

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:
- a) Variable Message Signs (VMS), signs which may display any message;
 - b) Changeable Message Signs (CMS), signs which may display predetermined messages;
 - c) Variable Speed Limit Signs (VSLS), regulatory signs capable of displaying a range of speed limits for a section of road; and
 - d) Lane Use Management Sign (LUMS), regulatory signs which display the status of a traffic lane or speed.
- 1.2 Requirements are specified for signs using either Light Emitting Diode (LED) technology or Rotating Prism (e.g. "TriVision") technology. This Part shall 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:
- a) AS 1742 Manual of Uniform Traffic Control Devices.
 - b) AS/NZS 1768 Lightning Protection.
 - c) AS/NZS 61000 Electromagnetic compatibility (EMC).
 - d) AS 2700 Colour Standards for General Purposes.
 - e) AS/NZS 3000 Electrical Installations (known as the Australian/New Zealand Wiring Rules).
 - f) AS 61000.6.1 Electromagnetic compatibility (EMC) - Generic standards - Immunity for residential, commercial and light-industrial environments.
 - g) AS 4852.1 Variable Message Signs: Fixed Signs.
 - h) AS 5156 Electronic speed limit signs.
 - i) Department Operational Instruction 2.36 Variable Message Signs.
 - j) RTA Specification TSI-SP-003 Communications Protocol for Roadside Devices.
 - k) Department Operational Instructions are available from <https://www.dpti.sa.gov.au/standards/tass>.
 - l) Department 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 Department's Traffic Management Centre (TMC) at Norwood used to manage the signs.

2 Quality Requirements

- 2.1 The Contractor shall prepare and implement a Quality Plan that includes or annexes the following documentation:
- a) design documentation in accordance with RD-ITS-D1 "Design for Intelligent Transport System (ITS)";
 - b) 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 shall 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 shall comply with the Roads and Traffic Authority (RTA: NSW) Protocol and shall 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 shall 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 shall be RS422.
- 3.4 The sign shall be capable of operating with future STREAMS drivers using only a software update. Hardware shall have suitable provisions for communicating via future version of the TS-SP-003 protocol or NTC/IP.
- 3.5 The signs shall be capable of local control via a stand-alone personal computer or remotely as a field peripheral device integrated with STREAMS.
- 3.6 Facilities shall 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 shall 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 shall have status monitoring and alarm facilities in accordance with RTA Specification TSI-SP-003 to indicate communications failure and pixel or prism failure and shall be equipped with the ability to perform self-monitoring and diagnostics and reporting of faults. Reporting shall 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 shall interface to STREAMS.
- 3.9 Each sign may be individually addressable or provided in a "master-slave" configuration. Each pair of signs shall have a uniform display (e.g. brightness, synchronised flash rate). The Contractor shall 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 shall be allowed for.

4 Operating Requirements

Sign Performance

- 4.1 The Contractor shall 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 shall 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 shall allow adjustment of the tilt angle and orientation after installation of the sign. Sun shields and optical visors shall 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 shall operate correctly and safely in the following conditions:
- a) ambient temperature in the range from -15°C to +70°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 comply with Australian Standards referenced in this document unless otherwise approved by the Principal in writing.
- 4.4 The signs shall 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 shall:
- 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 shall be a series of pixels forming a dot-matrix display system. A "full matrix" configuration shall 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 shall 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 shall be full colour on a matt black background. Each colour shall meet the chromaticity requirement of AS4852.1
- 5.5 VMSs shall comply with AS 4852.1.
- 5.6 The signs shall contain characters that comply with the requirements of the Department's Operating Instruction 2.36.
- 5.7 The design and layout shall be such that the message and / or symbols are visible and readable for a minimum of 6.2 seconds by an approaching motorist driving at the design speed of the road.
- 5.8 The display shall 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)) shall comply with AS 5156, except that, unless otherwise specified, discrete characters are not permitted.
- 5.13 LED digit displays shall consist of white pixels on a matt black background. The annulus shall consist of red pixels on a matt black background.
- 5.14 The sign shall 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) shall be capable of being flashed. The annulus is never to be totally blank; some of the pixels of the annulus shall be displayed continuously. Signs within close proximity to each other shall have their flash rates synchronised and their displays shall have a uniform appearance.
- 5.16 The display shall be visible and discernible under all ambient light and weather conditions, and shall be of uniform hue and light intensity across the face of the signs.
- 5.17 The luminous intensity of the displays shall be variable and automatically controlled by a light-sensing device.

