

TCS 037 - 2019

Specification for

The Supply of

Electronic Speed Limit Signs

January 2019
Rev A

TCS 037 – 2018

Foreword

This specification has been developed by VicRoads. It is one of a number of technical specifications, and associated standard drawings, which set out the requirements for roadside ITS devices, traffic signal equipment and other electrical equipment and associated devices and control systems.

This specification is intended for use in all relevant works undertaken by or on behalf of VicRoads.

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Specification updates. VicRoads specifications and associated standard drawings are subject to periodic review. To keep the specifications up to date, amendments or new editions are issued as necessary. It is therefore important for users of VicRoads specifications to ensure that they have the latest version and associated amendments.

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PREFACE

A. TELECOMMUNICATIONS EQUIPMENT

- A.1 All telecommunications equipment shall comply with relevant requirements of the Australian Communications and Media Authority (ACMA). Such equipment shall be labelled with a Regulatory Compliance Mark.

B. CHANGES TO THIS SPECIFICATION

- B.1 The main changes to this specification from the previous version are listed below:
- Addition of proposed new ESLS Network Monitoring and Control System
 - Addition of Side Road Activated Speed (SRAS) system

Revision History

Version	Revision	Date	Author	Description
2019	A	January 2019	SJS	Amendment to existing specification Incorporate Network Monitoring and Control System Incorporate Side Road Activated Speed (SRAS) system
2014	A	December 2014	SJS	Incorporate AS 5156, AS 4509.2, AS 4086.1 & AS 4086.2 Incorporate Tyco ESLS Management System
2004	7	January 2004	VicRoads ITS	Amendment to existing specification
2003	6	June 2003	VicRoads ITS	Amendment to existing specification
2001	5	September 2001	VicRoads ITS	Amendment to existing specification
2001	2,3 & 4		VicRoads ITS	Not released
2001	1	April 2001	VicRoads ITS	New specification

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SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

- 1.1.1 This specification covers the design, manufacture and operation of Electronic Speed Limit Signs (ESLS) intended for use as school speed zone, strip shopping centre and Side Road Activated Speed (SRAS) treatments.
- 1.1.2 This specification is not intended to cover the requirements of ESLS used as part of Lane Use Management Systems (LUMS). The requirements for Lane Use Signs (LUS) are outside the scope of this specification.

1.2 GENERAL

- 1.2.1 ESLS are used to display a legally enforceable speed limit to be adopted at different times. Any reference to “sign” within this document shall be taken to mean “Electronic Speed Limit Sign”.
- 1.2.2 Typical versions of the ESLS are:
- Single Speed – a single speed limit display at specified times and is blank at other times. Typically used for time-based school speed zones and Side Road Activated Speed.
 - Dual Speed – can display two different speed limits. Typically used for time-based shopping strip speed zones or school zones that display the default speed limit.
 - Multiple Speed – capable of displaying three or more speed limits.
- 1.2.3 The creation of the numeral be by either discrete character or matrix panel. Where supported by the operating and control system, the use of a matrix panel shall be used, otherwise a discrete panel may be employed and used. See Figures 1.1 and 1.2 below.

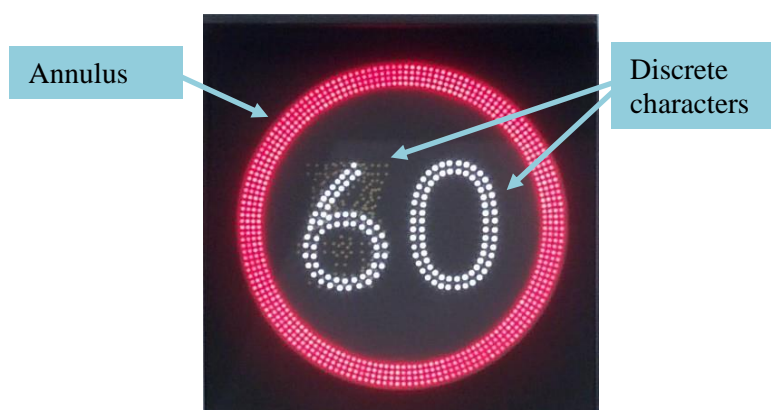


Figure 1.1 – Typical discrete character ESLS

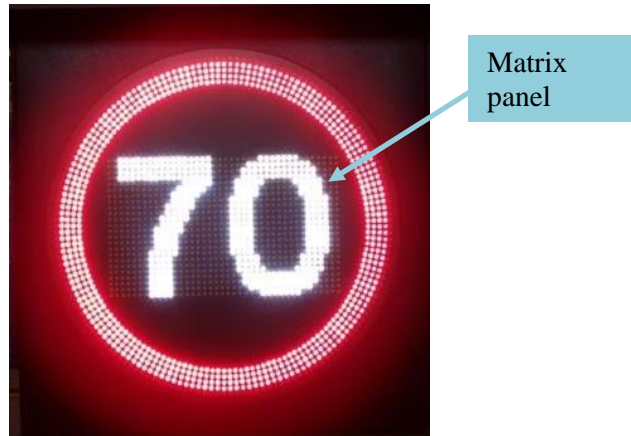


Figure 1.2 – Typical matrix ESLS

- 1.2.4 Individual tender documents shall detail the types of signs required for a specific project.
- 1.2.5 The sign display shall be made up of point light sources, arranged in accordance with this specification to comprise a clear and enforceable speed limit sign.
- 1.2.6 Signs are to be designed and constructed to conform to AS 5156 except where modified to meet the requirements stated in this document. Details of the exceptions and clarifications from AS 5156 are given in Section 2.4.
- 1.2.7 Conspicuity devices as described in AS 5156 shall not be used.
- 1.2.8 All ESLS shall be VicRoads Type Approved as detailed in APPENDIX F.

1.3 INTELLECTUAL PROPERTY

- 1.3.1 In relation to all Intellectual Property used in/or to operate the system, the contractor grants to VicRoads non exclusive licence to “use, modify and/or sell” or do anything else that without the licence, could be breach of the licensors Intellectual Property.

Intellectual Property shall include, but not be limited to, the following:

- Software.
- Source code(s).
- Schematic diagrams.
- Circuit diagrams.
- Wiring diagrams.
- Listings of components and sub-components.
- Any and all operational and maintenance documentation.

