

Roads

Master Specification

RD-ITS-S4 Supply of Electronic Signs

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RD-ITS-S4 Supply of Electronic Signs

1 General

- 1.1 This Part specifies the requirements for the supply of:
- Variable Message Signs (VMS), signs which may display any message;
 - Changeable Message Signs (CMS), signs which may display predetermined messages;
 - Variable Speed Limit Signs (VSLS), regulatory signs capable of displaying a range of speed limits for a section of road; and
 - Lane Use Management Sign (LUMS), regulatory signs which display the status of a traffic lane.
- 1.2 Requirements are specified for signs using either Light Emitting Diode (LED) technology or Rotating Prism (e.g. "TriVision") technology. This Part must be read in conjunction with RD-ITS-S1 "General Requirements for the Supply of ITS Equipment" and if installation is being undertaken, RD-ITS-C1 "Installation and Integration of ITS Equipment".
- 1.3 Standards and documents referenced in this Part are listed below, and unless specified otherwise, includes all current published parts and amendments:
- AS 1742 Manual of Uniform Traffic Control Devices.
 - AS/NZS 1768 Lightning Protection.
 - AS/NZS 61000 Electromagnetic compatibility (EMC).
 - AS 2700 Colour Standards for General Purposes.
 - AS/NZS 3000 Electrical Installations (known as the Australian/New Zealand Wiring Rules).
 - AS 61000.6.1 Electromagnetic compatibility (EMC) - Generic standards - Immunity for residential, commercial and light-industrial environments.
 - AS 4852.1 Variable Message Signs: Fixed Signs.
 - AS 5156 Electronic speed limit signs.
 - DPTI Operational Instruction 2.36 Variable Message Signs.
 - RTA Specification TSI-SP-003 Communications Protocol for Roadside Devices.
 - DPTI Operational Instructions are available from <https://www.dpti.sa.gov.au/standards/tass>.
 - DPTI Technical Standards and Guidelines including above drawings are available from the following web site: <https://www.dpti.sa.gov.au/standards>.
- 1.4 Where this Part specifies a higher standard than that required by the above Australian Standards, the requirements of this Part will take precedence.
- 1.5 "STREAMS" is the traffic management system operated by the DPTI Traffic Management Centre (TMC) at Norwood used to manage the signs.

2 Quality Requirements

- 2.1 The Contractor must prepare and implement a Quality Plan that includes or annexes the following documentation:
- design documentation in accordance with RD-ITS-D1 "Design for Intelligent Transport System (ITS)";
 - Factory Acceptance Test Plan (refer RD-ITS-S1 "General Requirements for the Supply of ITS Equipment", Clause 13 "Testing and Acceptance"), which provides full details of all tests necessary;

- c) evidence of durability, interoperability with the STREAMS and optical performance of signs (refer to Clause 3 “Communications Protocol”);
 - d) if applicable, comprehensive details of any proposed wireless communication system (refer Clause “Wireless Communications”);
 - e) routine maintenance recommendations;
 - f) Site Acceptance Test Plan, which provides full details of all tests necessary;
 - g) spare part requirements;
 - h) manufacturer’s specifications (catalogue extracts) of all major components detailing ratings and performance characteristics; and
 - i) all layout, fabrication, interconnection and assembly drawings and diagrams necessary for this contract.
- 2.2 If not submitted beforehand, the documentation required by this Clause must be submitted at least 20 working days prior to the commencement of site work or placing an order for Equipment.
- 2.3 The Contractor shall provide evidence of STREAMS compatibility in accordance with RD-ITS-D1 “Design For Intelligent Transport System (ITS)” and RD-ITS-S1 “General Requirements for the Supply of ITS Equipment”, Clause 6 “STREAMS”.
- 2.4 Provision of the documentation listed in this Clause shall constitute a **Hold Point**.

