



**Transport
for NSW**

INTELLIGENT TRANSPORT SYSTEMS

TRAFFIC SYSTEMS

SPECIFICATION NO. TSI-SP-082

PORTABLE VARIABLE SPEED LIMIT SIGN

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RECORD OF AMENDMENTS

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1 SCOPE

This specification covers the requirements for Portable Variable Speed Limit Sign (Portable VSLS), to be used in New South Wales.

Variable Speed Limit Signs (VSLS) are illuminated signs that comply with the format and colours specified for speed limit signs in the NSW Road Rules, with displayed speed limits that are capable of being changed by electronic means. Portable VSLS are VSLS signs with the display is mounted and deployed on a re-locatable trailer.

Portable VSLS are used to advise road users of temporary regulatory control of traffic speed. PVSLS may only be used in accordance with 20.346 - TfNSW Technical Manual - Traffic control at work sites [10].

2 REFERENCES AND APPLICABLE DOCUMENTS

2.1 Australian and International Standards

- [1] AS 1743 – Road Signs - Specifications
- [2] AS 4509.2 – Stand-alone power systems part 2: system design
- [3] AS 4852.2 - Variable message signs Part 2 Portable signs
- [4] AS 5156 – Electronic Speed limit Signs
- [5] ISO 9001 – Quality Management System
- [6] IEC 60068-2-30 Environmental testing: Damp heat, cyclic.

2.2 TfNSW Documents

- [7] TSI-SP-003 – Communications Protocol for Roadside Devices
- [8] TS201 – Approval of ITS Field Equipment
- [9] Drawing VM005-01 – Housing Facility Key drawing
- [10] 20.346 – Technical Manual - Traffic control at work sites.

2.3 Other Documents

- [11] NSW Work Health and Safety Act 2011
- [12] TCS 062 Trailer mounted Electronic Speed Limit Signs (ESLS): issuer VicRoads.

2.4 Clause Referencing of documents

Within in this document a numbered clause reference has sometimes been given to help the user to locate the relevant section of a document. Where this has been done, it respectively refers to the versions listed below:

- AS 4852.2 [3]: references apply to version 2019
- AS 5156 [4]: references apply to version 2020
- TCS 062 [12]: references apply to revision A, April 2015.

Note however that the most recent version of a referenced document applies, so if a later version is issued, the equivalent section shall be sought and applied.

3 DEFINITIONS AND GLOSSARY OF TERMS

The definitions and abbreviations given in AS 4852.2 shall apply, unless varied by the listing below:

Term	Definition
GPS	Global Positioning System
GUI	Graphical user interface
ISLUS	Integrated Speed Limit and Lane Use Signs
ITS	Intelligent Transportation Systems
PHCS	Product Host Control System (a remote server based system provided by the supplier to facilitate operation and monitoring of multiple signs)
PVSLs	Portable Variable Speed Limit Sign
Sign	PVSLs unless the context of use shows otherwise
TfNSW	Transport for NSW, a New South Wales government agency
TSI	Traffic Systems Integration
VSLs	Variable Speed Limit Sign

4 GENERAL REQUIREMENTS

4.1 Applicable Standards and Specifications

Where not otherwise specified, the sign shall be in accordance with relevant Australian Standards or Specifications, and in their absence, with relevant IEC or ISO Standards or Specifications.

4.2 Work Health and Safety

The sign and its installation and usage, including the Supplier's instructions for installation, operation and maintenance, shall comply with the requirements of the NSW Work Health and Safety Act [11].

5 DESIGN

5.1 General

The sign shall comprise a roadworthy trailer bearing an LED display to show variable speed limits, a solar chargeable power system, and a control system enabling the sign to be controlled both locally and remotely.

5.2 Compliance with Standards

The sign shall comply with Section 2 of AS 4852.2 [3]

5.3 Markings and Labels

5.3.1 The sign shall meet the requirements for RCM Compliance and shall bear the applicable RCM label.

- 5.3.2 The sign shall bear any other additional marking if so required by regulatory legislation current at the time for the state of NSW, such as relating to the relevant certificate of suitability.

