INTELLIGENT TRANSPORT SYSTEMS

TRAFFIC SYSTEMS

SPECIFICATION NO. TSI-SP-047

DYNAMIC DIRECTION SIGNS

Issue: 1.0
Dated: 20/08/2020
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**RECORD OF AMENDMENTS**

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<th>Summary</th>
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1 SCOPE

1.1 General

This specification covers the general requirements for Dynamic Direction Signs. They are used in permanent positions above or adjacent to the roadway, in the state of New South Wales.

These signs shall have the general appearance of a static directional sign, as described in AS 1743 [1], but have the whole face as an LED matrix display.

The sign is to operate as a Changeable Message Sign (CMS). The sign is to provide capability to switch displays depending on the road requirements e.g. at different times of the day when lanes are closed or when a tunnel is closed, and in tidal flow systems.

The sign comprises a display, a controller, and a roadside cabinet. The controller shall control just one physical display, providing messages (graphic display faces) according to the commands sent from the host control system. Any coordination required between different physical signs is to be managed by the host control system.

The following items are out of scope of this specification:

- Overall design of the image displayed on the sign
- Dimensions of the sign.
- Requirements for the sign support structure
- Static Signs with dynamic inserts, where much of the sign face is static, but some parts of the sign have LED or prismatic inserts that can change face.

1.2 Diagram of Alternate Messages

An example of a dynamic direction sign showing typical alternate messages, with the static sign’s specified dark green background is given below.

![Figure 1 – Typical Sign Faces](image)

Signs may have more than two alternative faces. For examples of 3 and 4 face signs, refer Appendix B.
2 REFERENCES AND APPLICABLE DOCUMENTS

2.1 Australian Standard Specifications

[1] AS/NZS 1170.2 – Structural design actions - Wind actions
[2] AS 1743 – Road signs - Specifications
[6] AS/NZS 3000 – Electrical Installations (known as the Australian wiring rules)
[7] AS/NZS 3100 – Approval and test specification – General requirements for electrical equipment
[8] AS/NZS 3820 Essential safety requirements for electrical equipment
[9] AS/NZS 61000.6.1 – Electromagnetic Compatibility (EMC) - Immunity

2.2 TfNSW Specifications and Documents

[13] TSI-SP-003 – Communications Protocol for roadside devices
[16] TSI-SP-071 - ITS Equipment Communication Interface Requirements
[17] TS201 – Approval of ITS Field Equipment
[18] VM005-01 – Housing Facility Key drawing

2.3 Other References

[19] EN 12966 Road vertical signs – Variable message traffic signs
[21] NTCIP 1203 – Object definitions of Dynamic Message Signs
3 DEFINITIONS AND GLOSSARY OF TERMS

The definitions and abbreviations given in EN12966 [19], and NTCIP 1203 [21] shall apply, unless varied by the listing below:

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display System</td>
<td>The visual display seen by the road user</td>
</tr>
<tr>
<td>Host control system</td>
<td>A remote computer system that communicates with the sign to effect control of the sign under normal operation. May be referred to as the ‘master’ in communications protocols.</td>
</tr>
<tr>
<td>Product Host control System</td>
<td>A system provided by the sign manufacturer to support sign configuration and maintenance.</td>
</tr>
<tr>
<td>IEC</td>
<td>International Electro-technical Commission</td>
</tr>
<tr>
<td>ISO</td>
<td>International Standards Organisation</td>
</tr>
<tr>
<td>LED</td>
<td>Light emitting diode</td>
</tr>
<tr>
<td>Message</td>
<td>An image on a sign display face intended to convey information. It may be graphical, text, or a combination.</td>
</tr>
<tr>
<td>NSW</td>
<td>New South Wales</td>
</tr>
<tr>
<td>RCM</td>
<td>Regulatory Compliance Marking</td>
</tr>
<tr>
<td>RGB</td>
<td>Red-Green-Blue</td>
</tr>
<tr>
<td>Sign</td>
<td>Display system, sign controller and ground level enclosures, but excluding the support structure.</td>
</tr>
<tr>
<td>Sign controller</td>
<td>The control equipment unit that is a required component for operation of the sign.</td>
</tr>
<tr>
<td>Supplier</td>
<td>An organization that is contracted or intending to supply sign(s) covered by this Specification.</td>
</tr>
<tr>
<td>TfNSW</td>
<td>Transport for New South Wales, a NSW Government agency</td>
</tr>
<tr>
<td>UPS</td>
<td>Uninterrupted Power supply</td>
</tr>
</tbody>
</table>

