Department of Transport and Main Roads

Technical Specification

Transport and Main Roads Specifications MRTS94 Road Lighting

March 2025

Queensland Government

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1 Introduction

This Technical Specification applies to the supply and installation of Rate 3 Road Lighting Equipment, including the requirements for manufacturing, testing and delivering luminaires, pedestrian crossing floodlights and luminaire terminal panels.

This Technical Specification does not apply to Rate 1 or 2 Road Lighting. For Rate 1 or 2 Lighting, reference shall be made to the relevant electricity entity policies, standards and specifications.

All Electrical Works shall comply with the requirements of the most current amendments to the *Electrical Safety Act* 2002 (Qld) and associated regulations and codes of practice.

This Technical Specification shall be read in conjunction with MRTS01 *Introduction to Technical Specifications*, MRTS50 *Specific Quality System Requirements* and other Technical Specifications as appropriate.

This Technical Specification forms part of the Transport and Main Roads Specifications Manual.

All new Rate 3 road lighting projects are to use LED luminaires. LED luminaires will be connected to a Transport and Main Roads Control and Monitoring System (CMS) through wireless-enabled, plug-in street lighting controllers.

2 Definition of terms

The terms used in this Technical Specification shall be as defined in Clause 2 of MRTS01 *Introduction to Technical Specifications*. Further definitions are defined in Table 2 and AS/NZS 3000 *Electrical installations (known as the Australian / New Zealand Wiring Rules)*.

Table 2 – Definition of terms

Term	Definition
Act	*Electrical Safety Act* 2002 (Qld) and associated regulations and codes of practice
Administrator	Principal's Representative or Superintendent as defined in Clause 14 of MRTS01 *Introduction to Technical Specifications*
AEMO	Australian Energy Market Operator
BSI	British Standards Institution
CMS	Control and Monitoring System
Electricity Entity	As defined in the Act
Electrical Works	As defined in the Act
IEC	International Electrotechnical Commission
ISO	International Organisation for Standardization
Licensed Electrical Contractor	Holder of an Electrical Contractor Licence under the Act
Rate 1 Lighting	Public lighting supplied, installed, owned and maintained by the electricity entity

Term	Definition
Rate 2 Lighting	Public lighting owned and maintained by the electricity entity
Rate 3 Lighting	Public lighting supplied, installed, owned and maintained by Transport and Main Roads
SLC	Smart Lighting Controller

3 Referenced documents

All equipment and material, where not otherwise specified, shall be in accordance with the appropriate Australian Standard Specifications, where such exist, and in their absence, with BSI, IEC or ISO Specifications.

Where a standard specification is quoted or implied, the latest version shall be applicable, including the amendments to date.

A list of relevant Australian Standards and other related documents referred to in this Technical Specification, is shown in Table 3.

Table 3 – Referenced documents

Reference	Title
ANSI C136.2	*American National Standard for Roadway and Area Lighting Equipment – Dielectric Withstand and Electrical Transient Immunity Requirements*
ANSI C136.41	*American National Standard for Roadway and Area Lighting Equipment – Dimming Control between an External Locking Photo-control and Ballast or Driver*
AS 1798	*Lighting poles and bracket arms – Recommended dimensions*
AS CISPR 15	*Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment* (CISPR 15:2013+AMD1:2015 (ED.8.1) MOD)
AS/NZS 1158.1.1	*Lighting for roads and public spaces, Part 1.1: Vehicular traffic (Category V) lighting – Performance and design requirements*
AS/NZS 1158.2	*Lighting for roads and public spaces, Part 2: Computer procedures for the calculation of light technical parameters for Category V and Category P lighting*
AS/NZS 1158.4	*Lighting for roads and public spaces, Part 4: Lighting of pedestrian crossings*
AS/NZS 3000	*Electrical installations (known as the Australian / New Zealand Wiring Rules)*
AS/NZS 60598.1	*Luminaires, Part 1: General requirements and tests* (IEC 60598-1, Ed.8.0 (2014) MOD)
AS/NZS 60598.2.3	*Luminaires, Part 2.3: Particular requirements – Luminaires for road and street lighting* (IEC 60598-2-3, Ed.3.1 (2011) MOD)
AS/NZS 60598.2.5	*Luminaires, Part 2.5: Particular requirements – Floodlights* (IEC 60598-2-5:2015 (ED.3.0), MOD)
AS/NZS 61000.3.2	*Electromagnetic compatibility (EMC), Part 3.2: Limits – Limits for harmonic current emissions (equipment input current less than or equal to 16 A per phase)*
CIE S 025	*Test Method for LED Lamps, LED Luminaires and LED Modules*