3 Communications Protocol

- 3.1 The protocol to be used to communicate with the signs must comply with the Roads and Traffic Authority (RTA: NSW) Protocol and must be interoperable with the existing STREAMS at the TMC. The Contractor may seek approval for an alternative protocol, which would require an appropriate protocol converter.
- 3.2 Where a Composite Variable Message sign is specified, the communications protocol must be capable of representing the colour pictogram and monochrome text display as one sign in STREAMS. This may be achieved using the appropriate version of the TSI-SP-003 protocol.
- 3.3 The communications/control port must be RS422.
- 3.4 The sign shall be capable of operating with future STREAMS drivers using only a software update. Hardware should have suitable provisions for communicating via future version of the TS-SP-003 protocol or NTC/IP.
- 3.5 The signs must be capable of local control via a stand-alone personal computer or remotely as a field peripheral device integrated with STREAMS.
- 3.6 Facilities must be included for control and diagnostics of the signs via a personal computer connected to an RS232 port within the sign connection Enclosure. The Contractor must supply all control and diagnostic software for use on the personal computer. The supply of the personal computer is not part of this Contract.
- 3.7 The signs must have status monitoring and alarm facilities in accordance with RTA Specification TSI-SP-003 to indicate communications failure and pixel or prism failure and must be equipped with the ability to perform self-monitoring and diagnostics and reporting of faults. Reporting must include, but not be limited to:
- a) communication failure;
 - b) partial or full display failure;
 - c) mains power failure;
 - d) battery condition;
 - e) current state;
 - f) current display intensity;
 - g) status of local facility switch;

- h) door open; and
 - i) temperature alarm.
- 3.8 The monitoring, fault reporting and alarm facilities must interface to STREAMS.
- 3.9 Each sign may be individually addressable or provided in a "master-slave" configuration. Each pair of signs must have a uniform display (e.g. brightness, synchronised flash rate). The Contractor must provide details specifying how this will be achieved with the signs, taking into account the cable run distance between each pair of signs. If no distance is specified, a run of at least 200 metres must be allowed for.

4 Operating Requirements

Sign Performance

- 4.1 The Contractor must provide evidence that the signs meet the requirements of this specification with regard to durability, interoperability with STREAMS and optical performance. Provision of this information shall constitute a **Hold Point**.
- 4.2 The Contractor must determine the tilt angle and orientation of the signs to ensure that the line of sight is set at its optimum. The design of the sign support must allow adjustment of the tilt angle and orientation after installation of the sign. Sun shields and optical visors must be part of the sign design to ensure visibility in full sun at all times of the year.

Environmental

- 4.3 Further to RD-ITS-S1 "General Requirements for the Supply of ITS Equipment", Clause 4 "Environmental Requirements", the signs must operate correctly and safely in the following conditions:
- a) ambient temperature in the range from -150°C to +700°C;
 - b) relative humidity in the range from 0% to 95%;
 - c) when subjected to the design wind speeds;
 - d) when subjected to low frequency vibration and variations in air pressure induced by passing traffic and wind; and
 - e) sign Enclosure and control box IP rating shall be IP67 unless otherwise approved by the Principal in writing.
- 4.4 The signs must comply with the electromagnetic compatibility requirements of AS 4252.1, or an approved equivalent standard, and the appropriate Australian Standard for the sign type.

5 Signs Using LED Technology

General

- 5.1 Displays must:
- a) be visible and discernible under all ambient light and weather conditions;
 - b) be of uniform hue and light intensity across the face of the signs; and
 - c) incorporate variable luminous intensity automatically controlled by a light-sensing device.

Variable Message Signs (VMS)

- 5.2 VMSs must be a series of pixels forming a dot-matrix display system. A "full matrix" configuration must allow the display of graphics as well as both upper and lower case alphanumeric characters. The horizontal and vertical pitch of the pixels in the matrix must be equal.
- 5.3 Unless approved otherwise by the Principal, the sign shall comply with AS 4852.1 Section 3: "Display and optical requirements".