Table 1 – Definitions and Glossary of Terms
4 GENERAL REQUIREMENTS

4.1 Work Health and Safety

The sign and its installation shall comply with the requirements of the NSW Work Health and Safety Act 2011.

4.2 EN 12966 compliance

4.2.1 The sign shall comply with EN 12966 [19], with class designations tabled below:
   (a) Luminance, class: L3
   (b) Luminance Ratio, class: R3
   (c) Beam width, class: B6
   (d) Colour class: C1.
   (e) Temperature class: T1
   (f) Ingress protection against water and dust, class: IP55
   (g) Temporary deflections caused by wind loads, class: WL5
   (h) Temporary deflections caused by bending, class: TDB0
   (i) Permanent deflections caused by dynamic snow loads, class: DSL0

4.2.2 Suppliers shall show certification from an accredited independent testing facility demonstrating compliance to EN12966 [19] for the above class set (or higher).

4.3 Compliance with Specifications

All equipment and materials, where not otherwise specified, shall be in accordance with Australian Standard Specifications where such exist, and in their absence, with appropriate IEC, EN or ISO Standards/Specifications.

4.4 Design

The sign shall be designed to provide reliable operation for the roadside environment in the state of NSW.

4.5 Design Life

The designed operating life of the sign shall be as follows

4.5.1 Optical elements, minimum 10 years, remaining in specification.

4.5.2 Electrical elements, minimum 15 years.

4.5.3 Display enclosure and ground level cabinets minimum 20 years.

4.5.4 Sign mounting, support and structural elements, minimum 50 years.
4.6 Markings

4.6.1 Markings shall be clear, waterproof, and permanent such that they remain legible for the design life, and in a position that allows them to be read.

4.6.2 The sign controller, sign display enclosure, ground level housing, and any UPS housing if separate, shall each be marked with at least the items listed in 4.6.3.

4.6.3 Markings shall include product/model/variant name, manufacturer name, serial number, rating of the power supply system including voltage and power consumption, and relevant regulatory compliance marking (RCM).

5 MECHANICAL REQUIREMENTS

5.1 Sign Enclosure

5.1.1 The front face of the display enclosure shall be matt black.

5.1.2 Other external surfaces of the display enclosure shall be grey.

5.1.3 Lockable access doors shall be provided on the rear that open left or right, each with width maximum 1.2m. Door stays shall be provided to secure doors in an open position.

5.1.4 Doors shall permit display panels and other key items to be accessed for maintenance, including when the sign is mounted on a suitable support structure.

Note: A viewing window is not required, nor expected to be present.

5.2 Interface with Sign Support Structure

5.2.1 The sign display with its mounts shall be certified as able to meet relevant statutory structural requirements, including wind loading, when supported on its mounts in the designed manner.

5.2.2 The sign shall have appropriate structural integrity and features to enable it to be lifted into position without being damaged with the use of a lifting beam.

5.3 Roadside Cabinet

5.3.1 A ground level housing shall be provided that complies with TSI-SP-012 [15] except where varied by this document. It shall be supplied complete with the items below:

5.3.2 A main switchboard complying with AS 3000 [6] for the mains power supply to the sign installation.

5.3.3 A residual current device (RCD) for the switchboard. This shall be a 30mA type II residual current device conforming to AS/NZS 3190.

