

Main Roads Technical Standard

MRTS94

Road Lighting

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Table of Contents

	Page
1 INTRODUCTION.....	1
2 DEFINITION OF TERMS	1
3 REFERENCED DOCUMENTS	1
3.1 Standards	1
3.2 Standard Drawings.....	2
4 QUALITY SYSTEM REQUIREMENTS.....	3
4.1 Hold Points, Witness Points and Milestones.....	3
5 COMPLIANCE WITH LEGISLATION.....	3
6 COMPLIANCE WITH OTHER DOCUMENTATION.....	3
7 DESIGN BY THE CONTRACTOR	3
7.1 Submission of Design.....	3
7.2 Additional Requirement – Design of Poles.....	4
7.3 Additional Requirement – Luminaires	4
7.4 Design Changes During Construction	4
7.5 Electricity Entity	5
8 MATERIAL	5
8.1 General.....	5
8.2 Rate 3 Road Lighting Materials	5
8.2.1 Road Lighting Poles.....	5
8.2.2 Road Lighting Luminaires	9
8.2.3 Terminal Panels.....	10
8.2.4 Miscellaneous Materials	11
9 INSTALLATION, REMOVAL AND/OR RELOCATION OF EQUIPMENT.....	11
9.1 Road Lighting Luminaires and Pedestrian Crossing Floodlights – Rate 3.....	11
9.2 Installation of Poles – Rate 3.....	11
9.3 Pole Markings – Rate 3.....	11
9.4 Removal of Road Lighting Luminaires and Pedestrian Crossing Floodlights – Rate 3	11
9.5 Relocation of Road Lighting Luminaires and Pedestrian Crossing Floodlights – Rate 3.....	12
9.6 Removal of Poles – Rate 3.....	12
9.7 Relocation of Poles – Rate 3.....	12
9.8 Wiring – Rate 3.....	12
9.9 Earthing	12
9.9.1 Earthing of Ground-Mounted Lighting Poles	12
9.9.2 Earthing of Lighting Installations on Bridges and Other Structures.....	13
9.9.3 Lighting Installations adjacent to Railway Overhead Lines	13
10 TESTING	13
10.1 Testing Procedure.....	13
10.2 Testing Requirements	13
10.3 Testing Records	13
11 PACKAGING	14
12 SUPPLEMENTARY REQUIREMENTS.....	14

Road Lighting

1 INTRODUCTION

This Technical Standard applies to the supply and installation of Rate 3 Road Lighting Equipment, including the requirements for the manufacture, testing and delivery of poles, slip base mounts, outreach arms, extensions, luminaire headframes, luminaire terminal panels, luminaires and pedestrian crossing floodlights.

This Technical Standard 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.

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

This Technical Standard forms part of the Main Roads Specifications and Technical Standards Manual.

2 DEFINITION OF TERMS

The terms used in this Technical Standard shall be as defined in Clause 2 of MRTS01 *Introduction to Technical Standards*. Further definitions are defined in Table 2 and AS/NZS 3000.

Table 2 – Definition of Terms

Term	Definition
Act	<i>Electrical Safety Act 2002</i> and associated Regulations and Codes of Practice.
Administrator	Principal's Representative or Superintendent as defined in Clause 14 of MRTS01 <i>Introduction to Technical Standards</i> .
Electricity Entity	As defined in the Act.
Electrical Works	As defined in the Act.
Licensed Electrical Contractor	Holder of an Electrical Contractor License under the Act.
Rate 1 Lighting	Public lighting supplied, installed, owned and maintained by the Electricity Entity.
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.

3 REFERENCED DOCUMENTS

3.1 Standards

Table 3.1 lists documents referenced in this Technical Standard.

Table 3.1 – Referenced Documents

Reference	Title
AS/NZS 1158.1.1	Lighting for roads and public spaces – Vehicular traffic (Category V) lighting – Performance and design requirements
AS/NZS 1158.2	Lighting for roads and public spaces – Computer procedures for the calculation of light technical parameters for Category V and Category P lighting
AS/NZS 1158.4	Supplementary lighting at pedestrian crossings
AS/NZS 1158.6	Lighting for roads and public spaces – Luminaires
AS/NZS 1170	Structural design actions Set
AS/NZS 1170.1	Structural design actions – Permanent, imposed and other actions