- 5.4 Unless otherwise specified, VMS display must be full colour on a matt black background. Each colour shall meet the chromaticity requirement of AS4852.1
- 5.5 VMSs must comply with AS 4852.1.
- 5.6 The signs must contain characters that comply with the requirements of DPTI Operating Instruction 2.36.
- 5.7 The design and layout must be such that the message and / or symbols are visible and readable for a minimum of 5 seconds by an approaching motorist driving at the design speed of the road.
- 5.8 The display must consist of modules of a size capable of removal and installation by hand via access door(s) installed.
- 5.9 The sign shall continue to display where there are greater than 1 percent and less than 10 percent of total pixels are deemed to be faulty (refer to clause 5.11 for definition), in which case, a single-LED fault shall be reported via STREAMS.
- 5.10 The sign shall not display a message where 10 percent or more of total pixels are deemed to be faulty (refer to clause 5.11 for definition), in which case, a multiple-LED fault shall be reported via STREAMS.
- 5.11 A faulty pixel shall be defined as a pixel where 1 or more LEDs forming part of the pixel does not behave as expected to such an extent that it adversely affects the pixel operation (luminous intensity / colour / display where applicable). Such behaviour shall include LEDs remaining in the wrong state (on or off), LEDs which flicker, and LEDs which exhibit reduced or increased brightness compared to properly functioning LEDs.

Variable Speed Limit Signs (VSLS)

- 5.12 VSLS (also referred to as Electronic Speed Limit Signs (ESLS)) must comply with DR AS 5156, except that, unless otherwise specified, discrete characters are not permitted.
- 5.13 LED digit displays must consist of white pixels on a matt black background. The annulus must consist of red pixels on a matt black background.
- 5.14 The sign must be able to display any speed limit from a totally blank display to 110 kph (e.g. blank, 25, 40, 50, 60, 70, 80, 90, 100 and 110 kph).
- 5.15 When the speed limit is reduced from the nominal speed limit, the annulus (or other conspicuity device) must be capable of being flashed. The annulus is never to be totally blank; some of the pixels of the annulus must be displayed continuously. Signs within close proximity to each other must have their flash rates synchronised and their displays must have a uniform appearance.
- 5.16 The display must be visible and discernible under all ambient light and weather conditions, and must be of uniform hue and light intensity across the face of the signs.
- 5.17 The luminous intensity of the displays must be variable and automatically controlled by a light-sensing device.

Composite Variable Message Signs (VMS)

- 5.18 Composite VMSs must be a series of pixels forming a dot-matrix display system. A "full matrix" configuration must allow the display of graphics as well as both upper and lower case alphanumeric characters. The horizontal and vertical pitch of the pixels in the matrix must be equal. Unless otherwise specified, displays must consist of a four-coloured pictogram on the left containing red, green, white and amber LEDs on a matt black background, and the remainder of the display being a single-colour section containing amber pixels on a matt black background.
- 5.19 The two displays of the Composite Variable Message Signs must be controlled via one group controller.
- 5.20 VMSs must comply with AS 4852.1.
- 5.21 The signs must contain characters that comply with the requirements of DPTI Operating Instruction 2.36.

- 5.22 The design and layout must be such that the message and / or symbols are visible and readable for a minimum of 5 seconds by an approaching motorist driving at the design speed of the road.
- 5.23 The display must consist of modules of a size capable of removal and installation by hand via access door(s) installed.

6 Signs Using Rotating Prism Technology

- 6.1 Alignment of prisms must remain consistent and there must be uniformity of the surface across the face of the sign. All sign faces, including the legend and the background must use Class 1 material in accordance with RD-LM-D1 "Traffic Control Device Design".
- 6.2 Each sign face must be displayed using a motor actuator to affect the change. The sign must rotate in both directions and all prisms must change simultaneously.
- 6.3 The design and layout must be such that the message and / or symbols are visible and readable for a minimum of 5 seconds by an approaching motorist driving at the design speed of the road. Displays must be visible and discernible under all ambient light and weather conditions.
- 6.4 A local control facility must be provided. This must include the combination of a Remote / Local Selector switch and a three-way switch to allow the prisms to be operated in either direction. The status of the selector switch must be interfaced to STREAMS.
- 6.5 Signs must be provided with appropriate status monitoring and alarm facilities to indicate sign failure and message transfer failure as required. The monitoring and alarm facilities must be interfaced to STREAMS for appropriate response at the TMC.