Reference	Title
DiiA Specification – DALI Part 251	*Digital Illumination Interface Alliance (DiiA) – DALI Part 251: Memory Bank 1 Extension*
DDPSM Volume 2	*Drafting and Design Presentation Standards* Manual*, Volume 2*: *Road Design Concept and Development Presentation*
IEC 61643-11	*Low-voltage surge protective device – Part 11: Surge protective devices connected to low-voltage power systems – Requirements and test methods*
IEC 62386-102 Ed. 2.0	*Digital addressable lighting interface (DALI) – Part 102: General requirements – Control gear*
IES LM-79	*Approved method for Electrical and Photometric Measurements of Solid-State Lighting Products*
IES LM-80	*Approved method for Measuring Luminous Flux and Colour Maintenance of LED Packages, Arrays and Modules*
IES TM-21	*Technical Memorandum: Projecting Long-Term Lumen, Photon and Radiant Flux Maintenance of LED Light Sources*
MRTS01	*Introduction to Technical Specifications*
MRTS50	*Specific Quality System Requirements*
MRTS97	*Mounting Structures for Roadside Equipment*
RPDM	*Road Planning and Design Manual 2nd Edition*
SA/SNZ TS 1158.6	*Lighting for roads and public spaces, Part 6: Luminaires – Performance*
SD1323	*Road Lighting – Luminaire Terminal Panel*
SD1335	*Road Lighting – Pedestrian Crossing Floodlight Mounting Bracket Outreach Mount (Option 2)*
SD1336	*Road Lighting – Pedestrian Crossing Floodlight Mounting Bracket Spigot Mount (Option 1)*
SD1380	*Road Lighting – Slip Base Mounted Pole – Footing Details for Installation in the Median*
SD1381	*Road Lighting – Slip Base Pole and Footing Installation Details for Crossfalls Up to and Including 1:6*
SD1382	*Road Lighting – Slip Base Pole and Footing Installation Details for Crossfalls Greater than 1:6 Up to and Including 1:3*
SD1389	*Road Lighting – Slip Base Pole Male / Female Connectors Installation Details*
SD1390	*Road Lighting – Base Plate Mounted Pole Aerial Connection Wiring Details*
SD1392	*Road Lighting – Base Plate Mounted Pole and Footing Installation Details for Crossfalls Up to and Including 1:2*
SD1393	*Road Lighting – Base Plate Mounted Pole – Footing Details for Installations on Slopes of greater than 1:2*
SD1395	*Road Lighting – Base Plate Mounted Pole within Concrete Barrier – Footing Details and Installation of Pole*
SD1399	*Road Lighting – Base Plate Mounted Pole Wiring Details*
SD1400	*Road Lighting – Slip Base Pole Wiring Details*
SD1406	*Road Lighting – Pedestrian Crossing Floodlight Installation and Aiming*

Reference	Title
SD1409	*Road Lighting – Luminaire Headframes Wiring Details Excluding 4 x 400 W Luminaires*
SD1410	*Road Lighting – Luminaire Headframes Wiring Details 4 x 400 W Luminaires*
SD1411	*Road Lighting – Mast Arm Road Lighting Junction Box (Type B)*
SD1412	*Road Lighting – Mast Arm Road Lighting Junction Box (Type B) Wiring Details*
SD1429	*Road Lighting – Slip Base Mounted Pole – Footing Details for Installation using Concrete Step Tread on Slopes of greater than 1:6 up to and including 1:3*
SD1431	*Road Lighting – Base Plate Mounted Pole Wiring Details for Median Barriers*
SD1637	*Road Lighting – Underpass Lighting Wiring Details*
SD1671	*Traffic Signals / Road Lighting - Road Lighting Labels Installation*
SD1673	*Traffic Signals / Road Lighting - Labels*
SD1707	*Road Lighting – Base Plate Mounted Pole Mounted on Bridges Wiring Details*
SD1755	*Road Lighting – Slip Bolt Tethering System for Transport and Main Roads Rate 3 Slip Base Poles*
SLC Installation Guide	*Smart Lighting Controller Installation Guide*
Smart Lighting Asset Data Capture Requirements	*Smart Lighting Asset Data Capture Requirements*
TN200	*Slip Base Pole Clamping Bolt Tethering System Installation*
TRUM	*Traffic and Road Use Management* (TRUM) *Volume 4 – Part 3: Electrical Design for Roadside Devices*

4 Quality system requirements

4.1 Hold Points, Witness Points and Milestones

General requirements for Hold Points, Witness Points and Milestones are specified in Clause 5.2 of MRTS01 *Introduction to Technical Specifications*.

The Hold Points, Witness Points and Milestones applicable to this Technical Specification are summarised in Table 4.1.

Table 4.1 – Hold Points, Witness Points and Milestones

Clause	Hold Point	Witness Point	Milestone
7.1	1. Design by the Contractor		Submission of lighting design (28 days)
7.2	2. Testing of poles	1. Testing of poles and components	
7.3	3. Supply of luminaires		Submission of luminaire documentation (7 days)
10.1	4. Compliance testing		Submission of compliance testing procedure (28 days)

Clause	Hold Point	Witness Point	Milestone
10.2		2. Compliance testing of luminaires	
11			Submission of asset data accepted by the Administrator

5 Compliance with legislation

The work covered by this Technical Specification shall comply with the requirements of the Act and subordinate legislation and AS/NZS 3000 *Electrical installations (known as the Australian / New Zealand Wiring Rules)*.

The Contractor shall engage a Licensed Electrical Contractor to perform the duties and functions of Electrical Works. This includes the installation of pits and conduits for power and communications cables.

6 Compliance with other documentation

For Rate 3 Road Lighting installations, this Technical Specification shall be read in conjunction with referenced documents, RPDM Volume 6: *Lighting*, TRUM *Volume 4 – Part 3: Electrical Design for Roadside Devices* and AS/NZS 3000.

7 Design by the Contractor

7.1 Submission of design

Where road lighting design is undertaken by the Contractor, either as part of the Contract or as an alternative design, the requirements of Clause 7 shall apply.

No fewer than 4 weeks prior to installation of luminaires and/or poles, the Contractor shall submit to the Administrator, a road lighting design which complies with the requirements of RPDM Volume 6: Lighting, and the *Smart Lighting Asset Data Capture Requirements* complete with all design-related information. **Milestone** The design shall be submitted in accordance with the provisions of the relevant clauses of the Conditions of Contract and/or Supplementary Conditions of Contract governing design by the Contractor.