1.4 ACRONYMS

The acronyms used in this document shall be interpreted as follows:

ACMA	Australian Communications and Media Authority
AS	Australian Standard
CLI	Command Line Interface
ELV	Extra Low Voltage
EMC	Electromagnetic Compatibility
ESLS	Electronic Speed Limit Sign
FP	Field Processor
GPS	Global Positioning System
GNSS	Global Navigation Satellite System
HTTPS	Hypertext Transfer Protocol Secure
ICMP	Internet Control Message Protocol
IP	Ingress Protection (degree of protection)
ITS	Intelligent Transport System
LED	Light Emitting Diode
NMCS	Network Management and Control System
NMS	Network Management System
NTP	Network Time Protocol
NZS	New Zealand Standard
RCD	Residual Current Device
RMS	Roads and Maritime Services (NSW)
SNMP	Simple Network Management Protocol
SSH	Secure Shell
SSL	Secure Sockets Layer
SRAS	Side Road Activated Speed
STREAMS	An ITS communications/control platform used by VicRoads to manage traffic operations on freeways
TCP/IP	Transmission Control Protocol/Internet Protocol
TLS	Transport Layer Security
UTC	Coordinated Universal Time

SECTION 2 RELATED SPECIFICATIONS AND DRAWINGS

2.1 AUSTRALIAN STANDARDS

- 2.1.1 The fabrication and supply of all components shall conform to all relevant Australian Standards.
- 2.1.2 Where no specific reference is made to an Australian Standard, the materials and processes used shall conform to the relevant Australian Standard or generally accepted practice.
- 2.1.3 The following related Australian Standards are referenced:

AS 1742.2	Manual of Uniform Traffic Control Devices, Part 2, Traffic Control Devices for General use
AS 1743	Road signs - Specifications
AS/NZS 3000	Wiring Rules
AS 4086.1	Secondary batteries for use with stand-alone power systems - General requirements
AS 4086.2	Secondary batteries for use with stand-alone power systems - Installation and maintenance
AS/NZS 4509.2	Stand-alone power systems - System design
AS 5156	Electronic speed limit signs
AS 60529	Degrees of protection provided by enclosures (IP code).
AS IEC 62619	Secondary cells and batteries containing alkaline or other non-acid electrolytes — Safety requirements for secondary lithium cells and batteries, for use in industrial applications
AS/NZS 61000.6.1	General Standards – Immunity for residential, commercial and light industrial environments
AS/NZS 61000.6.3	General Standards – Emission standard for residential, commercial and light industrial environments

2.2 VICROADS SPECIFICATIONS AND DRAWINGS

- 2.2.1 All installation works shall conform to the relevant VicRoads specifications and related specifications and standards as indicated throughout this document.
- 2.2.2 The fabrication and supply of all components shall conform to the relevant VicRoads specifications, and related specifications and standards, as indicated throughout this document.
- 2.2.3 The following VicRoads documents are referenced:

Standard Contract Section 730	Traffic Signal installation
TCG 016	Product Compliance Process for ITS and Electrical Products
TCS 060	VicRoads Extensions to RTA Protocol for Roadside Devices
TCS 071	The Supply of Side Road Activated Speed (SRAS)

2.3 ADDITIONAL SPECIFICATIONS AND DRAWINGS

- 2.3.1 The fabrication and supply of all components shall conform to the following specifications and drawings as indicated throughout this document.

2.4 EXCEPTIONS AND CLARIFICATIONS TO AS 5156–2010

2.4.1 The following changes or clarifications to AS 5156 are summarised in Table 2.1 below:

AS 5156 Clause	Description	Exception / Clarification
2.1.1.7	Conspicuity devices	Clause does not apply
2.1.2.2	Pixel arrangement - Annulus	Refer to this specification Section 5.5
2.1.2.3	Pixel arrangement - Matrix display signs	Refer to this specification Section 5.4
2.1.2.4	Pixel arrangement - Discrete character signs	Refer to this specification Section 5.3
2.1.2.5	Pixel arrangement - Annulus display	Refer to this specification Section 5.5
3.2.1	Product host control system	Refer to this specification Section 3
3.2.2	Facility switch	Refer to this specification Section 4.3
3.3	Remote control	Refer to this specification Section 3
3.4	Programming	Refer to this specification Section 5.4 & Section 3
3.5	Communication protocol	Refer to this specification Section 3
3.6	Monitoring, fault logging and reporting	Refer to this specification Section 3
3.7	Fall-back operation	Refer to this specification Section 3
4.1.1	Mechanical requirements - General	Refer to this specification Section 4.1
4.1.2	Mechanical requirements - Sign enclosure	Clause (g) does not apply
4.1.3	Mechanical requirements - Sign mounting facilities	Refer to this specification Section 4.2
4.1.4.1	Control housing - Construction and positioning	Clause does not apply
4.1.4.2	Control housing - Anti-vandalism measures	Clause does not apply
4.1.4.3	Control housing - Power and communication equipment	Clause does not apply
4.1.5.1	Facility switch - General	Refer to this specification Section 4.3
4.1.5.2	Facility switch - Control housing	Refer to this specification Section 4.3
4.1.5.3	Facility switch - Type and rating	Refer to this specification Section 4.3
4.1.5.4	Facility switch - Mounting	Refer to this specification Section 4.3
4.1.5.5	Facility switch - Marking	Refer to this specification Section 4.3
4.2.2	Operating voltage	Refer to this specification Section 6.1
4.2.3	Battery backup	Refer to this specification Section 6.4
4.4	Solar power	Refer to this specification Section 6.2
4.6	Real-time clock	Refer to this specification Section 3
Appendix B - B2.3	Display changes due to external switch inputs	Refer to this specification Section 3.5
Appendix B - B2.4	Graphics requirements	Clause does not apply
Appendix B - B4.1	Graphics requirements	Clause does not apply
Appendix B - B4.2	Message numbering for speed displays	Refer to VicRoads specification for extensions to RTA protocol for roadside devices TCS 060
Appendix B - B4.3	Frame numbering for other displays	Clause does not apply
Appendix B - B4.4	Message numbering for other displays	Clause does not apply
Appendix B - B4.5	Standard bitmap display images	Information only. Alternate image definitions may be considered.

Appendix B - B4.6	Bitmap definitions for other displays	Clause does not apply -
Appendix D	Wireless communications	Clause does not apply

Table 2.1 - Exceptions and Clarifications to AS 5156

SECTION 3 OPERATION AND CONTROL

3.1 GENERAL

- 3.1.1 Individual ESLS shall typically operate as an autonomous device.
- 3.1.2 Pairs of adjacent ESLS shall operate as a master/slave arrangement.
- 3.1.3 The sign operation and management system shall be one of the following:
- VicRoads Network Monitoring and Control System (NMCS). This is still to be specified;
 - ESLS Network Management System Version 2 (NMS V2). This system operates speed changes via a calendar uploaded into the sign;
 - Side Road Activated Speed (SRAS). This system is a standalone operation activated by vehicles approaching from the side road; or
 - STREAMS (Possible future application).
- 3.1.4 The selection of the type of operation and management system shall be defined in individual tender documents.
- 3.1.5 In the event of a major system failure the sign shall default to a blank display as specified in AS 5156 Clause 3.7.
- 3.1.6 Unless otherwise specified in individual tender documents, communications between the management system and each sign shall be via a 3/4G mobile data connection.
- 3.1.7 Master / Slave pairs of signs shall employ a single data connection.
- 3.1.8 Accuracy of the internal time clock to ensure synchronisation of signs shall be via Global Navigation Satellite System (GNSS) as specified in Clause 3.7 below.
- 3.1.9 For signs operating via a calendar, if no calendar is present in the sign, it shall blank in accordance with Clause 3.1.5 above, this is not applicable for SRAS treatment.

3.2 NETWORK MONITORING AND CONTROL SYSTEM

- 3.2.1 Where specified in the contract documents, the signs shall be designed for monitoring and control through the VicRoads Network Monitoring and Control System (NMCS)
- 3.2.2 Signs connected to the NMCS shall use the protocols detailed in APPENDIX B.
- 3.2.3 Signs designed to operate on the NMCS shall be fully compliant and compatible, and shall obtain a compliance certificate prior to supply. See APPENDIX F, Requirements for Type Approval.