Reference	Title
AS/NZS 1170.2	Structural design actions – Wind actions
AS/NZS 1554.1	Structural steel welding – Welding of steel structures
AS/NZS 1594	Hot-rolled steel flat products
AS 1798	Lighting poles and bracket arms – Preferred dimensions
AS/NZS 3000	Electrical installations (known as the Australian/New Zealand Wiring Rules)
AS 3600	Concrete structures
AS/NZS 3678	Structural steel – Hot-rolled plates, floor plates and slabs
AS/NZS 4065	Concrete utility services poles
AS 4068	Flat pallets for material handling
AS 4100	Steel structures
AS/NZS 4676	Structural design requirements for utility services poles
AS/NZS 4680	Hot-dip galvanized (zinc) coatings on fabricated ferrous articles
AS/NZS 60598.1	Luminaires – Part 1 : general requirements and tests
AS/NZS 60598.2.5	Luminaires – Part 2.5: Particular requirements – Floodlights
AS/NZS CISPR 15	Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment
RPDM	Road Planning and Design Manual – published by Transport and Main Roads
TRUM	Traffic and Road Use Management Manual – published by Transport and Main Roads

3.2 Standard Drawings

Table 3.2 lists the Standard Drawings referenced in this Technical Standard or relevant to the design, construction, maintenance and operation of Road Lighting.

Table 3.2 – Referenced Standard Drawings

Drawing Number	Title
1323	Road Lighting – Luminaire terminal panel
1328	Road Lighting Pole – Anchor Cage Fabrication Details
1335	Road Lighting – Mounting bracket for floodlight & road lighting luminaire
1336	Road Lighting – Mounting bracket for floodlight
1380	Road Lighting – Slip Base Pole Installation Details for no Cross fall
1381	Road Lighting – Slip base pole installation details for crossfalls up to and including 1:6
1382	Road Lighting – Slip base pole installation details for crossfalls greater than 1:6 up to and including 1:3
1389	Road Lighting – Slip Base Pole Male/Female Connectors Installation Details
1390	Road Lighting – Base Plate Mounted pole aerial connection wiring details
1392	Road Lighting – Base Plate Mounted pole installation for crossfalls up to and including 1:2
1393	Road Lighting – Base Plate Mounted pole installation details for crossfalls greater than 1:2
1395	Road Lighting – Base Plate Mounted pole in concrete median barrier installation details

Drawing Number	Title
1399	Road Lighting – Base Plate Mounted pole wiring details
1400	Road Lighting – Slip Base Pole Wiring Details
1406	Road Lighting – GEC Sentry PX Flood Light Installation and Aiming
1409	Road Lighting – Luminaire headframes wiring details excluding 4 x 400 W luminaires
1410	Road Lighting – Luminaire headframes wiring details 4 x 400 W luminaires
1411	Road Lighting – Mast arm road lighting junction box (Type B)
1412	Road Lighting – Road Lighting Junction Box (Type B) Wiring Details
1429	Road Lighting – Slip base pole installation details for crossfalls greater than 1:6 up to and including 1:3 using concrete step tread
1431	Road Lighting – Base Plate Mounted pole wiring details for median barriers

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 Standards*.

The Hold Points, Witness Points and Milestones applicable to this Standard 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	Testing of poles and components	Submission of pole calculations (7 days)
7.3	3. Supply of luminaires		Submission of luminaire documentation (7 days)
10.1	4. Compliance testing		Submission of compliance testing procedure (28 days)
10.2		Compliance testing of luminaires	

5 COMPLIANCE WITH LEGISLATION

The work covered by this Standard shall comply with the requirements of the Act and subordinate legislation and AS/NZS 3000.

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 Standard shall be read in conjunction with referenced documents, RPDM Chapter 17: Lighting, TRUM 5.3 and 5.4, 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.

Not less than 28 days 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 AS/NZS 1158. **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.

The design shall be certified by a person experienced in road lighting design and holding a current registration as a Registered Professional Engineer, Queensland.

For luminance based designs, the design submission shall include all design data produced by the Stan computer design software, as marketed by Standards Australia.

For illuminance based designs, the design submission shall include a drawing for each luminaire showing isolux contours, appropriate to the Category V level detailed in AS/NZS 1158.1.1 which has been chosen for the design. The drawing is to have a minimum scale of 1:500 at A1 unless otherwise approved by the Administrator. All text shall be legible when produced in A3 format. The isolux contours shall be electronically overlaid on a layout which includes line marking details.

Construction under this Standard shall not commence until expiration of the 28 day 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

Where so stated in Clause 1 of Annexure MRTS94.1, tests shall be carried out, in accordance with this Standard, on one pole, one outreach arm, one outreach arm extension, one luminaire head frame and/or one slip base mount.