Construction under this Technical Specification shall not commence until expiration of the 4-week period, or as otherwise provided for by the relevant design by the Contractor clauses mentioned in the second paragraph of this clause. **Hold Point 1**

7.2 Additional requirement – design of poles

Refer to MRTS97 *Mounting Structures for Roadside Equipment* for all requirements relating to road lighting pole, outreach arms, luminaire headframes and luminaire brackets. **Hold Point 2** **Witness Point 1**

7.3 Additional requirement – luminaires

At least 7 days prior to delivery to the Site, for each luminaire, supporting documentation, as detailed in Clause 6 of SA/SNZ TS 1158.6 *Lighting for roads and public spaces, Part 6: Luminaires – Performance* and this Technical Specification, including manufacturers' drawings, shall be submitted to the Administrator. All photometric data provided must be supported by an independent test report from a laboratory which is endorsed by an accreditation body, which is a signatory to the International Laboratory Accreditation Corporation (ILAC) through the Mutual Recognition Agreement (MRA). A current Transport and Main Roads type approval certificate for the luminaire is sufficient for supporting documentation. **Milestone**

The submission shall include evidence of the reliability of equipment and the performance of the proposed materials for a service life of 20 years under the system configuration and environmental conditions, stated in the design drawings. Such evidence shall support the manufacturer's stated reliability and performance, including failure mode and effect analysis. The submission shall include a list of current users of the proposed equipment, including contact names and phone numbers of personnel who can verify the stated service performance.

Luminaires shall not be delivered to the Site until expiration of the 7-day period. **Hold Point 3**

Where so stated in Annexure MRTS94.1, production samples of luminaires shall be submitted to the Administrator. Samples shall be used for the purpose of providing reference against which all subsequent items are compared for compliance with this Technical Specification.

7.4 Design changes during construction

Any change to the design of any component proposed during construction shall be subject to the provisions of Clause 7 of this Technical Specification. Only after all the requirements of Clause 7 have been satisfied, shall such changes be incorporated in the Works.

7.5 Electricity entity

As part of the design requirement, the provision of new road lighting installations and the removal or relocation of existing road lighting luminaires shall require advice to be provided to the Electricity Entity. Such advice shall include at least a record of the location (for example, suburb), wattage and pole number of all luminaires. A copy of this advice shall be included in the quality records.

8 Material

8.1 General

All equipment and component parts shall comply with the requirements of this Technical Specification.

8.2 Rate 3 road lighting materials

8.2.1 Road lighting poles

Refer to MRTS97 *Mounting Structures for Roadside Equipment* for all requirements relating to road lighting poles, outreach arms, luminaire headframes and luminaire brackets.

8.2.2 Road lighting luminaires

8.2.2.1 General

Luminaires, other than pedestrian crossing floodlights, shall be designed and constructed in accordance with the requirements of AS/NZS 60598.2.3 *Luminaires, Part 2.3: Particular requirements – Luminaires for road and street lighting* and SA/SNZ TS 1158.6. Photometric performance to AS/NZS 1158.1.1 *Lighting for roads and public spaces, Part 1.1: Vehicular traffic (Category V) lighting – Performance and design requirements* and AS/NZS 1158.2 *Lighting for roads and public spaces, Part 2: Computer procedures for the calculation of light technical parameters for Category V and Category P lighting*.

Luminaires for pedestrian crossing floodlights shall be designed and constructed to AS/NZS 60598.2.5 *Luminaires, Part 2.5: Particular requirements – Floodlights* and shall have photometric performance to AS/NZS 1158.4 *Lighting for roads and public spaces Part 4: Lighting of pedestrian crossings*.

The equipment shall be exposed to the environmental conditions detailed in Clause 1.5 of SA/SNZ TS 1158.6.

Top entry access to the control gear chamber is preferred for road lighting luminaires. Compartment covers shall comply with Clause 2.7 of SA/SNZ TS 1158.6.

Luminaires shall be designed so that the stated photometric distribution of the luminaire shall be maintained throughout its life.

Luminaires shall comply with the relevant spigot fixing sizes detailed in Clause 4.1 of AS 1798 *Lighting poles and bracket arms – Recommended dimensions*. The depth of the spigot entry shall be as specified in Table 2.2 of SA/SNZ TS 1158.6.

The spigot entry shall form an integral part of the luminaire body casting. Luminaires with a separate mounting bracket will not be accepted, excluding pedestrian crossing floodlights.

SA/SNZ TS 1158.6 Category V Luminaires shall have a mass no greater than 15 kg and a sail area no greater than 0.17 m^2.

The electrical interference produced by the luminaire shall not exceed the limits prescribed in AS CISPR 15 *Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment*.

The luminaires shall have Total Harmonic Distortion (THD) limited in accordance with AS/NZS 61000.3.2 *Electromagnetic compatibility (EMC), Part 3.2: Limits – Limits for harmonic current emissions (equipment input current ≤ 16 A per phase).* The luminaires shall be on the Australian Energy Market Operator (AEMO) National Electricity Market Load Tables for Unmetered Loads or in the process of applying for entry onto the table.

Luminaires shall be subject to the Impulse Voltage test in accordance with Clauses 5.5.2 and 5.5.3 of SA/SNZ TS 1158.6.

8.2.2.2 LED luminaires

Luminaires shall be supplied as:

a) side entry mounting luminaires with integral control gear, and

b) pedestrian crossing floodlights with preferably integral control gear.

The luminaire shall be provided with at least the following degrees of protection when tested in accordance with AS/NZS 60598.1 *Luminaires, Part 1: General requirements and tests*:

a) Light Source Chamber – IP65, and

b) Control Gear Chamber – IP65 or where the LED driver unit has an IP65 rating, the control gear chamber may be IP24.

The luminaire must be capable of being monitored and controlled via cellular based CMS. Luminaires which can only be operated on a proprietary CMS product, will not be considered.