3.3 ESLS NETWORK MANAGEMENT SYSTEM

- 3.3.1 Where specified in the contract documents, the signs shall be designed for monitoring and control through the VicRoads Network Management System (NMS) for ESLS.
- 3.3.2 Signs connected to the NMS shall use the protocols detailed in APPENDIX A.

- 3.3.3 Signs designed to operate on the NMS shall be fully compliant and compatible, and shall obtain a compliance certificate prior to supply. See APPENDIX F, Requirements for Type Approval

3.4 SIDE ROAD ACTIVATED SPEED

- 3.4.1 Where specified in the contract documents, the signs shall be designed for monitoring and control through a Side Road Activated Speed (SRAS) system.
- 3.4.2 Control and interfacing of the ESLS shall be as specified in TCS 071.
- 3.4.3 Monitoring and/or control through SRAS shall not eliminate the option of concurrent monitoring and/or control through another system listed in clause 3.1.3 above.

3.5 DISPLAY CHANGES DUE TO EXTERNAL SWITCH INPUTS

- 3.5.1 Where specified in the contract documents, the signs shall be designed for monitoring and control through external switch inputs. This will typically be for SRAS operation.
- 3.5.2 Where external switch inputs are used they shall, at minimum, comply with Clause B2.3 of AS 5156.
- 3.5.3 Where external switch inputs are used, additional *open collector* outputs shall be provided in equal number to the inputs.
- 3.5.4 When an external switch is activated, and the respective message is displayed, the sign shall activate the corresponding output to notify of successful operation.
- 3.5.5 Outputs shall remain active while the respective message is being displayed, unless a critical fault occurs within the sign.

3.6 STREAMS OPERATION

- 3.6.1 In the future, VicRoads may move to the STREAMS platform for Electronic Speed Limit Signs. See APPENDIX C for an overview of the STREAMS platform.
- 3.6.2 Signs designed to operate on the STREAMS platform shall be fully compliant and compatible with STREAMS.
- 3.6.3 To ensure compliance with STREAMS, the supplier shall obtain a compliance certificate from Transmax for operation on their STREAMS system.
- 3.6.4 A copy of STREAMS certification shall be provided to VicRoads.

3.7 SYNCHRONISATION OF SIGNS

- 3.7.1 Every sign within a single speed zone or treatment shall be synchronised to ensure all signs within a single treatment display the same speed at all times.
- 3.7.2 Where a pair of signs are required on an approach, the pair shall be interlocked as Master/Slave to ensure synchronisation of displays.
- 3.7.3 To achieve clock synchronisation, each sign shall obtain a time synchronisation signal from a Global Navigation Satellite System (GNSS).

- 3.7.4 The internal time clock shall remain synchronised with the GNSS clock within ± 1 second at all times.
- 3.7.5 The internal time clock shall include calendar functions that enable the sign to operate independent from the management system and communications carrier for periods of at least 30 days with a time error of no more than one minute at any instant during the 30 days.
- 3.7.6 An error of more than one minute shall be considered a major system failure and result in a blank display.
- 3.7.7 The sign internal time clock shall display local time for the operator (e.g. UTC plus 9 hours).
- 3.7.8 The internal time clock shall automatically update for daylight saving time.
- 3.7.9 The internal time clock shall allow a schedule to be programmed at least twelve months in advance.

3.8 MONITORING

- 3.8.1 Signs shall provide alarm notification to the monitoring system for all faults as specified in Clause 3.6 of AS 5156.
- 3.8.2 The fault notification shall be the same regardless of what monitoring system the signs are being operated on.
- 3.8.3 A list of the minimum required alarm notifications is provided in Appendix D1.
- 3.8.4 The notification and clearance of alarms shall be logged.

3.9 LOGGING

- 3.9.1 Signs shall provide all fault logging as specified in Clause 3.6 of AS 5156, with a minimum of 500 entries.
- 3.9.2 In addition, a separate event log will be provided to record all operational, maintenance and regulatory requirements for a period of 90 days.
- 3.9.3 Lists of the minimum required details to be recorded in the event log are provided in Appendix D2.

SECTION 4 MECHANICAL REQUIREMENTS

4.1 GENERAL

- 4.1.1 Signs shall conform to the requirements of Clause 4.1 of AS 5156, with the following exceptions:
- a) Forced ventilation (i.e. a fan) shall not be used to in the venting and/or air circulation system specified in Clause 4.1.2 (e)
 - b) Socket outlets, as specified in Clause 4.1.2 (g), are not to be supplied
- 4.1.2 In addition to Clause 4.1.2 (d), the door must be capable of being hinged on either the right or left side to enable the door to always be swung to the footpath side of the sign.
- 4.1.3 The door shall be fitted with a tamper switch to sense when it is open or incorrectly secured.
- 4.1.4 All metal seams shall be continuous welded. Spot welding shall not be used.
- 4.1.5 All external metal sections of the completed housing shall be of powder coat or baked enamel finish, matt black in colour. Optionally, the rear of the housing can be powder coat or baked enamel finish, grey in colour.
- 4.1.6 The height and width dimensions of the sign face shall not exceed 100 mm difference compared with the equivalent static sign (R4-1).
- 4.1.7 The height and width of the sign enclosure shall be designed so that no part of the annulus is closer than 40mm to the outside edge of the enclosure.
- 4.1.8 The lock shall be as defined in individual tender documents.
- 4.1.9 A shroud or visor is not required. Signs shall be designed in such a way that a shroud or visor is not required to achieve the requirements of Section 5.

4.2 SIGN MOUNTING

- 4.2.1 Unless otherwise specified, each sign shall be designed to be mounted using one of the following methods:
- Mounted directly onto a 2A traffic signal pedestal (typically for A size signs) or a 2B pedestal (typically for B and C size signs), and shall be secured from the rear of the sign enclosure, or
 - Mounted on a purpose-built pole designed for the sign enclosure to be secured at the base.
- 4.2.2 The mounting method shall ensure that the display face of the sign is vertical and has provision for adjustment of the vertical and horizontal alignment.
- 4.2.3 Pedestals shall be installed in accordance with the relevant requirements of VicRoads Standard Section 730 Traffic Signal Installation.
- 4.2.4 For signs mounted on a 2A or 2B pedestal, access for all power supply, control and communication cabling shall be through the centre of the pedestal and shall enter the sign housing through appropriately constructed, sealed entry holes.

- 4.2.5 For base mounted signs, access for all power supply, control and communication cabling shall be through the centre of the pole and shall enter the sign housing through an appropriately constructed, sealed entry hole in the base on the sign enclosure.

4.3 FACILITY SWITCH

- 4.3.1 An external facility switch shall not be provided.
- 4.3.2 Each sign shall incorporate an internal facility switch function or manual override function (manual switch and/or software switch), accessible from the inside of the housing.
- 4.3.3 The function shall include the following options:
- For single speed signs the options detailed in Table 4.1 below;
 - For dual speed signs the options detailed in Table 4.2 below; and
 - For multiple speed signs the options detailed in Table 4.3 below.