5.3.4 A double socket outlet with integral 30mA type II residual current device conforming to AS/NZS 3190. The socket-outlet shall be supplied and protected by a dedicated circuit-breaker in the main switchboard.

5.3.5 Relays and control circuits, including terminations for all interconnecting cables.
5.3.6 Sign controller.

5.3.7 Back-up battery for control unit, as defined in item 6.2.

5.3.8 A key operated facility switch with six operational positions, accessible from outside the cabinet, allowing a technician to either turn the display off, select automatic control, or select one of up to four alternate messages/graphics. There shall be space for labelling each switch position.

5.3.9 The facility switch position shall be selected by a key as per drawing VM005-01, with the actuator head recessed 10mm to 12mm inside a metal ferrule.

5.3.10 When the facility switch described above is set to the “off” position, this shall disconnect the display from power by direct electrical means, rather than via software. This shall turn off the display even if the sign’s processors are unresponsive.

5.3.11 Vacant shelf area, sufficient for the installation of a modem or other small additional hardware.

5.3.12 Space and mounting points shall be provisioned in the cabinet for an optical fibre cable termination tray. Unless otherwise defined by a project, mountings shall be provided for a 19” rack mount sliding tray of 1-unit height for this purpose.

5.3.13 A door switch, allowing the sign controller to flag when the cabinet door is open.

6 ELECTRICAL REQUIREMENTS

6.1 General

6.1.1 The sign and electrical installation for the sign shall conform to all applicable requirements of AS 3000 [6], AS 3100 [7] and AS 3820 [8]

6.1.2 The sign shall operate correctly and reliably from a mains power supply with supply voltages over the range 205 V to 264 V rms and frequency 48 Hz to 52 Hz.

6.1.3 The equipment shall be protected from electrical damage outside the ranges detailed in item 6.1.2.

6.1.4 Surge and transient protection shall be provided for the sign, including electrical and communications supply paths, to withstand the surges specified in AS/NZS 1768 [3], Category B, with medium exposure peak amplitudes, for:

(a) Display System items

(b) Ground level housing items

6.1.5 Lightning protection in accordance with AS 1768 [3] shall be provided to sign installations. Information describing the required lightning protection circuit and earth resistance shall be given in the manual.

6.2 Battery backup

6.2.1 A battery backup system shall be provided with each sign, to maintain control unit function in the event of loss of mains/UPS power.
6.2.2 This shall be able to maintain normal sign operation, except for display, for 12 hours, including any communication services.

6.2.3 The battery system shall be a leak free low maintenance type, automatically recharged from an internal system provided in the sign.

6.3 Electromagnetic Compatibility (EMC)

6.3.1 Immunity: The sign shall conform to AS 61000.6.1 [9]

6.3.2 Emissions: The sign shall conform to AS 61000.6.3 [10]

6.4 Real-time Clock

6.4.1 The sign controller shall have a real-time clock, that provides for the time and date functions of years, months, days, hours, minutes, and seconds

6.4.2 The clock accuracy shall be better than ± 5 seconds a week.

6.4.3 The clock shall have a dedicated backup battery that is recharged by the system, and in the absence of external power is able to operate the clock for at least 1 year.

6.4.4 The clock shall synchronise with the time source configured by the user. Configurable options shall include time messages received from the host control system, a network IP based time server, and the time base of the sign’s GPS receiver.

6.5 GPS Receiver

6.5.1 The Display system shall have a GPS receiver capable of measuring the location of the sign’s display, and able to receive time updates.

6.5.2 The GPS parameters of time and location shall be remotely accessible via the control unit and the protocol.

6.6 Power consumption

6.6.1 The maximum power consumption of signs at full brightness, with all pixels in the sign lit as colour white, and supporting ancillaries such as heaters and fans running, shall not exceed 120 W/m². (for signs of area over 10m²).

6.6.2 The sign shall not exceed 32A current (with 240V supply).

6.6.3 The sign shall be designed such that, under all power restoration scenarios, the sign does not trip its own supply. The circuit breaker shall not be tripped by inrush current when the sign is turned on.