At least 7 days prior to such testing, full detailed calculations of stress and deflection, to serve as a comparison with the test results, shall be submitted to the Administrator **Milestone** Calculations for each item shall be submitted in sufficient detail to prove that the proposed tests are representative of the maximum design loads. The submission shall state the maximum bending moment that may be applied at the ground line of each pole type offered.

Should failure occur during testing, designs shall be modified and resubmitted in accordance with this clause and further testing carried out. **Witness Point**

Where testing is required by this clause, construction shall not proceed until all tests have been completed successfully. **Hold Point 2**

7.3 Additional Requirement – Luminaires

At least 7 days prior to delivery to the site, for each luminaire, supporting documentation, as detailed in Section 6 of AS/NZS 1158.6, including manufacturer's drawings, shall be submitted to the Administrator. **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 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 Clause 2 of 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 Standard.

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. 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 (e.g. suburb), wattage and pole number of all luminaires. A copy of such 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 Standard.

8.2 Rate 3 Road Lighting Materials

8.2.1 Road Lighting Poles

8.2.1.1 General Details

Figures 1 to 9 inclusive included in Appendix A to this Technical Standard show the general arrangements of Rate 3 road lighting installations covered by this Standard.

8.2.1.2 Pole Design Parameters

8.2.1.2.1 General

All poles shall be designed to withstand, without permanent deformation, the worst combination of the following loadings –

- a) dead load of the pole, outreach arm, extension and luminaire;
- b) live load, applied by any aerial supply cable; and
- c) wind load on the pole, outreach arm, extension, and luminaire.

The design strength of poles shall be calculated in accordance with the requirements of AS 4100, AS 3600, AS/NZS 1594, AS/NZS 3678, AS/NZS 4065 and AS/NZS 4676, as appropriate.

Design parameters are stated in Attachment 1 "Road Lighting Pole Design Parameters" to this Technical Standard.

8.2.1.2.2 Wind Loading

Pole wind loads shall be determined from the methods detailed in AS/NZS 1170.2 using a wind velocity V_z as stated in Table 8.2.1.2.2.

Table 8.2.1.2.2 – Wind Velocity

Height (m)	V_z (m/s)		
	V_s Serviceability	V_p Permissible	V_u Ultimate
15	29	45	57
10	27	43	53
5	25	39	50
< 3	23	36	47

The wind loading design drag coefficients shall be 1.0 for luminaires, 1.2 for outreach arms and 1.0 for traffic signals.

8.2.1.2.3 Aerial Connection

In addition to any wind loading, road lighting poles fitted with aerial supply cable shall be designed to withstand an ultimate static force of 1 kN exerted by the aerial cable.

The aerial connection shall be applied horizontally in any direction 125 mm below the spigot line on poles up to 10 metres high and 3125 mm below the spigot line on poles exceeding 10 metres high.

8.2.1.2.4 Load Combinations

Load combinations of dead loads, live loads and wind loads for design purposes shall be determined from Clause 4.2.2 of AS/NZS 1170.1 in accordance with AS 4100 and AS 3600.

8.2.1.2.5 Deflection

The deflection of the pole from the vertical position under serviceability limit state shall be calculated according to AS/NZS 1170 and shall not exceed 4% of the vertical section height of the pole measured at the base of the outreach arm fixing spigot.

8.2.1.2.6 Tip Loading

The maximum allowable tip load shall be indelibly marked on the name plate of each pole manufactured.

The maximum allowable tip load is defined as the maximum continuous load that can be applied horizontally (in any direction) to the base of the outreach arm fixing spigot with the pole installed in its normal vertical working position.

8.2.1.2.7 Hinged Poles

Hinged poles shall be base plate mounted type with an underground power supply.

The top of a hinged pole shall consist of a spigot for a luminaire head frame.

An access hatchway shall be located such that it is unobstructed by the hinged section of the pole, i.e. perpendicular to the swing direction. The hatchway size shall be –

- a) 600 mm x 150 mm on 350 mm PCD poles; or
- b) 600 mm x 230 mm on 500 mm PCD poles.

The top of the hatchway shall be a maximum of 1500 mm above the base of the pole. The lower end of the mast arm shall be above the access hatchway. The swing arm complete with luminaires shall be such that the outreach when lowered shall be at a height of between 1200 mm and 1400 mm above the pole base. The pole shall be designed such that it is not possible for the luminaires to touch the lower section of the pole. Pulling eyes shall be located on the flap and at the pole base so that a rope may be used to raise the hinged section and regulate the lowering speed of the hinged section.

The pole shall have two independent latching systems to hold the flap in place, each of sufficient strength to restrain the pole from lowering. One system shall comprise a tamper proof stainless steel bolt of appropriate strength to hold the flap rigidly to the pole free from movement.