Option	Function
AUTO	Shall allow the sign to operate normally and be controlled via the management system
OFF	Shall switch the sign off and prevent control via the management system
ON	Shall switch on the display and prevent control via the management system

Table 4.1 - Single Speed Signs

Option	Function
AUTO	Shall allow the sign to operate normally and be controlled via the management system
OFF	Shall switch the sign off and prevent control via the management system
SPEED 1	Shall switch on the lowest speed and prevent control via the management system
SPEED 2	Shall switch on the second speed and prevent control via the management system

Table 4.2 - Dual Speed Signs

Option	Function
AUTO	Shall allow the sign to operate normally and be manually switched via the management system
OFF	Shall switch the sign off and prevent control via the management system
SPEED 1	Shall switch on the 1 st (lowest) speed and prevent control via the management system
SPEED 2	Shall switch on the 2 nd speed and prevent control via the management system
SPEED (n)	Shall switch on the n th speed and prevent control via the management system

Table 4.3 – Multiple speed ESLs

- 4.3.4 The local manual override shall override all commands received from the management system. Under no circumstances shall the management system be capable of overriding the display, unless the sign is in AUTO.

SECTION 5 DISPLAY AND OPTICAL REQUIREMENTS

5.1 GENERAL

- 5.1.1 The display shall conform to the relevant clauses of AS 5156. The speed limit values and sign sizes to be supplied shall be as specified in individual tender documents.
- 5.1.2 The display shall be formed from LED pixels to comply with Section 2.1.2 of AS 5156 and this specification.
- 5.1.3 Where 3mm LED's are used, greater pixel spacing may be considered.
- 5.1.4 In addition to Clause 2.1.1.8.2 of AS 5156, signs shall provide a pixel map report on each segment with a tag defining the fault position.
- 5.1.5 If 20% or more of the LEDs in any one element of the display fail, the whole display shall be shut down and the sign deemed to have failed.
- 5.1.6 Any single numeral shall be considered a single element. The annulus shall be deemed to be a single element.
- 5.1.7 In addition to Clause 2.1.2.1 of AS 5156, the arrangement of LEDs shall be such that a failure of up to 20% of the LEDs in one numeral or the annulus shall not affect the recognisability of the display.
- 5.1.8 When displaying other than the normal speed limit, the red annulus shall be designed so that all inner rings of the annulus flash on and off. The number of rings of the annulus that flash shall be in accordance with Table 5.2 below.
- 5.1.9 With the exception of Clause 5.1.8 above, the sign shall meet the requirements of Clause 2.1.2.5 of AS 5156.
- 5.1.10 Signs shall incorporate features to provide a completely blank (all pixels inactive) display.
- 5.1.11 The design of the sign display shall ensure that there is an adequate space between the inner ring of the annulus and any numeral adjacent to the annulus. This is to prevent 'bleeding' of the LED's into adjacent LED's and provide a clear display.

5.2 OPTICAL REQUIREMENTS

5.2.1 The optical requirements of the display shall conform to the requirements of Section 2.2 of AS 5156.

5.3 DISPLAY – DISCRETE NUMERALS

5.3.1 Where one or two speed values are specified in the tender, the display shall typically comprise of discrete numerals as shown in Figure 5.1 below.

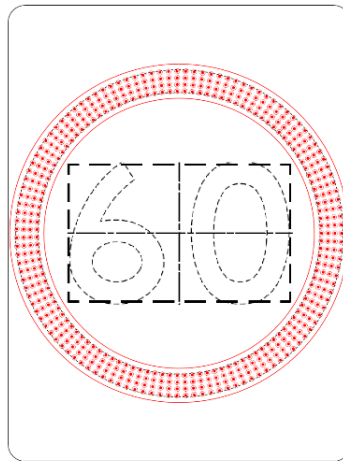


Figure 5.1 - Example discrete layout (R4-1B)

5.3.2 Numerals shall be configured in accordance with Table 5.1 below, for the respective R4-1 sign sizes specified in AS 1743:

Sign Size	Number of pixel rows ¹	Stroke width
A	2	~25mm
B	2	~35mm
C	(3 digits) (2 digits)	~55mm

Table 5.1 - Discrete numeral requirements

5.3.3 The total size of the stroke width (i.e. outside to outside of the LED's) will typically be slightly less than the requirement of AS 1743 due to flaring of LED's.

¹ Pixel rows are the number of rows of LEDs in the stroke of a character

5.4 DISPLAY – MATRIX

5.4.1 Where a matrix display is employed for the numerals the display shall typically consist of an arrangement as shown in Figure 5.2 below.

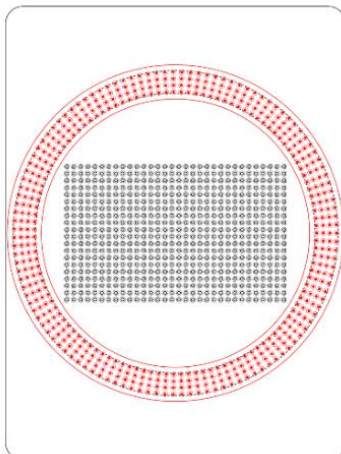


Figure 5.2 - Example matrix layout (R4-1B)

5.4.2 Where a matrix display is employed for the numerals the display shall be unable to display numerals which are not specified in the tender, through exclusion of those frames.

5.4.3 For a matrix display, the pixel pitch shall be equal in the vertical and horizontal direction.

5.4.4 The minimum number of pixels in the vertical direction for a speed numeral shall be 20 as specified in Clause 2.1.2.3 of AS 5156.

5.4.5 Where the pixel spacing would be greater than 1.5 times the diameter of the pixel, the display resolution or pixel diameter shall be increased to ensure suitable spacing.

5.5 DISPLAY – ANNULUS

5.5.1 The number of pixel rings used for the annulus shall be as specified in Table 5.2 below.

Sign Size	Number of pixel rings ²	Number of inner rings to flash	Inner annulus diameter mm	Outer annulus diameter mm	Annulus thickness mm	Equivalent static annulus thickness mm (AS 1743)
A	2	1	~375	~425	25 ± 2	45
B	4	3	~495	~575	40 ± 3	60
C	5	4	~730	~870	70 ± 5	90

Table 5.2 - Annulus size requirements

5.5.2 The total thickness of the annulus (i.e. inside pixel ring to outside pixel ring) will typically be slightly less than the requirement of AS 1743 due to flaring of the LED’s as shown in Figure 5.3 below.

² Pixel rings are the number of evenly spaced rings of LEDs which constitute the annulus

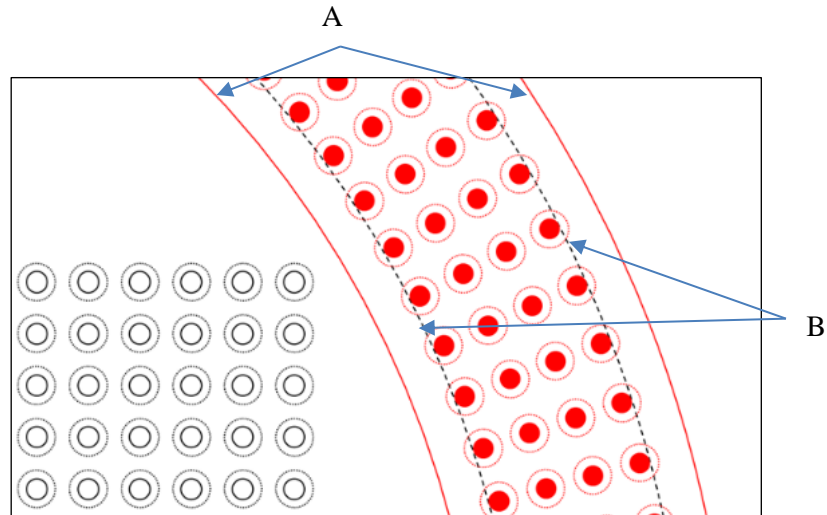


Figure 5.3 - Example annulus pixel ring spacing

Notes:

- A: Equivalent width of annulus for a static sign in accordance with AS 1743 (indicative only).
- B: Actual illuminated annulus width using LED pixels (indicative only).