Note: “Soft start” circuits and components may be needed to achieve this.

6.6.4 Large area signs that would exceed the 32A limit if the whole display delivers “white” pixels at full brightness, or a similar high demand display, shall be configured to limit brightness as the 32A limit is approached such that it is not possible to exceed 32A.

6.6.5 The sign shall monitor its own power consumption, and be able to report via the
protocol the daily power consumption, and instantaneous or short-term values of current (amps) and voltage.

6.6.6 As part of approvals process, the supplier shall declare the power consumption when not dimmed (for illuminance 40000 lux), with 10% of the pixels in the sign lit as colour white, and:

(a) The remaining 90% pixels of the sign lit in dark green.

(b) The remaining 90% pixels of the sign unlit.

6.7 UPS (uninterrupted power supply)

6.7.1 Unless otherwise specified by the project, a UPS shall be provided for the sign that is capable of running the normal display message for a minimum of 4 hours.

Note: This is a system requirement; it is not considered part of the sign itself, and the UPS will in many cases be provided by another manufacturer.

6.7.2 Display of the sign’s normal message when supplied by the UPS shall not draw more current than the UPS can support. Unless otherwise defined by the project, it shall be assumed the UPS is limited to a maximum 8A output (at 240V). Either:

(a) The electrical current to provide the normal graphic for the sign shall be supportable by the UPS.

(b) The electrical current to provide an agreed fall-back graphic/message shall be supportable by the UPS. The sign shall automatically use the relevant fall-back message when it is being supplied by the UPS.

Note: Fall-back graphics are to have fewer lit pixels. Background pixels (normally dark green) would not be lit, so the background would appear black, but information conveyed would be the same as the normal message. See example below:

![Figure 2 – Example of fall-back display face set for use during UPS supply](image)

6.7.3 The sign shall be capable of monitoring and reporting alarms and status delivered as contact closure outputs from a UPS that complies with TSI-SP-033.

7 DISPLAY AND OPTICAL REQUIREMENTS

7.1 General

7.1.1 The sign shall meet the requirements of EN 12966 as detailed in item 4.2.1

7.2 Display arrangement

7.2.1 The sign shall be a full matrix LED display, where the whole display up to and including the white sign border is formed by an evenly spaced grid of pixels.
7.2.2 LED based sign faces shall be a visual equivalent of the design of the static sign faces. Refer to Appendix A for adaptation of a static sign face for LED usage.

Note: Static sign display face designs fall under the jurisdiction of the “Signs and Delineation” section of TfNSW.

7.2.3 Face dimensions of the display area shall be as defined by the static sign, or as specified by the project. Some examples are tabled below, illustrating typical sign dimensions that this specification targets.

| Width (mm) | 14000 | 14000 | 10500 | 8356 | 7847 | 7000 | 5699 | 3940 |
| Height (mm) | 5100 | 4052 | 4945 | 4602 | 3250 | 4062 | 2848 | 3830 |

Table 2 – Example Display Dimensional Requirements

7.2.4 The physical outer corners of the sign shall have radius equal to that specified in AS 1743 [1], or may be lower, down to a minimum of 5 mm.

7.2.5 The edge strip surrounding the sign border may be either static (unlit), partially lit, or fully lit. Its background shall match the colour of the backing board used for the rest of the display, to give a consistent overall display appearance.

7.2.6 The border shall be a lit display item; a part of the graphic image.

7.2.7 The border corner radius shall be as in AS 1743 [1], unless otherwise specified by the project.

7.2.8 The pixel pitch shall be a maximum of 12.5mm.

7.2.9 The sign shall not have conspicuities (flashers).

7.3 Pixel Element Service life

7.3.1 Luminance and chromaticity shall remain within the EN 12966 limits for the design life given in item 4.5.1.

For duty cycle it should be assumed the sign spends 50 % of the time at full brightness (illumination 40000 lux), 50% at minimum brightness (fully dimmed), and that pixels are required to keep delivering the same colour (i.e. the same default graphic in use continuously).