5.4 Trailer

- 5.4.1 The trailer shall comply with section 3 of TCS 062 [12] except as varied below::
- 5.4.2 References to the Victorian road network are to be replaced by reference to the NSW road network.
- 5.4.3 References to the Victorian road regulations are to be replaced by reference to the NSW road regulations.
- 5.4.4 References to the VicRoads requirements are to be replaced by reference to the TfNSW requirements.

6 MECHANICAL REQUIREMENTS

6.1 Compliance with Standards

The sign shall comply with Section 3 of AS 4852.2 [3].

6.2 Display Articulation

- 6.2.1 Facilities shall be provided for the display to be raised and locked in the operating position.
- 6.2.2 The display's operating height shall be adjustable, such that the lower edge of the display panel can be positioned at any chosen height in the range from 2m to 4m above the ground.
- 6.2.3 When raised in the normal operating position, the sign display panel shall be capable of rotation through 360 ° on the vertical axis with reference to the trailer orientation.
- 6.2.4 The sign shall incorporate means to secure the display panel for transport, so it neither becomes damaged nor presents a danger to others from detachment.

Note: The sign display panel may be either turned to align closely with the direction of travel or tilted face down in an approximately horizontal position to reduce wind force loading while being transported.

7 ELECTRICAL REQUIREMENTS

7.1 Compliance with Standards

The sign shall comply with Section 4 of AS 4852.2 [3].

7.2 Mains Charging

The sign shall be equipped such that the storage battery can be charged or topped up from mains supply voltage or suitable portable generator (~240V A.C.) by a plug lead, in the event that the solar supply input is insufficient.

7.3 GPS Receiver

7.3.1 The sign shall have a GPS receiver capable of measuring the location of the sign and able to receive time updates.

7.3.2 The GPS parameters of time and location shall be remotely accessible to the product host control system.

7.4 Wireless Link

7.4.1 The sign shall be supplied with the hardware needed to operate a wireless link (e.g. items including modem and antennae).

7.4.2 The link shall enable the sign to connect remotely to a host control system.

7.5 Facility Switch

7.5.1 A facility switch shall be provided for local (on-site) control of the message display mode, with 2 positions, AUTO and BLANK.

7.5.2 The switch shall be operable from the exterior of the housing by means of a key complying with Drawing VM005-1 [9].

7.5.3 "Auto" shall be the normal operation mode.

7.5.4 "Blank" shall blank the display by de-powering it. It shall leave the controller operational and the solar power system still charging. This shall not be dependent upon functionality of the controller software to execute the operation of de-powering the display.

7.5.5 The controller shall monitor the position of the facility switch.

7.5.6 The facility switch shall comply with clauses 3.4.2 to 3.4.4 of AS 5156 [4]

8 DISPLAY AND OPTICAL REQUIREMENTS

8.1 Compliance with Standards

The sign display shall comply with Section 5 of AS 5156 [4].

8.2 Conspicuity

8.2.1 Conspicuity devices (beacons) shall be provided as described in AS 5156 [4].

8.2.2 It shall also be possible to flash the inner rings/area of the annulus. The number of pixels flashing shall be between 60% and 80% of the pixels in the annulus. Annulus flashing shall have a nominal cycle time of 1 s and a duty cycle of 50%.

8.3 Dimensions

8.3.1 The display shall be a 'C' size speed limit sign as defined in AS 1743 [1].

8.3.2 The display shall be square in shape and approximately 1050mm x 1050mm.

8.4 Required Display Frames

8.4.1 The following speed numerals shall be available, as pre-set frames in the sign: 10, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100, and 110.

8.4.2 Speed numeral displays shall be displayed together with the speed annulus.

8.4.3 Frames shall be stored in non-volatile memory.

8.4.4 Frame numbers, message numbers and sign responses in protocol TSI-SP-003 [7] shall be as given in Appendix A.

9 OPERATION AND CONTROL

9.1 Compliance with standards

The sign shall comply with Section 6 of AS 5156 [4], except as supplemented below.

9.2 Activation

The sign shall be capable of being activated by all of the methods a), b), c), d) and e) given in clause 6.1 of AS 5156 [4].