SECTION 6 ELECTRICAL REQUIREMENTS

6.1 GENERAL

- 6.1.1 All signs shall be designed to operate from a 12Vdc power supply.
- 6.1.2 Signs shall include an IP65 rated connector to enable the external power supply to be easily connected and disconnected from the sign.
- 6.1.3 The LED display modules, displays and associated driver units, monitoring and dimming networks and the control and communications equipment shall operate at extra low voltage (ELV).
- 6.1.4 Internal cables shall be laid out and secured to ensure typical maintenance activities, such as the opening and closing of the door, will not crease or damage cables or components within the sign.
- 6.1.5 All equipment shall be internally protected against damage resulting from:
 - a) lightning strikes at or near the sign
 - b) electrical transients on power cabling
 - c) electrical transients on communications wiring
 - d) radio frequency interference
 - e) static electrical discharge

6.2 SOLAR POWER

- 6.2.1 Where specified in individual tender documents, the sign shall be designed for solar operation.
- 6.2.2 The solar power system shall be designed, constructed and installed in accordance with AS 4509.2, AS 4086.1 and AS 4086.2 as specified in Clause 4.4 of AS 5156.
- 6.2.3 Where solar power is specified, the contractor shall design a suitable standalone solar power system, which shall be designed by an accredited or suitably qualified designer.
- 6.2.4 When designing the standalone solar power system consideration must be given to the power consumption, the hours of operation, the surrounding environment and the average amount of sunlight available.
- 6.2.5 The solar panel shall be installed in a position that minimises the possibility of vandalism and theft.
- 6.2.6 The support post shall be suitable for carrying the load associated with the sign, including battery, and solar panel.
- 6.2.7 The proposed support post shall be proof engineered by a VicRoads approved consultant.
- 6.2.8 The solar panel shall be designed for ease of cleaning and equipped with deterrents to bird roosting.

6.3 MAINS POWER

- 6.3.1 The mains supply voltage shall be deemed to be 230Vac +10%, -6% in accordance with AS 60038, Section 2. The system and or sub-elements of the system shall be capable of operating satisfactorily from the same within $\pm 15\%$.
- 6.3.2 For mains power operation, an external 230Vac/12Vdc power supply shall be used to provide the sign with the required 12Vdc power.
- 6.3.3 The external power supply to the sign shall incorporate an easily accessible circuit breaker (D-Curve), as a means to isolate power.
- 6.3.4 The external power supply and associated electrical installation shall comply with all applicable requirements of AS/NZS 3000 and AS/NZS 3100.
- 6.3.5 The sign shall be securely bonded for earthing to the mounting pedestal.
- 6.3.6 All external joints used for bonding purposes shall be protected from the environment (by painting or similar method).
- 6.3.7 All cables and wires shall be insulated with a material with a degree of protection not inferior to V-90 grade PVC and shall be suitably labelled.
- 6.3.8 Inrush current at switch on shall be not more than 20% of normal peak operational current.
- 6.3.9 The supplier shall submit the following details of the power load of each individual sign:
- a) Normal peak operation;
 - b) Dimmed operation;
 - c) In rush current at switch on.

6.4 BATTERY BACKUP

- 6.4.1 The sign shall include a battery backup as specified in Clause 4.2.3 of AS 5156 and detailed below.
- 6.4.2 Unless otherwise specified in tender documents, the battery system shall be capable of maintaining normal operation for a minimum period of 48 hours.
- 6.4.3 In the case of school speed zone signs, the battery system shall be capable of maintaining normal operation for a minimum period of 1 week, operating for 3 hours per day.
- 6.4.4 Suitable deep discharge, gel or AGM type batteries shall be used in the backup system.
- 6.4.5 The service life of the battery shall be not less than three (3) years.
- 6.4.6 In general, batteries shall comply with AS 4086.1. Additionally, lithium batteries shall comply with AS IEC 62619.
- 6.4.7 The installation of batteries shall comply with AS 4086.2.

6.5 ELECTROMAGNETIC COMPLIANCE (EMC)

6.5.1 All signs covered by this specification shall comply with:

- AS/NZS 61000.6.1 for immunity; and
- AS/NZS 61000.6.3 for emissions.

6.5.2 Signs shall also comply with the relevant requirements of the Australian Communications and Media Authority (ACMA) and shall be labelled with a RCM label as shown in Figure 6.1



Figure 6.1 - RCM Compliance Label

SECTION 7 MARKINGS AND DOCUMENTATION

7.1 MARKINGS

7.1.1 In addition to the markings and labels identified in AS 5156 Section 4.7, each individual sign shall be legibly and durably marked on the rear or interior surfaces with:

- a) the VicRoads Sign ID

7.1.2 In addition to the markings and labels identified in AS 5156 Section 4.7, each individual module within the sign shall be legibly and durably marked with:

- a) the name, trade name or trademark of the manufacturer;
- b) the equipment code or model number;
- c) date of manufacture;
- d) batch code, serial number, or other marking to provide traceability under the manufacturer's quality management system;
- e) the type approval number of the relevant Certificate of Suitability (if applicable);
- f) RCM certification (as applicable);
- g) the rated supply voltage, power and/or current;

7.2 DOCUMENTATION

7.2.1 The manufacturer shall provide the following documentation:

- a) Technical and operation manual
- b) Field manual
- c) Fault finding and diagnostic guide
- d) Recommended maintenance requirements
- e) List of all recommended spare components to enable fault and maintenance repairs

APPENDIX A NETWORK MANAGEMENT SYSTEM

(Normative)

A1 GENERAL

- A1.1 The ESLS Network Management System (NMS) is a monitoring/management system used to monitor ESLS devices connected to the VicRoads communication network. See Figure B.1 below.
- A1.2 A large number of ESLS at school speed zones and strip shopping centres currently use the ESLS Network Management System (NMS).

