;
- i) the IP addresses of the NTP servers must be configurable; and
- j) the motorway vehicle detection system software must:
 - i) allow a user to change the browser interface's username and password;
 - ii) support both HTTP and HTTPS and allow a user to choose the access mode from:
 - A. HTTP only;
 - B. HTTPS only; or

- C. both HTTP and HTTPS;
- iii) allow a user to change the TCP/IP ports used for HTTP and HTTPS;
- iv) support customisation of HTTPS and SSH TCP/IP ports;
- v) allow a user to change the session timeout for the browser-based user interface required by section 3.4.1a) (being the duration after the last active web request was received); and
- vi) comply with the Principal's password complexity standard (as required by RD-ITS-D1 "Design for Intelligent Transport Systems (ITS)").

3.4.3 Administration functions

The Contractor must ensure that the motorway vehicle detection system software provides the following administration functions:

- a) in relation to firmware upgrades:
 - i) the motorway vehicle detection system software must allow a user to upgrade the motorway vehicle detection system controller's firmware;
 - ii) where a firmware upgrade is undertaken, all existing pre-configured parameters of the motorway vehicle detection system controller (including IP addresses, network mask and default gateway) must be maintained;
 - iii) the motorway vehicle detection system software must allow a user to upgrade the motorway vehicle detection system's firmware for individual sensors that are connected to the motorway vehicle detection system controller; and
 - iv) the motorway vehicle detection system software must ensure that the entire firmware file is successfully downloaded and verified before attempting to apply the firmware upgrade;
- b) in relation to the save/recover configuration to/from file:
 - i) all the configuration parameters for the motorway vehicle detection system controller must be able to be saved and retained after rebooting the motorway vehicle detection system controller; and
 - ii) the motorway vehicle detection system software must allow a user to save the current configuration to a local file and be able to restore all the configuration parameters from that local file;
- c) in relation to the reboot and reset of the motorway vehicle detection system controller, the motorway vehicle detection system software must allow a user to reboot and reset the motorway vehicle detection system controller with the following options:
 - i) reset to manufacturer default settings;
 - ii) reset to manufacturer default settings, with the exception of the current network configuration (including IP addresses, network mask and default gateway); and
 - iii) reboot the motorway vehicle detection system controller with all configured settings maintained;
- d) in relation to the options detailed in section 3.4.3c), the motorway vehicle detection system software must clearly indicate to the user which of these options is selected prior to undertaking the reboot and reset;
- e) in relation to system event logs, the motorway vehicle detection system software must:
 - i) in relation to system fault events:
 - A. log the login and logoff events for the browser-based user interface software required by section 3.4.1a), including any failure attempts;

- B. log all parameters required by section 3.4.3e)i)A, including the attempted usernames, passwords and source IP addresses;
 - C. the browser-based user interface software required by section 3.4.1a) must log the events into a log file, which must be able to be displayed via a web interface and to be exported to text or CSV format files;
 - D. the browser-based user interface software required by section 3.4.1a) must keep a minimum of the last 30 days or 5000 log entries, whichever limit comes first; and
 - E. each log entry required in section 3.4.3e)i)D must contain a timestamp with the resolution to 1 millisecond;
- ii) log significant system and audit events, including:
 - A. system start and stop;
 - B. network port up and down;
 - C. configuration changes;
 - D. critical errors; and
 - E. authentication events (success and failure);
 - iii) support sending the system and audit events to a central SYSLOG server and the SYSLOG server address must be configurable;
 - iv) support monitoring and discovery using the SNMPv3 protocol, which must include the following motorway vehicle detector unit information at a minimum:
 - A. make and model;
 - B. serial number;
 - C. firmware version;
 - D. location and site number;
 - E. network and serial port enumeration; and
 - F. network and serial port status (up/down);
- f) in relation to the non-functional requirements of the motorway vehicle detection system:
 - i) the motorway vehicle detection system software must respond to every administration user interaction within less than 3 seconds (excluding delays in the network);
 - ii) the motorway vehicle detection system must meet the following requirements:
 - A. the motorway vehicle detection system software must verify the username and password before granting access to the system;
 - B. the motorway vehicle detection system software must support both HTTP and HTTPS and allow a user to choose access mode from:
 - I. HTTP only;
 - II. HTTPS only; and
 - III. both HTTP and HTTPS;
 - iii) only transport layer security can be used for the HTTPS connection;
 - iv) after 3 successive failed login attempts, the minimum time allowed between login attempts must be changed to 60 seconds; and
 - v) the minimum time between logins must be removed upon a successful login;

- g) the motorway vehicle detection system software must operate reliably on a relatively slow IP network, such as 3G wireless network with around 500 Kbps bandwidth and 500 ms latency;
- h) the user interface must be simple to avoid long response times; and
- i) where large amounts of information are to be displayed (such as logs), the information must be displayed over multiple pages with page down and page up functions.