7.4 Display changes using facility switch

7.4.1 Display changes shall also be triggered by manual operation of the roadside cabinet facility switch, as defined in item 5.3.8.
7.4.2 It shall be possible to configure which stored graphic/message is displayed for each of the four facility switch positions assigned to messages/graphics.

7.5 Contact Closure Inputs and Outputs

7.5.1 The default sign shall provide at least 8 contact closure inputs, rated for 24V d.c.

7.5.2 The default sign shall provide at least 6 contact closure outputs, rated for 24V d.c.

7.5.3 When the sign is configured to use contact closures for control, such as when being driven by a traffic signal controller, then:

(a) If one of the inputs is closed, the sign shall display a corresponding stored graphic/message.

(b) If no input is closed, or more than one input is closed, the sign shall present a blank face (all display elements unlit).

(c) There shall be a dedicated contact closure output for each message/graphic that shall be closed when the display is showing that face, and open when not showing.

(d) There shall be a dedicated contact closure output that shall be open when the facility switch is set to “Automatic”, and closed when the facility switch is in any other position.

(e) There shall be a dedicated contact closure output that shall be closed when a fault is detected.

(f) Inputs and outputs from any UPS shall be fed direct to the controlling device rather than the sign.

7.5.4 When the sign is configured to be driven from a host control centre by protocol, and a UPS is in use, then the contact closures are to be used for monitoring the UPS.

Note: When the sign is configured to be driven from a host control centre by protocol, and there is an alternate independent monitoring system for the UPS that is accessible to those managing the sign and agreed by the project and operating entity as sufficient, then contact closures may be omitted.

7.6 Dimming

7.6.1 The sign shall have multiple light sensors, to provide input to a dimming algorithm.

7.6.2 The sign shall use the light sensor input to automatically adjust the luminance (adjust dimming level) to maximise legibility and avoid glare (other inputs may also be used such as location, date, time of day, sign orientation, and horizon line).

7.6.3 The sign shall provide at least 16 steps of dimming.

7.6.4 The sign shall adjust the luminance progressively or in small steps. The sign shall take from one to 4 minutes to change from no dimming to maximum dimming or vice versa. The same rate of change of luminance shall apply for smaller steps.

7.6.5 If sensors fail, the sign shall dim based on the time, with full brightness for day between sunrise and sunset, half dimmed for civil twilight, and fully dimmed for night.
7.7 Colours

7.7.1 The sign shall provide the colours Red, Yellow, White, and Blue as defined in EN 12966.

7.7.2 The sign shall also provide “Dark Green” as per Table 1 of EN12899-1. This has the CIE Chromaticity coordinates tabled below.

<table>
<thead>
<tr>
<th>Colour</th>
<th>Corner coordinates</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dark Green</td>
<td>x</td>
<td>0.248</td>
<td>0.127</td>
<td>0.313</td>
<td>0.313</td>
</tr>
<tr>
<td></td>
<td>y</td>
<td>0.409</td>
<td>0.557</td>
<td>0.682</td>
<td>0.453</td>
</tr>
</tbody>
</table>

Table 3 – Chromaticity of Dark Green

Note 1: This is the same as Dark Green of AS 1906 [4], and considered equivalent to AS 2700 [5] G12 Holly Green, Pantone 3435C, and RGB 2, 71, 49.

Note 2: Dark Green is to be used for the directional sign background.

7.7.3 The luminance of Dark Green shall present similarly to that of the static sign’s background. It is suggested that luminance be set to fall within the L1 values of Table 7 of EN 12966 [19] (for Green) to achieve this.

8 OPERATION AND CONTROL

8.1 General

8.1.1 The sign shall be capable of remote control by a host control system that supports NTCIP.

8.1.2 The sign shall also be provided with a Product Host Control System (PHCS) (provided by the manufacturer) that is usable through a web interface/internet browser. This shall provide a comprehensive set of functions for configuration, monitoring, control and maintenance.