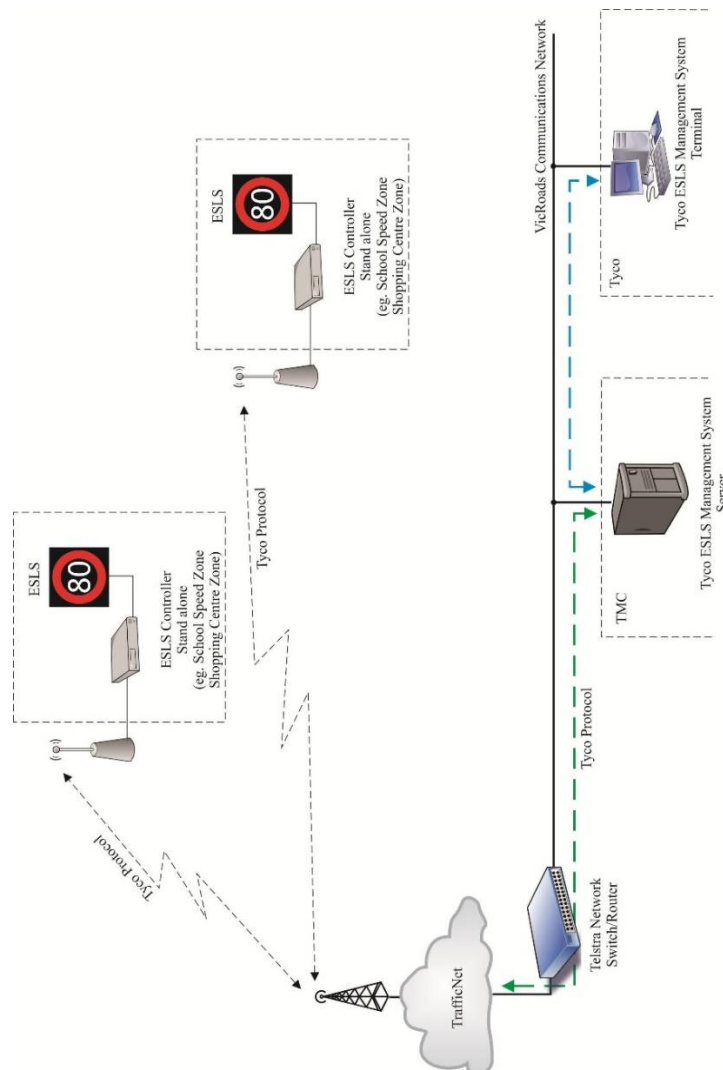


Figure B.1 – NMS communication/control schematic

A2 PROTOCOLS

- A2.1 Copies of the NMS compatible sign protocol specifications are available upon request from the Smart Journey Systems group.

APPENDIX B NETWORK MONITORING AND CONTROL SYSTEM

(Informative)

B1 GENERAL

- B1.1 VicRoads proposes to develop and/or implement a new ESLS Network Monitoring and Control System (NMCS) in the future.
- B1.2 The proposed system is expected to include, as a minimum, the following capability.
- B1.3 The new NMCS will be a monitoring/management system used to monitor ESLS devices connected to the VicRoads communication network. See Figure A.1 below.
- B1.4 In future ESLS at school speed zones and strip shopping centres shall use the Network Monitoring and Control System (NMCS).

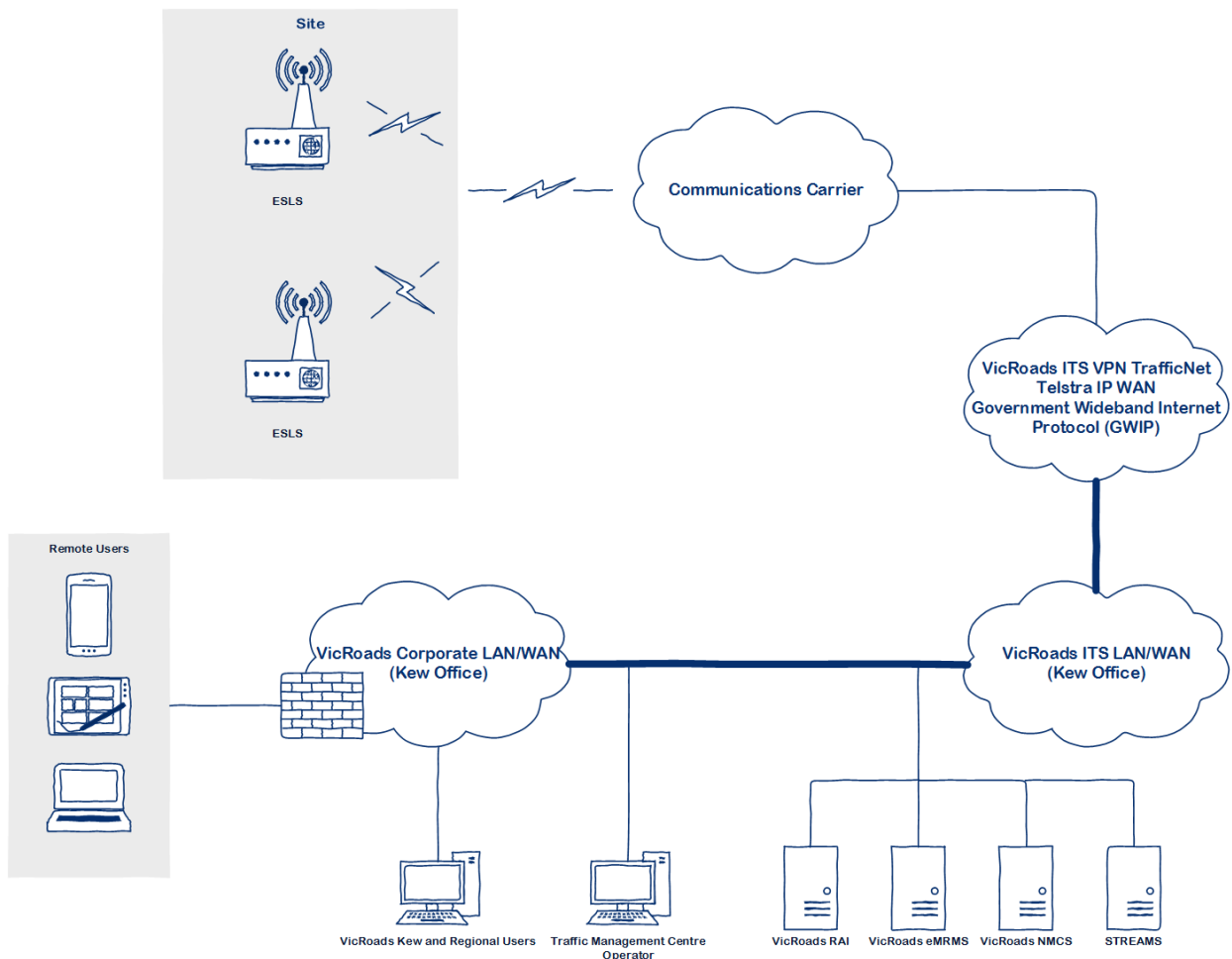


Figure A.1 – Example of possible Network Monitoring and Control System

B2 PROTOCOLS

- B2.1 This has been included for possible future use.

APPENDIX C VICROADS ITS PLATFORM

(Informative)

C1 GENERAL

- C1.1 VicRoads ITS platform currently uses the STREAMS system.
- C1.2 STREAMS is owned and maintained by Transmax Pty Ltd, a Queensland based company which is part of Queensland Main Roads.
- C1.3 STREAMS is an integrated control system which is being used by VicRoads to operate its ITS Freeway Management Devices on Melbourne's freeway network.
- C1.4 All ITS field devices must be compatible with STREAMS.
- C1.5 Typical ITS field devices connected to and operated by STREAMS include:
- Variable Message Signs (VMS)
 - Freeway Data Stations (FDS)
 - Ramp metering/control signs (RC)
 - Lane Control Signs (LCS)
 - Lane Use Signs (LUS)
 - Travel Time Signs (TTS)
- C1.6 The above devices are typically connected to STREAMS via a Field Processor (FP).