Luminaires are to be fitted with a 'NEMA' 7-contact pattern photocell socket complying with ANSI C136.41 *American National Standard for Roadway and Area Lighting Equipment – Dimming Control between an External Locking Photo-control and Ballast or Driver* and a matching shorting plug.

Electronic control gear shall comply with Clause 3.2.4 of SA/SNZ TS 1158.6 with the following additions:

a) a power factor not less than 0.9 at full power

b) be protected by a Surge Protection Device (SPD) with minimum rating of 15kV / 10kA complying with ANSI C136.2 *American National Standard for Roadway and Area Lighting Equipment – Dielectric Withstand and Electrical Transient Immunity Requirements*, and IEC 61643-11 *Low-voltage surge protective device – Part 11: Surge protective devices connected to low-voltage power systems – Requirements and test methods* for risk categories and SPD test methods. This requirement supersedes the surge protector requirements given in Clause 3.2.4 of SA/SNZ TS 1158.6

c) be DALI 2 compatible complying with IEC 62386-102 Ed. 2.0 *Digital addressable lighting interface (DALI) – Part 102: General Requirements – Control gear*

d) asset information shall be stored on the control gear in line with *DALI Part 251: Memory Bank 1 Extension* and Attachment 3 of this Technical Specification.

e) a minimum predicted power supply failure rate of 0.2% per 1 000 operating hours

f) must be capable of supporting constant light output technology, and

g) dimming curve shall be factory set to linear.

Photometric data for the luminaire shall be measured according to IES LM-79 *Approved method for Electrical and Photometric Measurements of Solid-State Lighting Products* or CIE S 025 *Test Method for LED Lamps, LED Luminaires and LED Modules*. The luminous intensity distribution table (I-table) shall be included in the body of the photometric data report.

The manufacturer / supplier shall detail the mechanism(s) for arresting any flicker mode for individual LED units. This must consider dimming levels of 25%, 50%, 75% as well as 100% operating power. As standard, nominal correlated colour temperature (CCT) shall be 4000 (K). There shall be no variation between individual LED units comprising a complete luminaire. Chromaticity tolerance shall be as per Table 5.3 in SA/SNZ TS 1158.6. Transport and Main Roads may require a 3 000 (K) version for specific environmental considerations.

Luminaires shall have a minimum colour rendering index (CRI) of not less than 70.

Lumen depreciation ≥ L90 after 50,000 hours, when tested in accordance with IES LM-80 *Approved method for Measuring Luminous Flux and Colour Maintenance of LED Packages, Arrays and Modules* and IES TM-21 *Technical Memorandum: Projecting Long-Term Lumen, Photon and Radiant Flux Maintenance of LED Light Sources* at an ambient temperature of 25°C. Extrapolated data shall be supplied using the IES TM 21 calculator.

Minimum luminaire efficacy shall be 110 lumens / watt.

No parts shall be constructed of polycarbonate unless it is UV stabilised (Lens discolouration shall be considered a failure under warranty).

As the luminaires comprise of several individual LED units, the manufacturer / supplier shall detail the failure mode for the luminaire and subsequent effect on performance should individual or strings of LEDs fail.

As standard, all luminaires shall have the light source chamber covered with an aeroscreen (cut off) type visor, while maintaining minimum IP65 ingress protection. No LED lenses shall be directly exposed to the elements in normal operation. Transport and Main Roads may request a semi-cut off visor for specific applications for example, flag lighting.

The cooling system for the LEDs shall consist of a heat sink only with no fans, pumps or liquids and shall be resistant to debris build up to maintain the heat dissipation performance.

The department’s standard lighting outreach spigot has a 5-degree upcast. The luminaire spigot entry shall have an integral system or fitted insert to allow this to be reduced to 0-degrees.

Transport and Main Roads has ongoing issues with cockatoos opening light source chambers and control gear chambers fitted with securing latches. All latches shall be secured with a secondary fixing arrangement to prevent opening. The secondary fixing arrangement shall be non-obtrusive and match in with the existing shape of the luminaire. Where screws are used, they shall be stainless steel, of the captive type and a long-life non-corrosive and anti-seize gel shall be applied to these screws. Transport and Main Roads approval of the fixing arrangement will be required.

The luminaire shall have a QR code label fitted to the underside of the luminaire in a readily accessible area suitable for scanning. The label shall be made of a material which maintains readability and integrity for the life of the asset, when subjected to the environmental conditions referenced in Clause 8.2.2.1. The scannable code shall be nominally 30 mm x 30 mm in size. Minimum fields required are shown in Table 8.2. The code shall be set up with either a 'carriage return' or semicolon delimiter to separate the fields shown in Table 8.2.

Table 8.2 – QR code requirements

Field
Manufacturer
Luminaire wattage
Luminaire model
Luminaire model number
Luminaire serial number
Manufacture date

Category V road lighting luminaire performance shall be assessed against the spacing tables in Attachment 2 of this Technical Specification.

Attachment 1 of this Technical Specification for each luminaire submitted, shall be provided to the Administrator.

8.2.2.3 Smart Lighting Controllers

Smart lighting controllers shall be installed on all new Transport and Main Roads Rate 3 LED road and pathway lighting luminaires and shall be supplied as per Transport and Main Roads Intelligent transport systems and electrical, Intelligent Transport Systems approved products list and MRS94 *Road Lighting*.

Smart lighting controllers shall be configured to communicate directly with Transport and Main Roads smart lighting CMS.

All smart lighting controllers shall only be installed on Transport and Main Roads Rate 3 LED luminaires with a 7-pin Nema socket receptacle.

The smart lighting controller shall be set as a 'Photocell' or 'Astro-clock' type configuration, as detailed in the project documentation.