3.5 Fault reporting

In relation to fault reporting, the Contractor must ensure that the motorway vehicle detection systems:

- a) monitor the fault status of each motorway vehicle detection device;
- b) provide fault information to the Principal via STREAMS;
- c) classify the faults in accordance with one of the following 2 severity levels:
 - i) critical failure (one or more detection zones not working); or
 - ii) non-critical failure (all detection zones working but attention required);
- d) send a notification event if the reported fault is cleared; and
- e) keep fault logs for a minimum of last 30 days or 5000 log entries (whichever limit comes first).

3.6 Performance requirements

The Contractor must ensure that the motorway vehicle detection system complies with the following:

- a) the motorway vehicle detection systems must:
 - i) continuously monitor traffic flows 24 hours a day;
 - ii) operate in all light and weather conditions;
 - iii) comply with the requirements of AS2703 Vehicle detector systems, particularly clause 3.7 (reliability);
 - iv) ensure that the time between the arrival and departure presence events corresponds to the time between the front bumper arriving in the detection zone and the rear bumper departing the detection zone thereby ensuring that the occupancy data calculated from the presence data reflects the time that the bumper-to-bumper length of the vehicle was in the detection zone;
 - v) be able to detect vehicles for a minimum of 5 lanes in each direction;
 - vi) be designed for constructability and maintainability including civil works;
 - vii) be designed such that no recalibration activities will be required as a routine maintenance;
 - viii) be designed such that frequency of routine maintenance activities including cleaning must not be less than 12 months;
 - ix) detect and log for reporting all faults and clearances of the faults within 5 seconds of the fault or clearance occurring; and
 - x) provide all data required by Table RD-ITS-S7 3-1;
- b) the motorway vehicle detection systems must satisfy the following requirements:
 - i) rack mounted sensor units must comply with the requirements of either:
 - A. part 15 of ANSI/NEMA TS1 Traffic Control Systems; or
 - B. standard Eurocard (100 mm x 160 mm) or equivalent;

- ii) the sensor unit must be multi-channel with at least 4 channels or 8 channels per sensor unit;
 - iii) each individual detection channel must be able to operate in either passage or presence detection mode; and
 - iv) sensitivity and threshold settings for each channel must be adjustable; and
- c) in relation to data accuracy and response times, the motorway vehicle detection systems must:
- i) send only one event against one vehicle at one site to ensure that there is no double-counting from adjacent lanes;
 - ii) where a data value (including speed, length, presence event, vehicle width or lateral lane position) returned by a motorway vehicle detection system is unable to be measured, return a value that is clearly identifiable as an indicator of no data or incorrect data (for example, where speed cannot be measured, an indicator value (e.g. 255) must be returned (not 0));
 - iii) ensure that data is provided by the motorway vehicle detection system when a vehicle is travelling in the wrong direction and that data must identify the vehicle as travelling in the wrong direction, enabling an alarm to be triggered in STREAMS; and
 - iv) be able to identify vehicles travelling the wrong way on the motorway with an accuracy of at least 98.0%.

Table RD-ITS-S7 3-1 Motorway vehicle detector system data accuracy and response times

Data per vehicle	Range	Accuracy	Maximum response time (secs) ⁽¹⁾
Uncontrolled motorway			
Speed (km/h)	10 - 160	±2%	0.3
Length (m)	1.5 - 35	±2% or ± 100 mm ⁽²⁾	0.3
Presence event ⁽³⁾	on or off	±2%	0.3
Controlled motorway mainline			
Speed (km/h)	10 - 160	±2%	0.3
Length (m)	1.5 - 35	±2% or ± 100 mm ⁽²⁾	0.3
Presence event ⁽³⁾	on or off	±2%	0.3
Vehicle width	0 - 4 m	±20 cm	0.3
Lateral lane position	0 - 3 m	±20 cm	0.3
Controlled motorway ramps			
Speed (km/h)	10 - 160	±2%	0.3
Length (m)	1.5 - 35	±2% or ± 100 mm ⁽²⁾	0.3
Presence event ⁽³⁾	on or off	±2%	0.3
Motorway statistical sites			
Speed (km/h)	10 - 160	±2%	0.3
Length (m)	1.5 - 35	±2% or ± 100 mm ⁽²⁾	0.3
Presence event ⁽³⁾	on or off	±2%	0.3
Axles number	1 - 6	±2%	0.3
Axles groups	1 - 6	±2%	0.3
d1 (Distance between axle 1 and 2, m)	1 - 4	±2%	0.3
d2 (Distance between axle 2 and 3, m)	1 - 4	±2%	0.3
Vehicle width	0 - 4 m	±20 cm	0.3
Lateral lane position	0 - 3 m	±20 cm	0.3