C2 FIELD PROCESSOR

- C2.1 The FP is used to interface internet protocol (IP) and serially connected field devices to STREAMS.
- C2.2 Communications between the FP and the ITS Field Device is typically RMS protocol.
- C2.3 The FP is typically installed within an ITS Field Cabinet.
- C2.4 The ITS Field Cabinet is typically located adjacent to the freeway.
- C2.5 In some situations, the FP may be located in VicRoads building at Kew.
- C2.6 A typical STREAMS connection schematic is shown in Figure C.1.

C3 COMPLIANCE WITH STREAMS

- C3.1 Where requested, ESLS must be fully compliant and compatible with STREAMS.
- C3.2 To ensure compliance with STREAMS, the supplier shall obtain a compliance certificate from Transmax Pty Ltd for operation on VicRoads system.
- C3.3 A copy of Transmax Pty Ltd certification shall be provided to VicRoads.

C4 SPECTRUM NETWORK MANAGEMENT SYSTEM

- C4.1 The Spectrum Network Management System (Spectrum NMS) is a communications monitoring/management system used to monitor/manage IP addressable devices connected to the VicRoads communication network.
- C4.2 Spectrum NMS can be used to monitor/manage any device that has an IP address without any modification required by the device.

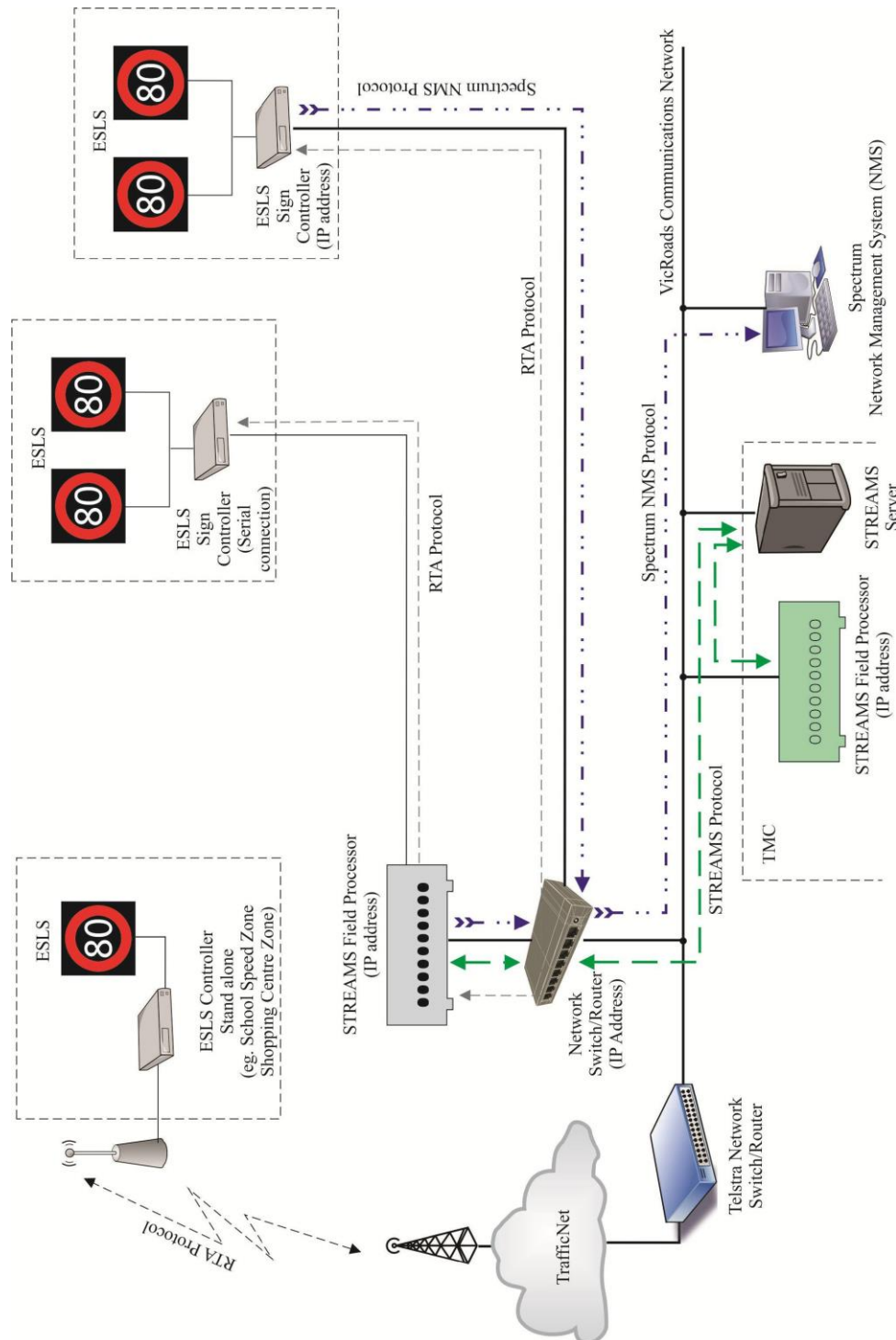


Figure C.1 - STREAMS communications/control schematic

APPENDIX D FAULT NOTIFICATIONS AND LOGGING

(Normative)

D1 MINIMUM REQUIRED FAULT NOTIFICATIONS

D1.1 Each ESLS shall provide to the control system, as a minimum, the alarm notifications detailed in Table D.1.

Alarm	Description	Classification	Required System Response
GPS Invalid	The sign has failed to obtain a valid data string from the GPS network to synchronise its internal time clock for the past 24 hours.	Critical	Display Alarm & raise a fault.
GPS Fail	The sign has failed to obtain any data from the GPS network for the past 24 hours.	Critical	Display Alarm & raise a fault.
Processor Watchdog	The sign processor has flagged a watchdog alarm.	Critical	Display Alarm & raise a fault.
Processor or System Failure	The sign processor or system has failed.	Critical	Display Alarm & raise a fault.
Communications Failure	The sign has stopped communicating with the management system.	Critical	Display Alarm & raise a fault.
Power Supply Failure	The sign has lost internal power.	Critical	Display Alarm & raise a fault.
Mains Failure	The external power source to the sign has failed.	Critical	Display Alarm & raise a fault.
Solar Panel Failure	The solar panel has stopped operating.	Critical	Display Alarm & raise a fault.
Solar panel tamper	The solar panel has been moved.	Critical	Display Alarm & raise a fault.
Battery Level Warning 1	The battery has 24 hours of charge left.	Critical	Display Alarm & raise a fault.
Battery Level Warning 2	The battery has less than 6 hours charge left.	Critical	Display Alarm & raise a fault.
Battery Failure	The battery has failed.	Critical	Display Alarm & raise a fault.
Battery Overcharge	The battery is overcharged or exceeded maximum operating temperature.	Critical	Display Alarm & raise a fault.
Excessive Internal Temperature	The internal temperature of the sign has exceeded the maximum safe level for the internal components.	Critical	Display Alarm & raise a fault.
Display shut down - Numerals	20% of the LED's in a numeral have failed and the sign has shutdown.	Critical	Display Alarm & raise a fault.
Display shut down - Numerals	20% of the LED's in the annulus have failed and the sign has shutdown.	Critical	Display Alarm & raise a fault.
Facility Switch – Not in AUTO position	Facility switch has been set to a set speed.	Critical	Display Alarm & raise a fault.