7 Electrical and Telecommunications Requirements

General

- 7.1 Unless otherwise specified, all signs must operate from a 230 V AC mains power supply. The switchboard installed in the sign Enclosure must incorporate:
 - a) a single pole 250 V (single phase) mains isolating switch;
 - b) a main circuit breaker;
 - c) one or more 250 V single pole 10 kA miniature circuit breakers;
 - d) neutral cover and link;
 - e) earth link; and
 - f) labelling, which comprises white traffolyte with black text, 20 mm high with 8 mm text up to 3 lines.
- 7.2 RCD protected GPOs must be installed in the sign Enclosure for set up and maintenance purposes. Lighting must be provided within the sign Enclosure to assist in maintenance operations.

Power Supply Environmental and Backup Requirements

- 7.3 All Equipment attached to mains power must meet the requirements of AS 2279.
- 7.4 The signs must:
 - a) operate correctly and reliably from a mains power supply with supply voltages over the range 205 V to 264 V r.m.s. and for any variations of frequency in the range 47 Hz to 52 Hz to meet the requirements of AS4851.1 and SAPN voltage and frequency ranges of operation;
 - b) operate normally for supply breaks or brownouts of duration up to 100 ms;
 - c) be protected from damage if subjected to voltages and frequency outside these ranges; and
 - d) return to normal operation automatically upon restoration of power after a power failure.

- 7.5 Components of the signs must withstand transients induced by lightning strikes. The protection must be in accordance with AS 1768.
- 7.6 The components and electrical wiring must incorporate protection against transients and over voltage.
- 7.7 In the event of failure of the primary power supply, a standby supply or battery backup must be available to operate the sign as follows:
 - a) LED signs: Operate the sign in full colour. Battery backup shall support 50% of the yellow pixels at maximum illumination for a minimum period of 4 hours.
 - b) CMS signs: Operate the sign at least 8 times.
- 7.8 Following restoration of the primary source, the standby supply must fully recharge within a maximum period of 12 hours.
- 7.9 In addition to Clause 3.6, the sign shall report alarms regarding battery condition, battery low and battery failed to the TMC by STREAMS.
- 7.10 Battery backup shall be included for any associated device that is required for the continued operation of the sign. Battery backup shall enable the sign to operate normally, including allowing the sign to continue communicating with the TMC.

Sign Controllers

- 7.11 The sign controllers must interface to STREAMS via an RS 485, RS 232 or RS 422 cable, which will run from the nearest fibre optic modem located in the field.
- 7.12 Optical fibre modems must use single mode type optical fibre. Each modem must use one fibre core for normal operation.
- 7.13 The sign controller must be of modular construction to allow field replacement of major modules without the need for special tools.

Wireless Communications

- 7.14 This clause applies where a sign communication system using wireless technology has been specified. Acceptable wireless technologies include:
 - a) CDPD (Cellular Digital Packet Data);
 - b) Spread Spectrum;
 - c) Radio Modems;
 - d) 3G; and
 - e) Microwave.
- 7.15 The Contractor must nominate the technology to be used for wireless control and monitoring of the sign. In particular, the licensing implications of the proposed technology must be clearly stated. Wireless communications to the sign must be from the closest field processor. Communications interface Equipment and antennae must be installed at the field processor site to facilitate communications between the field processor and the CMS. Antennae must not be placed on moveable poles such as CCTV "see saw" poles.
- 7.16 Corresponding communications interface Equipment must be installed at the sign site. This Equipment must be suitably interfaced to the sign controller.
- 7.17 The Contractor must provide information that:
 - a) ensures that the maximum expected latency in wireless sign communications does not exceed the maximum response times allowed within STREAMS;
 - b) confirms the nominated wireless communication system is compatible with STREAMS; and
 - c) ensures the performance meets the specifications.
- 7.18 Provision of this information shall constitute a **Hold Point**.

8 Sign Support

- 8.1 The supply and selection of sign support shall be in accordance with RD-LM-C4 "Sign Installation".