Composite Variable Message Signs (VMS)

- 5.18 Composite VMSs shall be a series of pixels forming a dot-matrix display system. A "full matrix" configuration shall 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 shall be equal. Unless otherwise specified, displays shall 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 shall be controlled via one group controller.
- 5.20 Composite VMS shall not be supplied without prior approval from the Department. Composite VMS shall comply with AS 4852.1.

- 5.21 The signs shall contain characters that comply with the requirements of the Department's Operating Instruction 2.36.
- 5.22 The design and layout shall 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 shall 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 shall remain consistent and there shall be uniformity of the surface across the face of the sign. All sign faces, including the legend and the background shall use Class 1 material in accordance with RD-LM-D1 "Traffic Control Device Design".
- 6.2 Each sign face shall be displayed using a motor actuator to affect the change. The sign shall rotate in both directions and all prisms shall change simultaneously.
- 6.3 The design and layout shall be such that the message and / or symbols are visible and readable for a minimum of 6.2 seconds by an approaching motorist driving at the design speed of the road. Displays shall be visible and discernible under all ambient light and weather conditions.
- 6.4 A local control facility shall be provided. This shall 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 shall be interfaced to STREAMS.
- 6.5 Signs shall be provided with appropriate status monitoring and alarm facilities to indicate sign failure and message transfer failure as required. The monitoring and alarm facilities shall be interfaced to STREAMS for appropriate response at the TMC.

7 Electrical and Telecommunications Requirements

General

- 7.1 Unless otherwise specified, all signs shall operate from a 230 V AC mains power supply. The switchboard installed in the sign Enclosure shall 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 shall be installed in the sign Enclosure for set up and maintenance purposes. Lighting shall 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 shall meet the requirements of AS 2279.
- 7.4 The signs shall:
 - 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 shall withstand transients induced by lightning strikes. The protection shall be in accordance with AS 1768.
- 7.6 The components and electrical wiring shall 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 shall 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 shall 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 shall 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 shall use single mode type optical fibre. Each modem shall use one fibre core for normal operation.
- 7.13 The sign controller shall 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 shall nominate the technology to be used for wireless control and monitoring of the sign. In particular, the licensing implications of the proposed technology shall be clearly stated. Wireless communications to the sign shall be from the closest field processor. Communications interface Equipment and antennae shall be installed at the field processor site to facilitate communications between the field processor and the CMS. Antennae shall not be placed on moveable poles such as CCTV "see saw" poles.
- 7.16 Corresponding communications interface Equipment shall be installed at the sign site. This Equipment shall be suitably interfaced to the sign controller.
- 7.17 The Contractor shall 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 shall allow access to the sign for maintenance. The hinges shall be of such design that the hinge pins cannot be removed unless the door is in the open position. The interior and exterior shall be free from sharp corners and projections that may cause injury.

9.2 Each VLS Enclosure shall 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 shall be equipped with a "South Co." Hex cam key-lockable rotary action latch to prevent unauthorised entry.

9.4 Sealing of the sign Enclosure shall protect all equipment contained within the sign Enclosure from moisture, dust, dirt and corrosion and shall be vermin proof.

9.5 The mounting brackets for the signs shall be incorporated in the design to eliminate the need to drill or weld to the Enclosure. Access for cables to the signs shall be included in the design. The design shall be such as to allow adjustment of the viewing angle of the sign and rapid detachment and replacement for maintenance purposes.

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 shall incorporate the motor actuator and all necessary mechanical linkages within the sign Enclosure.

10 Access Platform

10.1 Unless specified otherwise, all VMSs shall incorporate a service access platform that provides a safe working environment for maintenance staff. The platform shall be designed to limit opportunities for unauthorised people to climb any part of the structure, and access shall be secured to prevent unauthorised access to the sign. The platform shall 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 shall perform Factory Acceptance Testing (FAT) on each sign prior to delivery. Any Site Acceptance Testing (SAT) requirements shall be undertaken in accordance RD-ITS-C1 "Installation and Integration of ITS Equipment".
- 11.2 The Contractor shall 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:

Table RD-ITS-S4 12-1 Hold Points

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 shall 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".