8.2.3 Terminal panels

Terminal panels shall be as shown on Standard Drawings 1323 and 1411 as applicable to the pole in which they are mounted.

The terminal panel shall be suitable for operation on a 230 volt + 10% - 6%, 50 Hz ± 0.1 Hz system.

The following information shall be indelibly marked on each panel:

a) manufacturer’s / supplier’s name and identification mark, and

b) country of manufacture.

All components and ancillaries shall be securely fixed in place and the fixing devices used shall be compatible with the materials to be joined.

All steel screws, nuts and other steel parts shall be either stainless steel, galvanised, electro-plated or have an equivalent protective finish.

All brass screws, nuts and so on, shall be plated.

All ferrous materials shall be protected by a suitable non-corrosive finish.

Any spot-welding burns and cuts shall have zinc-rich paint applied to provide suitable corrosion protection.

8.2.4 Miscellaneous materials

Nuts, screws, bolts and washers, pole markings, cable terminations, insulation tape, heat shrink tubing and all materials necessary to complete the installation of the pole shall be provided as required.

9 Installation, removal and/or relocation of equipment

9.1 Road lighting luminaires and pedestrian crossing floodlights – Rate 3

The luminaire shall be connected to the lighting circuit and mounted onto the outreach arm or, for pedestrian crossing floodlights, mounted onto the outreach arm spigot by means of a mounting bracket as shown on Standard Drawings 1335 and 1336.

Mounting may be completed before the pole is erected, only if the following steps are adhered to:

a) the luminaire shall not be in contact with the ground when fixing to the outreach arm spigot

b) while the pole is being erected, sufficient care shall be taken to reduce undue stress and vibration and

c) for road lighting luminaires, the luminaire shall be fixed to the outreach arm spigot so that, when the pole is installed in its upright position, the luminaire is correctly aligned to the road surface so that the luminaire is parallel with the grade of the road at its centre-line.

Cabling shall be secured clear of heat sources, which may degrade the cable insulation.

Pedestrian crossing floodlights shall be aimed so that the maximum intensity of the luminaire coincides with the calculated aiming point as detailed in the design drawings. Aiming of LED floodlights must be carefully considered, as the maximum intensity is generally not perpendicular to the visor surface of the floodlight. Method for floodlight-aiming can be confirmed with the manufacturer.

9.2 Installation of poles – Rate 3

Base plate mounted pole installations for crossfalls up to and including 1:2, shall be erected in accordance with Standard Drawing 1392.

Base plate mounted pole installations details for crossfalls greater than 1:2, shall be erected in accordance with Standard Drawing 1393.

Base plate mounted poles erected in concrete median barriers, shall be erected in accordance with Standard Drawing 1395.

Base plate mounted poles on bridges, shall be erected in accordance with the requirements of the bridge structural drawings. The requirement for a high-access-hatchway shall be confirmed before installation. The poles shall be oriented so that the access hatchway faces the roadway. An internally mounted stainless steel plastic coated wire shall be fitted between the terminal panel strap and the access hatchway door.

Slip base poles erected in locations with no cross fall, shall comply with Standard Drawing 1380.

Slip base pole installations for crossfalls up to and including 1:6, shall be in accordance with Standard Drawing 1381.

Slip base pole installations for crossfalls greater than 1:6 up to and including 1:3, shall be in accordance with either Standard Drawings 1382 or 1429.

Where the crossfall exceeds 1:3, the use of a slip base pole is not recommended.

A slip base clamping bolt tethering system shall be installed for each slip base pole in accordance with Standard Drawing 1755 *Slip Bolt Tethering System for Transport and Main Roads Rate 3 Slip Base Poles* and Technical Note TN200 *Slip Base Pole Clamping Bolt Tethering System Installation*.

The purpose of using the tethering system is to prevent clamping bolts from being projected at high speed or long distance from the pole when the pole slips upon vehicle impact.

9.3 Pole markings – Rate 3

Pole markings shall be as stated in the design drawings and comply with Standard Drawings 1671 and 1673 or, where not stated, the minimum requirement shall be a MR3 Road Lighting Label.

9.4 Removal of road lighting luminaires and pedestrian crossing floodlights – Rate 3

Rate 3 luminaires shall be de-energised before removal. Luminaires that are removed shall be returned to the owning region's store or other designated location. Care shall be taken when transporting the luminaires so that they arrive in the same condition as they were when removed and without any further damage from transportation.

Any damage that occurs due to removal or handling after removal, shall be made good by the Contractor.

9.5 Relocation of road lighting luminaires and pedestrian crossing floodlights – Rate 3

Luminaires to be relocated shall be first checked for any internal or external damage, including gaskets and control gear. If the luminaire fitting is damaged in any way, a report of such damage shall be provided to the Administrator.

The luminaire shall be stored under cover in a clean dry location until required to be reinstalled.

The luminaire visor and reflecting surfaces shall be cleaned prior to reinstallation.

The luminaire shall be reinstalled in accordance with the requirements of this Technical Specification.

9.6 Removal of poles – Rate 3

The pole shall be lifted from the footing and laid down carefully.

Poles that are removed shall be returned to the owning authority’s store or other designated location. They may be disassembled for transport. Care shall be taken in the transportation of the poles and outreach arms so that they arrive in a sound serviceable condition and without any further damage.

Any damage that occurs due to removal or handling after removal, shall be made good by the Contractor.

9.7 Relocation of poles – Rate 3

The pole shall be lifted from the footing and carefully laid down. It shall be examined for any structural damage, for example rust or dents. If the pole is damaged in any way, a report of such damage shall be provided to the Administrator.

Once inspected, the internal electrical components shall be removed and stored in a clean dry location. The pole shall be stored in a safe place until required to be reinstalled. It shall not be stored directly on the ground.