8.1.3 The PHCS shall provide means for graphic frames to be uploaded to the sign.

8.1.4 Communication interfaces listed as required by this specification shall meet the relevant detail requirements given in TSI-SP-071 [16] for those interfaces.

8.1.5 The sign’s display shall be capable of being activated by

(a) Command instruction from a remote site using the protocol.

(b) Command instruction from a remote site using the PHCS.

(c) Command instruction locally from a portable device.

(d) External switch input (Contact closure).

(e) Manual switching in cabinet (facility selector switch).

8.2 Local Control

8.2.1 The sign shall have a TIA 232/485 port for local control (one port that supports both protocols).

8.2.2 The sign shall have an Ethernet port for local control.
8.3 Remote control

8.3.1 The sign shall be capable of being operated remotely via an IP-based telecommunications service together with a suitable modem.

8.3.2 The sign shall have an Ethernet port for remote control.

8.4 Non-volatile memory capacity

8.4.1 The sign shall be capable of storing a minimum of 16 separate graphic frames up to the full size of the sign’s matrix.

8.5 Communications Protocol

8.5.1 The sign shall support at least one of the communication protocols below:
(a) NTCIP 1203 [21]
(b) TSI-SP-003 [13]

8.5.2 All mandatory items of the protocol relevant to use of CMS shall be incorporated.

8.5.3 If protocol NTCIP is used, an SNMP protocol MIB file shall be provided that allows for remote control and monitoring of the sign via network management software.

8.5.4 If protocol TSI-SP-003 is used:
(a) The sign shall use the high-resolution graphics sign mode. (This mode supports graphic displays up to 65535 x 65535 pixels.)
(b) The display colour “Dark Green” shall be assigned to, and triggered by, the protocol code 03h (normally assigned to Green).
(c) The sign shall support all MI code messages listed in item 3.6.4 of TSI-SP-003 for the VMS device type, except the sign set text frame message.

8.5.5 As part of approvals submission, the supplier shall provide evidence of comprehensive testing for the protocol. Areas of test shall include:
(a) Correct and timely positive responses on receipt of valid input.
(b) Appropriate responses and error codes on receipt of invalid input.
(c) Communications with host control systems.
(d) Appropriate responses to physical inputs such as switch actuations.
(e) Generation error codes and appropriate sign responses when a problem is induced in the sign that requires response.
(f) Reporting of sign status and logs in normal and error conditions.

8.6 Monitoring

8.6.1 The sign controller shall monitor the operation of the sign and generate status messages for the host control system as demanded, including the following:
(a) Communication with sign established
(b) Communication with sign discontinued
(c) Current time and date on the sign
(d) Identity of current frame, message and plan
(e) List of stored frames and plans
(f) Status of individual pixels on sign (on, off or faulty)
(g) Status of backup battery supporting the controller
(h) Status of mains power to the sign
(i) Timestamp of any fault, alarm and event or status entry, as supported by the protocol

8.6.2 The sign shall provide a blanking capability with configurable threshold. The sign shall be blanked, and a fault logged and reported, when the sum of all pixel failures exceeds the threshold. The default shall be 5% of the number of pixels on the display matrix.

8.6.3 The sign shall blank its display, and log and report a fault, when correct and reliable operation cannot be maintained due to variation in the mains supply voltage and/or frequency outside of the required operating range.

8.6.4 The sign shall only log the first occurrence of each fault type. Further occurrences of the same fault type shall not be logged until that fault type is cleared. Every clearance shall be associated with a fault and vice versa. The sign shall only log the last clearance of each fault type such that the fault no longer exists.

8.6.5 Faults that can be attributed to a primary fault shall not be logged. The primary fault shall be logged. For example, a power failure fault shall not cause the logging of a multi-LED fault, but the power failure shall be logged.