Table notes:

(1) Maximum response time: for all measurements except for presence event, the maximum response time refers to the maximum time gap between when the measured vehicle leaves the configured detection zone and when the measurement data is sent by the motorway vehicle detection system.

(2) Accuracy required is ±2% for vehicles with a length 5 m or more and 100 mm for vehicles with a length less than 5 m. Length accuracy only needs to be to 1 decimal place.

(3) For presence events, the maximum response time refers to the maximum time gap between the actual presence event and when the event data is sent by the motorway vehicle detection system.

4 Electrical requirements

4.1 General

The Contractor must ensure that the motorway vehicle detection system complies with the following electrical requirements:

- a) the motorway vehicle detection system must operate on mains supply, unless the Principal requires operation on ELV as defined in AS 2703 Vehicle detector systems;
- b) all wiring relating to the motorway vehicle detection system must comply with the requirements of AS/NZS 3000 Electrical installations;
- c) the motorway vehicle detection system and all sub-elements of the motorway vehicle detection system must be capable of operating in accordance with the requirements of the Contract Documents under the stated supply voltage conditions;
- d) the requirements for the power supply must comply with the requirements of the Contract Documents; and
- e) all cables and wires must be insulated with a material not inferior to V-90 grade PVC and must be suitably labelled.

4.2 Internal protection

The Contractor must ensure that all equipment forming part of the motorway vehicle detection system, including data lines, are internally protected against damage resulting from:

- a) lightning striking at or near the motorway vehicle detection system in accordance with clause 3.4 of AS 2703 Vehicle detector systems;
- b) electrical transients on power cabling;
- c) electrical transients on communications wiring;
- d) radio frequency interference;
- e) static electrical discharge; and
- f) any harmonics caused by:
 - i) the events listed in sections 4.2a) to 4.2e); or
 - ii) any other equipment housed in the same cabinet as the motorway vehicle detection system.

5 Environmental requirements

5.1 Temperature and humidity

The Contractor must ensure that the motorway vehicle detection system complies with the environmental and atmospheric requirements of section 5 of AS 2703 Vehicle detector systems.

5.2 Electromagnetic compatibility

The Contractor must ensure that the motorway vehicle detection system complies with the electrical requirements of section 3 of AS 2703 Vehicle detector systems.

6 O&M Manuals

A detailed installation, operations and maintenance manual as described in section 4 of AS 2703 Vehicle detector systems must be supplied in accordance with RD-ITS-S1 "General Requirements for the Supply of ITS Equipment".

7 Warranty

A manufacturer warranty for all components of the motorway vehicle detection system must be supplied in accordance with RD-ITS-C1 “Installation and Integration of ITS Equipment” and PC-CN3 “Construction Management”.

8 Training

Training must be supplied in accordance with RD-ITS-S1 “General Requirements for the Supply of ITS Equipment”.

9 Testing and commissioning

Testing and commissioning of the motorway vehicle detection system must be undertaken in accordance with RD-ITS-C1 “Installation and Integration of ITS equipment” and in compliance with the requirements of PC-CN1 “Testing and Commissioning” as relevant to the motorway vehicle detection system.

10 Verification requirements and records

The Contractor must supply written verification as part of the Quality Management Records that the requirements listed in Table RD-ITS-S7 10-1 have been complied with.

Table RD-ITS-S7 10-1 Verification requirements

Subject	Record to be provided
Operation and maintenance manuals	Operation and maintenance manual as applicable to the motorway vehicle detection system, as required by section 6.
Warranty	Manufacturer’s warranty for all components of the motorway vehicle detection system, as required by RD-ITS-S1 “General Requirements for the Supply of ITS Equipment” and PC-CN3 “Construction Management”.
Testing and commissioning	All applicable test records for those tests required by RD-ITS-C1 “Installation and Integration of ITS Equipment” and in compliance with the requirements of PC-CN1 “Testing and Commissioning” as relevant to the motorway vehicle detection system (including tests confirming that parameters for each installed detector are within the manufacturer’s detection system specifications).
System documentation	As-Built Records as applicable to the motorway vehicle detection system.