The pole shall be installed in accordance with the requirements of this Technical Specification.

9.8 Wiring – Rate 3

Pole wiring in base plate mounted poles, including joint use traffic signal and road lighting poles, shall comply with Standard Drawing 1399.

Where base plate mounted poles are in a concrete median barrier, the wiring shall comply with Standard Drawing 1431.

Wiring for base plate mounted poles where power is supplied by an overhead cable, shall comply with Standard Drawing 1390.

Wiring for base plate mounted poles on bridges or other structures shall comply with Standard Drawing 1707.

Wiring in slip base poles shall comply with Standard Drawing 1400.

Wiring details for an energy-absorbing pole shall be supplied to the Administrator for approval.

Luminaire headframes wiring, excluding 4-way headframes, shall comply with Standard Drawing 1409.

Luminaire headframes wiring for 4-way headframes shall comply with Standard Drawing 1410.

Wiring for luminaires mounted on brackets in underpasses or walls, shall comply with Standard Drawing 1637.

Pole wiring in a combination traffic signal mast arm shall comply with Standard Drawing 1412.

9.9 Earthing

All metal and concrete poles shall be earthed in accordance with the requirements of AS/NZS 3000 and the relevant Standard Drawings.

9.9.1 Earthing of ground-mounted lighting poles

Lighting poles shall be earthed by direct connection to the supply neutral by means of a connection having a cross-sectional area of not less than 6 mm^2 (copper).

A separate earth stake is not required for poles that are supported by an anchor cage and footing installed in the ground, provided that all bolted connections used to attach the pole to the foundation are of low electrical resistance (for example not painted, bolts tight, not corroded, and so on).

Where a zero voltage touch potential cannot be achieved with the pole's earthing system, an earth stake shall be provided and bonded to the neutral conductor.

9.9.2 Earthing of lighting installations on bridges and other structures

A separate earth conductor of minimum size equal to the cross-sectional area of the supply active, shall be installed with the supply cabling. The earth shall be connected to the earth point at the pole and at the earth point at the point of the circuit supply. At the point of circuit supply, the earth shall also be connected to the neutral conductor. The neutral conductor shall not be connected to earth at any pole on the bridge. For details refer to Standard Drawing 1707 and 1637.

Where a luminaire installed on a bridge is within 2.4 m of the ground or within 1.5 m reach of the public, the luminaire body shall be connected to the earthing system by a connection having a cross-sectional area of not less than 6 mm² (copper).

This clause shall also apply to lighting installed on other structures.

9.9.3 Lighting installations adjacent to railway overhead lines

Where a bridge passes over a railway overhead wiring network, the lighting equipment may have to be bonded to Queensland Rail's traction earthing system. In this case, the earthing system shall be segregated from the MEN earthing system.

Advice shall be sought from Queensland Rail and the Electricity Entity for details of earthing requirements. Where segregation is required, the earth cable shall not be bonded to the neutral conductor.

10 Testing

10.1 Testing procedure

The Contractor is responsible for carrying out sufficient testing to ensure that materials and construction standards comply with the requirements of this Technical Specification and the requirements of the Act.

Testing shall be carried out following completion of the installation of all components and before commencement of commissioning. Tests shall include the mandatory tests detailed in AS/NZS 3000 and those detailed in Clause 10.2. The test methods to be used for equipment supplied and installed in accordance with this Technical Specification and the results achieved, shall be as defined in the Act. The completed installation shall comply with the requirements of the Act and AS/NZS 3000.

At least 28 days prior to the commencement of tests of installed equipment, a compliance testing procedure shall be prepared and submitted to the Administrator. **Milestone**

Compliance testing shall not commence until expiration of the 28-day period. **Hold Point 4**

10.2 Testing requirements

The following compliance tests shall be carried out:

a) insulation and resistance tests

b) polarity tests

c) earth continuity tests

d) earth fault loop impedance tests – active to earth fault return path

e) compliance testing of luminaires and ancillaries. Test certificates shall be supplied in accordance with Clause 7.2. All test certificates shall be available in English. Where requested, the tests shall be undertaken on each item in the presence of the Administrator. **Witness Point 2**, and

f) compliance testing of poles (see MRTS97 *Mounting Structures for Roadside Equipment).*

10.3 Testing records

In addition to copies of completed test sheets, the following documents shall also be included in the quality records:

a) a completed Certificate of Test and Compliance

b) where a luminaire / floodlight has been removed and/or relocated, a record of the pole number, lamp type, wattage and date when the luminaire / floodlight was removed and/or relocated, and new location

c) luminaire test certificates shall be current at the time of purchase and shall not be more than 10 years old. Where any significant change is made to the manufacturing process of the luminaire, which has the potential to affect the optical performance of the luminaire, new certified photometric data shall be provided to Transport and Main Roads within 3 months of the date of process change

d) mill certificates showing compliance with Clause 2.3.1 of SA/SNZ TS 1158.6 shall be available for each batch of luminaires supplied

e) the Contractor shall detail the origin of all major components of the luminaire and where final assembly is undertaken

f) where existing switchboard loads are amended, calculations for the new individual circuit voltage drops based on the new current loading

g) where existing switchboard loads are altered, amended schedules and labelling

h) a Record of Inspection and Tests, and

i) accurate As Constructed drawings in accordance with Clause 12 of MRTS50 *Specific Quality System Requirements* and the department's DDPSM Volume 2 *Road Design Concept and Development Presentation*.

11 As Constructed asset data collection for SLC connected Rate 3 luminaries

The Contractor is responsible for carrying out all relevant asset data collection activities, to ensure that all relevant asset data is collected for final SLC management system activation.