8.7 Logs

8.7.1 The sign shall have a log including date and timestamps.

8.7.2 Log entries shall have a sequence number that shall index upwards such that even if the date/time is incorrect or corrupted, log entries can still be sorted into the true sequence in which the trigger events occurred.

8.7.3 The log shall have at least 2 classes; Faults, and Events
   (a) Error states relating to the sign itself having defects shall be recorded in the fault log.
   (b) Display changes shall be recorded in the Event log. Entries shall identify the frame displayed, and what type of input caused the change of frame.

8.7.4 The log shall support at least 4096 entries

8.7.5 In each log class, at least the most recent 255 entries shall be retained.

8.7.6 Where the log is full, the oldest item (excepting those retained by the requirement of 8.7.5) shall be discarded to make room for each new item.

8.7.7 Fault and event logs shall be readable locally and remotely using the PHCS.

8.7.8 It shall be possible to download the logs locally and remotely using the PHCS, into a format that allows subsequent analysis and filtering (eg csv formatted text)
8.7.9 Restrictions shall be in place such that normal users and technicians with their default access level cannot modify or delete log entries within the sign.

8.8 Fall Back sequence

8.8.1 When mains power is lost and the sign is directly connected to the mains power supply, the sign shall log and report the loss of mains power.

8.8.2 When mains power is lost and the sign is supplied via a UPS capable of notifying the sign of the change in supply status, the sign shall log and report the loss of mains power.

8.8.3 The sign shall continue to display whilst UPS power remains.

8.8.4 If a fall-back graphic has been defined to be used where mains power is lost and UPS power remains, as per item 6.7.1(b), the sign shall use the relevant fall-back display frame. Otherwise the relevant normal frame shall be used.

8.8.5 When neither mains power nor UPS power remain available, the sign shall maintain normal sign operation except for pixel lighting, using battery backup as in item 6.2.

8.8.6 When battery backup power loss is imminent, the sign shall log the event, report to the host control system as demanded and perform a controlled close-down.

8.8.7 The sign shall ensure that all of its configuration settings, logs and other data and information is preserved when power to the sign is off or lost.

8.9 Software

8.9.1 The sign manufacturer/supplier shall have a quality plan that follows industry standards, covering control of the issue of firmware/software versions.

8.9.2 The supplier shall define means to locally and remotely upgrade the sign’s software/firmware. Details shall be described in manuals. A relevant level of access and password protection shall be applied.

8.9.3 The sign shall revert to the previous version if the new version fails to validate or install correctly.

8.9.4 The sign shall not be rendered inoperable in the event of an interruption during the software/firmware upgrade process, for example a power failure.
8.10 Control of Sign Settings and Configuration

8.10.1 The sign shall provide both local and remote means to make changes to sign settings and configuration, to enable commissioning, operation, and normal maintenance including upload of new graphic frames.

8.10.2 The sign and the PHCS shall have at least 4 levels of access available, with a password permissions system or equivalent. The default roles for these access levels shall be “manufacturer, maintenance technician, host control operator, and host control systems support (administrator).

8.10.3 “Manufacturer only” settings shall be segregated by access control, or by other means, so as to limit risk of inappropriate changes by other personnel, such as by accident.

9 ENVIRONMENTAL

9.1.1 The sign shall meet the environmental requirements of EN 12966 as given in item 4.2

9.1.2 The sign, its mounts, and structure shall meet Australian wind loading conditions set down in AS/NZS 1170.2 for Terrain Category 2, Region B.

9.1.3 The sign shall provision to manage condensation that may occur within the display enclosure as a result of temperature drop of high humidity air, and water from minor enclosure leakage, such that in the event either occurs, the sign function and reliability is not adversely affected.

9.1.4 The sign shall not require scheduled service or inspection intervals more frequent than annually, to maintain function and reliability.

Note: As a preference it should not require any scheduled servicing/inspection.