Facility Switch – OFF	Facility switch has been turned to the ‘OFF’ position.	Critical	Display Alarm & raise a fault.
Door	The sign door is open	Critical	Display Alarm & raise a fault.
Tilt	The sign is no longer vertical	Critical	Display Alarm & raise a fault.
Surge Protection	Surge Protection device is low	Minor	Display Alarm & raise a fault.

Table D.1 - Minimum required fault notifications

D2 MINIMUM LOGGING REQUIREMENTS

D2.1 Each ESLS shall provide store, as a minimum, the log entries detailed in Table D.2 below.

Entry	Description	Classification
Battery Overcharge	The battery is overcharged or exceeded maximum operating temperature.	Battery fault/status
Battery low status level 3	Battery low status level 3 - critical (shutdown).	Battery status
Battery low status level 2	Battery low status level 2 - 6 hours of charge left.	Battery status
Battery low status level 1	Battery low status level 1 - 24 hours of charge left.	Battery status
Mains Failure	The external power source to the sign has failed.	Mains fault/status
Surge Protection	Surge Protection device is low	Sign fault/status
Solar Panel Failure	The sign has lost internal power.	Sign fault/status
Solar panel tamper	The solar panel has been moved.	Sign fault/status
10% LED failure - Annulus	10% of the LED's in annulus have failed.	Sign display fault/status
20% LED failure - Annulus	20% of the LED's in annulus have failed.	Sign display fault/status
LED failure – Annulus Failed	Annulus has failed.	Sign display fault/status
20% LED failure - Digits	20% of the LED's in any numeral have failed	Sign display fault/status
LED failure – Annulus Digits	Digits have failed.	Sign display fault/status
Dimming mode	Automatic or manual dimming mode	Sign status
Luminance level	Current luminance level	Sign status
Luminance controller failure	Sign luminance controller failure	Sign fault/status
Tilt	Sign tilt error	Sign fault/status

Sign time	Current sign time in seconds	Sign status
Firmware version	Current sign firmware of the sign	Sign status
Sign manufacturer	Sign manufacturer	Sign status
Sign model	Sign model	Sign status
Critical error	The sign is disabled due to a critical error and hasn't been overridden or cleared to run automatically by an operator or technician	Sign status/error
Sign up time	The time/duration of continuous operation of the sign	Sign status
Sign rings	Number of rings of in the annulus to flash	Sign status
Control mode	Manual or automatic sign operation mode	Sign status
Door	Sign open door alarm	Sign status/alarm
GPS status	Current status of GPS	Sign status
Site ID	Site ID of the sign	Sign status
Sign ID	ID allocated to the sign	Sign status
Temperature	Current temperature of the sign	Sign status
Phone number	Phone number of the sign's sim card	Sign status
Number of signs in Group	Number of signs in Group	Sign status
Solar current	Solar current measurement	Sign status
Battery status	Current battery measurement	Sign status
Voltage level	Current battery voltage measurement	Sign status
Internal communication error	Internal communications failure	Sign status/error
Display time-out	Sign display time-out	Sign status/error
Master/Slave comms failure	Master/Slave comms failure	Sign status/error
Watchdog	The sign processor has flagged a watchdog alarm.	Sign status/error

Table D.2 - Minimum logging requirements

APPENDIX E GUIDELINES FOR PURCHASING AND INSTALLATION

(Informative)

E1 DETAILS TO BE INCLUDED WHEN TENDERING

E1.1 Installation requirements will be site specific and detailed in individual tender documents.

E1.2 The following details should be considered when preparing tender documents:

- a) The size of the proposed signs, i.e. whether A, B or C size;
- b) Whether single speed, dual speed or multiple speed;
- c) Whether the proposed signs are mains or solar powered;
- d) Requirements for battery backup;
- e) Whether the display is discrete or a matrix;
- f) The numbers of signs and speed values to be provided;
- g) The proposed activation mode;
- h) The method of monitoring and control system (NMCS, NMS, STREAMS, SCATS, SRAS) the signs are to be operated on,
- i) The mounting arrangements for the signs;

APPENDIX F REQUIREMENTS FOR TYPE APPROVAL

(Normative)

F1 GENERAL

F1.1 Electronic Speed Limit signs for use on VicRoads projects are required to hold current VicRoads Type Approval.

F1.2 The Product Compliance evaluation process shall be carried out in accordance with VicRoads Guideline TCG 016.

F1.3 To enable assessment for the purpose of granting Type Approval, the manufacturer/supplier is to submit a formal request for Type Approval, for each sign type submitted, accompanied by the following:

- A complete working sample of the sign.
- An outline drawing showing the general presentation and overall dimensions of the complete sign.
- Documentation to demonstrate that the sign has been manufactured and supplied under an approved quality assurance system.
- Documentation to demonstrate that the sign conforms to the requirements of VicRoads Specification. This may be by means of submitting test results from approved and appropriately qualified independent testing organisations, or providing the manufacturer's assurance that the product complies with each paragraph of the specification, as appropriate.

F2 REQUIRED NATA ACCREDITED TESTING

F2.1 Notwithstanding F1 above, the manufacturer/supplier shall submit test results from a NATA accredited testing organisation to demonstrate compliance with the following:

Requirements (in accordance with AS 5156)	Evidence
Temperature and humidity	Test Report
Enclosure protection	Test Report
EMC Compliance	Test Report
Photometric	Test Report
Colorimetric	Test Report

F3 COMPATIBILITY WITH NMCS

F3.1 Where applicable, the supplier shall provide evidence of compatibility with the NMCS.

F4 COMPATIBILITY WITH NMS

F4.1 ESLS intended to be connected to the NMS must be fully compliant and compatible.

F4.2 To ensure compliance the supplier shall obtain a compliance certificate prior to operation on the NMS.

F4.3 A copy of this certification shall be provided to VicRoads.

F5 COMPATIBILITY WITH STREAMS

F5.1 Where applicable, the supplier shall provide evidence of compatibility with STREAMS.

F6 OTHER REQUIRED INFORMATION

F6.1 Confirmation that the manufacturer is on the VicRoads Register for the Pre-qualification for Supply of On-Road Electronic Devices.

F6.2 Copy of LED manufacturer's specification for each LED type used.

F7 ASSESSMENT PROCEDURE

F7.1 The assessment procedure for an ESLS may include, but not limited to, the following:

- a) Assessment of construction, workmanship and critical dimensions;
- b) Preliminary assessment of the sign under continuous burning at the VicRoads Test Rack for a period of not less than three months; and
- c) Evaluation of the submitted data against the requirements of the specification.

F7.2 Where some of these procedures have been completed prior to formal submission, the results will be considered in the evaluation, provided there is no relevant change in the design of the sign.

F7.3 The supplier is to state whether tests carried out prior to formal submission were carried out on an identical sample of the sign.

F7.4 VicRoads may require a trial installation of the sign to be undertaken.

F8 TYPE APPROVAL

F8.1 The decision to grant a Certificate of Type Approval is at the sole discretion of VicRoads.

F8.2 VicRoads may require additional information or testing to be carried out as part of its evaluation of the product.

F8.3 If the product is approved, a Certificate of Type Approval will be provided to the supplier. Until such time as this Certificate is issued, the product is not to be used for VicRoads works.