The asset data collection shall be carried out following completion of the installation of each streetlighting luminaire and connected SLC. The requirements for As Constructed asset data collection are as per the supporting Transport and Main Roads document *Smart Lighting Asset Data Capture Requirements*.

Upon completion, the collected As Constructed asset data shall be submitted to the Administrator for acceptance. **Milestone**

12 Luminaire warranty and product support

12.1 General

The warranty shall provide for either repair or replacement of the defective parts and be supported by a supplier or party located within Australia. The warranty is void if a luminaire or SLC-defect has resulted from improper installation, improper handling, vandalism, or vehicular accident. Delivery costs associated with repair or replacement of the luminaire or SLC under this warranty, shall be borne by the manufacturer / supplier.

12.2 LED luminaires

A warranty must be provided for the full replacement of the luminaire, due to any failure (see Clause 12.1), for a minimum of 10 years. This includes the LED light engine and power supply / drivers.

13 Packaging

13.1 General

All items shall be suitably packaged to ensure that the items are delivered undamaged, giving due consideration to the methods and distance of transportation and handling.

Cardboard boxes are to be cross-stacked in addition to the requirements for wrapping / strapping.

13.2 Terminal panels

All terminal panels shall be packed in suitable cardboard boxes, palletised and secured by use of heavy duty shrink wrap, strapping, or a combination of both, as required, and shall be packed minimum 10, maximum 15 per carton.

13.3 Luminaires

All luminaires shall be individually packaged in suitable cardboard boxes, palletised and secured by use of heavy duty shrink wrap, strapping, or a combination of both, as required. Where individual items weigh in excess of 20 kg, mild steel straps and metal crimp joiners shall be used.

The following information shall be marked indelibly on the individual packaging:

a) month and year of manufacture

b) name of manufacturer or trademark

c) batch number

d) description of contents and gross mass, and

e) Regulatory Compliance Mark (RCM).

13.4 Slip base mounts

The structural bolts, washers and shear washer associated with each slip base mount shall be securely packaged and attached to the mount’s cable clamp bracket.

Where slip base mounts are palletised, to facilitate safe unloading, the palletised goods are to be secured and stabilised with no overhang.

14 Environmental considerations

Manufacturers / suppliers are required to comment on the environmental soundness of the design and the materials used in the manufacture of the items tendered. In particular, comments should address such issues as recyclability and disposal at end of service life.

15 Training

The manufacturer / supplier shall provide any training material necessary to ensure required performance of any equipment supplied under this Technical Specification.

16 Supplementary requirements

The requirements of MRTS94 *Road Lighting* are varied by the supplementary requirements given in Annexure MRTS94.1.

Attachment 1 – Technical details LED luminaire

Luminaire Description: _____

Test		Response	Test Certificate / Report No. and Date
IP Rating of Luminaire	Light Source Chamber	IP_____	No:_____ Date: ____/____/____
(Refer Clause 8.2.2.2)	Control Gear Chamber	IP_____	
Does luminaire comply with the electrical safety requirements? (Clause 3 SA/SNZ TS 1158.6 and AS/NZS 60598.2.3)		Yes/No	No:_____ Date: ____/____/____
Does luminaire comply with the vibration test? (Clause 5.4 of SA/SNZ TS 1158.6)		Yes/No	No:_____ Date: ____/____/____
Does luminaire comply with impact resistance criteria? (AS/NZS 60598.2.3)		Yes/No	No:_____ Date: ____/____/____
Does luminaire comply with the impulse voltage test (Clause 5.5 of SA/SNZ TS 1158.6) Did flashover occur?		Yes/No Yes/No	No:_____ Date: ____/____/____
Does luminaire comply with the thermal endurance and thermal tests (Clauses 5.6 of SA/SNZ TS 1158.6)		Yes/No	No:_____ Date: ____/____/____
Has an IESNA LM-79 or CIE S 025 test report been provided		Yes/No	No:_____ Date: ____/____/____
Have IESNA LM-80 and IESNA TM21 calculations and extrapolations been provided		Yes/No	No:_____ Date: ____/____/____
Has a luminous intensity distribution table (I-table) in CIE and IES formats corresponding to the LM-79 or CIE S 025 test reports been provided		Yes/No	No:_____ Date: ____/____/____
Does the power supply meet the requirements of IEC 62386-102 Ed. 2.0		Yes/No	No:_____ Date: ____/____/____
Predicted minimum power supply failure rate of 0.2% per 1 000 hours of operation		Yes/No	No:_____ Date: ____/____/____
Surge Protection Device Rating		(kV) / (kA)	No:_____ Date: ____/____/____
Correlated Colour Temperature (CCT)		(K) ± (K)	No:_____ Date: ____/____/____
Initial Lumen Output (lumens)			No:_____ Date: ____/____/____
Luminaire Efficacy (lumens / watt)			No:_____ Date: ____/____/____

Test	Response	Test Certificate / Report No. and Date
Lumen Depreciation at 50,000 hours (L--)		No: _____ Date: ____/____/____
Overall Power Factor (steady running conditions)		No: _____ Date: ____/____/____
Luminaire Driver Current (milliAmps)		
Luminaire Running Current (Amps)		
Total Luminaire Power Consumption (Watts)		
Luminaire upcast reducing device	Spigot entry integral Spigot entry insert	
Luminaire Mass (kg)		
Luminaire Sail Area (m²)		
QR code label attached (refer to Clause 8.2.2.2)	Yes/No	
Is any training material required to ensure the luminaire performs as specified, for example handling, installation, cleaning	Yes/No	

Attachment 2 – Luminaire performance requirements for Category 'V' LED luminaires

- Performance against AS/NZS 158.1.1
- A maintenance factor of 0.8 shall be assumed for all spacing calculations
- Traffic flow for single carriageway roads shall be two-way, and
- Upcast angle 0 degree.