10 MANUALS

10.1 Sign Generic Manuals

10.1.1 Manuals shall be compliant with TSI-SP-062 [13].

10.1.2 Manuals shall also cover sign installation.

10.1.3 Maintenance manuals shall include arrangement drawings or photographs to illustrate activity required for replaceable items. This shall include pixel module replacement, as well as other replaceable items.

10.1.4 Manuals shall be provided in a submission as part of the TS201 [17] approval process.

10.1.5 A list of logged faults, alarms, and events for the sign shall be provided in the relevant sign manuals, together with descriptions of each, and their respective protocol message identity where applicable.
11 CERTIFICATION

The following certification shall be obtained and provided as part of approvals submissions:

11.1 EMC Immunity

11.1.1 Declaration of Conformance of the sign to AS/NZS 61000.6.1 [6], and supporting evidence.

11.2 Mandatory Regulatory items

Either all of 11.2.1 shall be supplied, or all of 11.2.2 shall be supplied;

11.2.1 Evidence of valid RCM compliance as defined in AS/NZS 4417.2.[11].

11.2.2 Both of the items below:
   (a) Certificate of Suitability issued by the NSW Office of Fair Trading.
   (b) Declaration of Conformance of the sign to AS/NZS 61000.6.3 [10] and supporting evidence.

12 SUPPORTABILITY

12.1 Design for maintenance

12.1.1 A modular approach shall be used in designing the equipment to facilitate maintainability, ease of installation and commissioning.

12.1.2 Equipment layout within housings shall be designed for ease of access during operation, maintenance and service.

12.1.3 Access to individual modules shall be provided for replacement of the module without the need for removing other components or wiring.

12.1.4 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.

12.2 Reliability

12.2.1 The MTBF of the sign shall be not less than 45,000 hours.

   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 or the display to be stuck ‘ON’.

12.2.2 As part of approval submissions in the TS201 [17] process, the supplier shall provide the MTBF of the sign display system, and information and calculations supporting the MTBF value provided.
13 QUALITY ASSURANCE

13.1 Quality System
The Supplier and the manufacturer shall operate a quality management system complying with ISO 9001 [19] and certified by an accredited quality management system certification body.

13.2 Quality Plan
The manufacturer shall document a quality plan that includes:
- Details of model numbers
- Traceability of key components
- In process and release inspections and records
- Control of software/firmware release associated with update/ rework of deployed signs.

14 APPROVAL

14.1 Approval Process

14.1.1 Manufacturers and Suppliers seeking approval of their signs shall follow the process defined in TS201 [17].

14.2 Changes
If a design, material or manufacturing method change is made to an approved sign, the Supplier shall notify the ITS Helpdesk at itshelpdesk@rms.nsw.gov.au, and the requirements of TS201 [17] regarding changes shall be followed.
APPENDIX A GRAPHIC PRESENTATION

This section is informative only.

Display graphics to be used as default direction signs are expected to be specified by the project, by provision of the equivalent static sign drawing.

The static display graphics are not expected to be identically copied, but shall be translated into a visually similar display graphic.

A boundary of unlit pixels between adjacent areas of different colour pixels may be used, if this improves the sign appearance.

“Unlit” features on a lit background (particularly black text on a white background) or other unlit items will typically need slightly enlarged stroke, height and width compared to the static sign dimension, to appear similar to the static sign, to counter the effect of lit pixels blurring inwards.

It is to be noted that the relatively high resolution of maximum 12.5mm pitch is intended to allow finer adjustments to element size to improve legibility, as well as provision for shaping of detailed elements.

Proposed sign graphic elements should be checked on an active sign of the same pixel pitch, with photos at relevant distances, to validate if acceptable.
APPENDIX B  SIGN EXAMPLES

B.1  3 display faces
Dimensions 7.847m wide x 3.250m high, Letter sizes 200/150mm.

Note the image above does not show the specified dark green background colour.

B.2  4 display faces
Dimensions 14.000m wide x 4.450m high, Letter sizes 280/210mm.

Note the image above does not show the specified dark green background colour.