9 Sign Enclosures

- 9.1 Hinged doors must allow access to the sign for maintenance. The hinges must be of such design that the hinge pins cannot be removed unless the door is in the open position. The interior and exterior must be free from sharp corners and projections that may cause injury.
- 9.2 Each VLS Enclosure must be fitted with a door stay capable of holding the door open approximately perpendicular to the Enclosure providing a safe working environment for maintenance.
- 9.3 All doors must be equipped with a "South Co." Hex cam key-lockable rotary action latch to prevent unauthorised entry.
- 9.4 Sealing of the sign Enclosure must protect all equipment contained within the sign Enclosure from moisture, dust, dirt and corrosion and must be vermin proof.
- 9.5 The mounting brackets for the signs must be incorporated in the design to eliminate the need to drill or weld to the Enclosure. Access for cables to the signs must be included in the design. The design must be such as to allow adjustment of the viewing angle of the sign.
- 9.6 All visible surfaces of the signs and the associated structure, other than the sign display and the shadow line, shall be painted as per the manufacturer's specification in G61 Dark Green colour.
- 9.7 In accordance with AS4852.1, the signs shall be fitted with a facility switch. The facility switch shall be installed within the Field Cabinet.
- 9.8 The following specification applies where the sign is designed to come with separate field cabinet(s).
- 9.9 All field cabinets complete with all required equipment shall be supplied and installed by the Contractor.
- 9.10 All field cabinets are to be accessible from ground height without the use of a ladder. All field cabinet doors shall be fitted with semi flush diecast aluminium swing handle locks and three point locking bars. Swing handle locks shall be capable of accepting a padlock with 10 mm clasp. Field cabinets can be either standalone or pole mounted, depending on each installation's individual requirements. Wherever possible, field cabinets shall be accessible without requiring work zone traffic management. All field cabinets shall be fitted with hinged doors to allow the ease of access to all equipment connection. Rear door shall be provided if any equipment is rear connected.
- 9.11 Signs using Rotating Prism technology must incorporate the motor actuator and all necessary mechanical linkages within the sign Enclosure.

10 Access Platform

- 10.1 Unless specified otherwise, all VMSs must incorporate a service access platform that provides a safe working environment for maintenance staff. The platform must be designed to limit opportunities for unauthorised people to climb any part of the structure, and access must be secured to prevent unauthorised access to the sign. The platform must include a gate and hoist arm to facilitate the retrieval of unconscious or injured personnel. Unless otherwise specified, access platforms are not to be provided on other types of signs.
- 10.2 All VMS structures shall have rear mounted platforms and access ladders. The ladders shall be appropriately secured to prevent unauthorised access to the platform.

11 Acceptance

- 11.1 The Contractor must perform Factory Acceptance Testing (FAT) on each sign prior to delivery. Any Site Acceptance Testing (SAT) requirements must be undertaken in accordance RD-ITS-C1 "Installation and Integration of ITS Equipment".

- 11.2 The Contractor must supply software to enable full functionality testing and re-programming of each sign by the Principal using a laptop computer.

12 Hold Points

- 12.1 The following is a summary of Hold Points referenced in this Part:

Document Ref.	Hold Point	Response Time
2.4	Provision of Quality Documents	10 working days
4.1	Evidence of durability, interoperability with STREAMS and optical performance of signs	5 working days
7.18	Confirmation of wireless communication compatibility and performance with STREAMS	10 working days

13 Verification Requirements and Records

- 13.1 The Contractor must supply the following records:

Table RD-ITS-S4 13-1 Records

Document Ref.	Subject	Record to be Provided
RD-ITS-S1.11	Manuals	Operation and maintenance manual(s)
RD-ITS-S1.12	Warranty	Manufacturer's Warranty
RD-ITS-S1.13	Testing and commissioning	Factory Acceptance Test (FAT) Records
RD-ITS-S1.14	System documentation	As-Built documentation
RD-ITS-C1.6	Testing and commissioning (if this Contract includes installation)	Site Acceptance Test (SAT) and System Integration Acceptance Test (SIAT) Records - refer RD-ITS-C1 "Installation and Integration of ITS Equipment".