Category V5 maximum wattage 100 W	Luminaire wattage: Lumen O/P: Luminaire efficacy:	Luminaire ID:	Luminaire manufacturer:
	Upcast Angle 0 degree	I Table No.:	LED manufacturer:

Spacing table - compliance must be continuous for at least 10 m below the spacing offered

ARR	MH (m)	MED (m)	O/H (m)	Wk (Carriageway width in metres)											
				10				12				14			
				Required minimum spacing (m)	Spacing offered (m)	$\bar{L}$ (cd/m²)	Ti	Required minimum spacing (m)	Spacing offered (m)	$\bar{L}$ (cd/m²)	Ti	Required minimum spacing (m)	Spacing offered (m)	$\bar{L}$ (cd/m²)	Ti
1	10.5		1.5	61				61				55			
1	12		1.5	69				66				61			
3	10.5		1.5	43				40				39			
3	12		1.5	52				48				46			
4	10.5		1.5									65			
4	12		1.5									72			

Category V3 maximum wattage 160 W	Luminaire wattage: Lumen O/P: Luminaire efficacy:	Luminaire ID:	Luminaire manufacturer:
	Upcast Angle 0 degree	I Table No.:	LED manufacturer:

Spacing table - compliance must be continuous for at least 10 m below the spacing offered

ARR	MH (m)	MED (m)	O/H (m)	Wk (Carriageway width in metres)											
				10				12				14			
				Required minimum spacing (m)	Spacing offered (m)	$\bar{L}$ (cd/m²)	Ti	Required minimum spacing (m)	Spacing offered (m)	$\bar{L}$ (cd/m²)	Ti	Required minimum spacing (m)	Spacing offered (m)	$\bar{L}$ (cd/m²)	Ti
1	10.5		1.5	56				50							
3	10.5		1.5	41				38				36			
4	10.5		1.5									61			
5	10.5	3	1.5	68				67				63			
			3	68				67				63			
6	10.5	3	1.5	62				63							
			3	63				64				60			
6	10.5	1	2.5	59				61							
			4	61				61				60			

Category V3 maximum wattage 200 W	Luminaire wattage: Lumen O/P: Luminaire efficacy:	Luminaire ID:	Luminaire manufacturer:
	Upcast Angle 0 degree	I Table No.:	LED manufacturer:

Spacing table - compliance must be continuous for at least 10 m below the spacing offered

ARR	MH (m)	MED (m)	O/H (m)	Wk (Carriageway width in metres)											
				10				12				14			
				Required minimum spacing (m)	Spacing offered (m)	$\bar{L}$ (cd/m²)	Ti	Required minimum spacing (m)	Spacing offered (m)	$\bar{L}$ (cd/m²)	Ti	Required minimum spacing (m)	Spacing offered (m)	$\bar{L}$ (cd/m²)	Ti
1	12		1.5	61				63							
3	12		1.5	54				51				46			
4	12		1.5									71			
5	12	3	1.5	71				69				61			
			3	71				69				61			
6	12	3	1.5	68				68							
			3	66				66				66			
6	12	1	2.5	67				67							
			4	67				66				66			

Category V3 maximum wattage 300 W	Luminaire wattage: Lumen O/P: Luminaire efficacy:	Luminaire ID:	Luminaire manufacturer:
	Upcast Angle 0 degree	I Table No.:	LED manufacturer:

Spacing table - compliance must be continuous for at least 10 m below the spacing offered

ARR	MH (m)	MED (m)	O/H (m)	Wk (Carriageway width in metres)											
				16				18				20			
				Required minimum spacing (m)	Spacing offered (m)	$\bar{L}$ (cd/m²)	Ti	Required minimum spacing (m)	Spacing offered (m)	$\bar{L}$ (cd/m²)	Ti	Required minimum spacing (m)	Spacing offered (m)	$\bar{L}$ (cd/m²)	Ti
5	15	5	1.5	83				76				70			
			3	86				81				74			
6	15	5	0.5	87				74							
			2	88				79				67			
6	15	1	2.5	87				70							
			4	88				75				68			

Attachment 3 – ALI 2 Part 251 Memory Bank 1 Extension

The minimum memory bank data requirements are listed in the table below:

Address	Description	Remarks
0 x 13	Luminaire year of manufacture [YY] Range 0-99, MASK = unknown	
0 x 14	Luminaire week of manufacture [WW] Range 1-53, MASK = unknown	
0 x 15	Nominal Input Power [W] (MSB)	
0 x 17	Input Power at minimum dim level [W] (MSB)	
0 x 19	Nominal Minimum AC mains voltage [V} (MSB)	
x 01B	Nominal Maximum AC mains voltage [V] (MSB)	
0 x 1D	Nominal light output [Lm] (MSB)	
0 x 20	CRI; Range 0-100, MASK = unknown	
0 x 21	CCT [K] (MSB)	
0 x 23	Light Distribution Type; 0 = not specified; 1 = Type 1; 2 = Type II; 3 = Type III; 4 = Type IV; 5 = Type V; 6-254 = available for additional types MASK = unknown According to IES RP-8, Roadway Lighting; Annex E, Classification of Luminaire Distribution.	
[0 x 24, 0 x 3B]	Housing finishing colour [24 ascii characters string, first char at 0 x 24][d] Range 32-26 (Ascii printing characters only)	
[0 x 3C, 0 x 77]	Luminaire identification [60 ascii characters string, first char at 0 x 3c][d] Range 32-126 (ascii printing characters only]	Input luminaire model number

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