9.3 Protocol

The sign shall support protocol TSI-SP-003 for communication with a host control system.

9.4 Operation

It shall be possible to carry out the following operations locally and remotely:

- 9.4.1 Identify, select and display a frame.
- 9.4.2 Blank the display.
- 9.4.3 Manage levels of access for different user types, including operator, maintainer and manufacturer.
- 9.4.4 Upgrade firmware and software.
- 9.4.5 Set the source and time zone for time synchronisation, used for the logs.
- 9.4.6 Set an identity for the sign (an input text string).
- 9.4.7 Configure remote connections and other key parameters.

9.5 Monitoring

The sign shall give local and remote access to at least the following information:

- 9.5.1 The identity of the currently displayed frame of the sign.
- 9.5.2 A list of the available stored frames of the sign.
- 9.5.3 The status of individual pixels of the sign (on, off or faulty, even when inactive).
- 9.5.4 Status of the power supply reservoir batteries.
- 9.5.5 Status of solar power to the sign.
- 9.5.6 Location of the sign as obtained from the GPS receiver.
- 9.5.7 If the sign has any fault (indicator that one or more faults are active on the sign).
- 9.5.8 Whether the sign has been blanked as a result of a fault that caused the sign to blank its display automatically.
- 9.5.9 Position of facility switch.
- 9.5.10 Sign firmware and software version numbers.
- 9.5.11 Time and date of the sign's clock, including configured source.
- 9.5.12 Time and date of the sign's GPS receiver.
- 9.5.13 Logs in the sign.

9.6 Logging

- 9.6.1 Logs shall be stored in the sign in non-volatile memory.
- 9.6.2 It shall not be possible to either edit logs, or to delete logs.

9.7 Event Log

- 9.7.1 An event log shall be present with a minimum capacity of 5000 entries.
- 9.7.2 The event log shall record the identity of displayed frames, when they commenced being displayed, and when they ceased being displayed.
- 9.7.3 The event log shall record software and firmware updates.
- 9.7.4 The event log shall record when the sign is manually blanked, and when manual blanking is turned off (method assumed to be that described in the manual).

9.8 Fault Log

- 9.8.1 A fault log shall be present with a minimum capacity of 500 entries.
- 9.8.2 Fault Logs shall contain entries for both the onset of the fault, and the clearance of the fault (when cleared).
- 9.8.3 Faults that can be attributed to a primary fault shall not be logged. The primary fault shall be logged.
- 9.8.4 The fault log shall record issues relating to a problem with the sign, so as to facilitate maintenance functions.

Note: Subject areas that may typically be covered by fault logs include critically low battery, solar power related faults, memory, LED failures, driver failures, internal and external communications failures, over-temperature, and failures of light sensors used for dimming.

9.9 Alarm Log

- 9.9.1 An alarm log shall be present with a minimum capacity of 500 entries.
- 9.9.2 The alarm log shall be used to record occurrences that do not come under the definitions of faults or events e.g. moderately low battery.

9.10 Security Control

The equipment supplier shall provide features/facilities to assure that the PVSL is not susceptible to hacking and inappropriate display setting.

This shall apply to both remote and local control/display setting.

10 ENVIRONMENTAL REQUIREMENTS

The sign shall comply with Section 7 of AS 4852.2 [3].

11 SUPPORTABILITY

11.1 Design for Maintenance

- 11.1.1 The equipment design and construction shall take account of ergonomic factors relating to operation and maintenance safety (item [3]).
- 11.1.2 A modular approach should be used in designing the equipment to facilitate maintainability, ease of installation and commissioning.
- 11.1.3 Equipment layout within housings shall be designed for ease of access during operation, maintenance and service. Access to individual modules shall be provided for replacement of the module without the need for removing other components or wiring. The access to and replacement of modules shall not require the removal of fasteners that are not reusable. Preference shall be given to fasteners which are held captive when loosened.
- 11.1.4 Preference shall be given to only requiring standard tools for preventive and repair maintenance activities. A standard tool in this context is considered one that is readily available from common hardware retailers, as distinct from one that has very restricted supply sources, such as only available from the PVSLS manufacturer.

11.2 Reliability

- 11.2.1 In addition to the requirements of clause 5.1.1.5 of AS 5156 [4], the following requirements shall apply.
- 11.2.2 The MTBF of the PVSLS shall be not less than 45,000 hours.
- 11.2.3 A failure for the purpose of the above MTBF limit is defined as any defect (hardware or software) which causes the display to be blanked. It also includes failures where the actual display differs from the intended display to the extent that viewers are unlikely to comprehend the intended speed.
- 11.2.4 As part of approval submissions in the TS201 [7] process, the supplier shall provide the MTBF of the PVSLS, and information and calculations supporting the MTBF value provided.

11.3 Software

- 11.3.1 In addition to the requirements of clause 6.8 of AS 5156 [4], the following requirements shall apply.
- 11.3.2 The PVSLS manufacturer/supplier shall control the issue of firmware/software versions for the PVSLS according to their quality plan for this activity.
- 11.3.3 The supplier shall provide a local means to upgrade the PVSLS's software/firmware, should this be needed post deployment. Details shall be described in maintenance manuals.
- 11.3.4 The PVSLS shall revert to the previous version if the new version fails to validate or install correctly.
- 11.3.5 The PVSLS shall not be rendered inoperable in the event of an interruption during the software/firmware upgrade process, for example a power failure.

12 QUALITY ASSURANCE

12.1 Quality System

The Supplier and the manufacturer shall operate a quality management system complying with ISO 9001 [5] and certified by an accredited quality management system certification body.

12.2 Quality Plan

The manufacturer shall document a quality plan. A copy of this quality plan shall be provided to TfNSW as part of the TS201 [7] approval process. Acceptance of this quality plan by TfNSW is a prerequisite to gaining overall approval.

The quality plan shall include details of model numbers, traceability of key components, in process and release inspections and records, and control of software/firmware release associated with update/rework of deployed PVSLs.

12.3 Quality Audits

TfNSW reserves the right to examine the Manufacturer's quality records pertaining to an order. TfNSW also reserves the right to arrange for an independent quality audit concerning items in contract.

APPENDIX A FRAME AND MESSAGE NUMBERING IN TSI-SP-003

Speed limit displays for use with the TSI-SP-003 protocol can be demanded either as graphic frames, or as messages. The following sections describe this further.

A.1 Graphic Frame numbers

Graphic frame speed limit displays are numbered FRAME 'abc' where 'ab' is the display speed in km/h divided by 10, and 'c' is the display attribute (such as the annulus), as below:

Value of 'c'	Display attribute	Example frame no.	Example description
0	Fixed annulus	100	100 km/h with fixed annulus
1	Flashing annulus	101	100 km/h with flashing annulus
2	No annulus, flashers up/down	102	100 km/h with no annulus, but with up/down flashers
3	Fixed annulus, flashers up/down	103	100 km/h with fixed annulus, and up/down flashers
4	Flashing annulus, flashers up/down	104	100 km/h with flashing annulus, and up/down flashers

The 25 km/hr speed differs slightly and is assigned frame numbers as follows:

Frame no.	Description
25	25 km/h with fixed annulus
26	25 km/h with flashing annulus
27	25 km/h with no annulus, but with up/down flashers
28	25 km/h with fixed annulus, and up/down flashers
29	25 km/h with flashing annulus, and up/down flashers

A.2 Message numbers

Messages are used in the TSI-SP-003 protocol to trigger frame sequences for speed changes. These are defined as MESSAGE "abc" where 'ab' is the display speed in km/h divided by 10, and "c" specifies the display attribute (such as the flashers), as below:

Value of "c"	Display Attribute	Example Message No.	Example Description
1	Speed Change without Flashers Frame "ab1" 15 seconds, then Frame "ab0" indefinitely	101	Speed Change to 100 km/h without Flashers Frame "101" for 15 seconds, then Frame "100" indefinitely
4	Speed Change with Flashers Frame "ab4" 15 seconds, then Frame "ab3" indefinitely	104	Speed Change to 100 km/h with Flashers Frame "104" for 15 seconds, then Frame "103" indefinitely