This bolt shall be located between 900 mm and 1500 mm above the pole base.

The other system shall comprise a lug welded to the inside face of the flap and protruding through the lower pole section when in the upright position. The lug shall have a hole through it to allow for padlock. It shall be possible to install the padlock to the inside of the pole via the hatchway.

Counterweights of appropriate mass shall be provided for different hinged pole sizes to achieve rotational balance. Individual counterweights shall not have a mass greater than 10 kg.

The connecting pin and the lower section of the swing arm shall be designed to resist shear forces and tension forces generated by dead, live and wind loads. The pivot hinge shall be adequately welded to the base section of the pole.

8.2.1.2.8 Proof Loading

The contractor must state the maximum bending moment that may be applied at the ground line for all poles.

8.2.1.2.9 Frangible Poles

Frangible poles may be either slip base mounted or energy absorbing type.

Slip base mounted poles shall conform to the requirements of this Standard and Figures 6 and 7 of MRTS94 Appendix.

Energy absorbing poles shall conform to the requirements of this Standard, Figure 8 of MRTS94 Appendix and to Clauses 8.2.1.2.9 and 8.2.1.2.10.

8.2.1.2.10 Energy absorbing Pole Crash Behaviour

Energy absorbing poles shall deform progressively when a vehicle crashes into them. The poles shall be designed to deform progressively so as to decelerate an impacting vehicle in a controlled and uniform manner.

The base of an energy absorbing pole shall remain attached to the footing after impact and the pole shall collapse upon vehicle impact in a predictable and acceptable manner.

8.2.1.2.11 Energy Absorbing Pole Crash Performance Tests

The Contractor shall supply evidence of full scale impact testing, carried out by an organisation with accredited data collection system, from which Transport and Main Roads Executive Director (Structures) shall assess the adequacy and suitability of the poles as being energy absorbing.

Poles shall be demonstrated to fall or collapse in a safe fashion so as to be not likely to cause injury to occupants in the impacting vehicle or to other vehicles on the road. The final position of the pole should not be expected to be on the road.

Two tests are required. The first is at 50 km/h and the second at 100 km/h by vehicles with a mass of 820 kg. The first test is to demonstrate that the failure or collapse mechanism is effective and will occur at 50 km/h. The second test is to evaluate vehicle stability and trajectory and also the trajectory of the pole.

The Occupant Ride-down Acceleration (ORA) and Occupant Impact Velocities (OIV) must be calculated in accordance with NCHRP 350, which is the basis of the testing procedure in AS 3845:1999.

The Occupant Impact Velocities should be in the range for longitudinal velocity components, that is 9 m/s preferred and 12 m/s maximum. These OIV values are calculated when an occupant is expected to be at the limit of the flail space. This is when the occupant has travelled either 600 mm in the forward direction or 300 mm laterally. The Occupant Ride-down Acceleration should be less than 15 g preferably and with a maximum of 20 g averaged over a moving 10ms period after occupant has reached the limits of the flail space.

The point of impact is to be on the centre line of the vehicle. The pole and the vehicle must be brought to rest in a safe and controlled manner. Any pitch, yaw or roll shall be noted with the Occupant Ride-down Acceleration and Occupant Impact Velocities.

The pole design must also include an electrical disconnect method acceptable to the Administrator.

With regard to the above crash performance criteria and electrical disconnect method, the Administrator reserves the right to –

- a) Accept any pole type where satisfactory evidence indicates that the above requirements are substantially, but not precisely, met;
- b) Waiver the right to further testing where the pole design has been previously tested and found to be satisfactory; or
- c) Reject any pole type.

8.2.1.2.12 Pole Footing

The design load of the pole shall not exceed the capacity of the footings as detailed on Standard Drawing number 1328.

8.2.1.2.13 Outreach Arms, Extensions and Head frames

All outreach arms and extensions shall be designed to withstand, without permanent deformation, the worst combination of the following loadings –

- a) dead load due to outreach arm, extension and luminaire; and
- b) wind load on outreach arm, extension and luminaire.

All luminaire head frames shall be designed to withstand, without permanent deformation, the worst combination of the following loadings –

- a) dead load due to luminaire head frame and luminaire; and
- b) wind load on luminaire head frame and luminaire.

Design strength of an outreach arm and extension, and luminaire head frame, shall be calculated in accordance with the requirements of AS 4100, as appropriate.

Design parameters are detailed in Attachment 2 "Outreach Arms and Extensions; and Luminaire Head frames Design Parameters" to this Standard.

The wind loading shall be determined by the method detailed in Clause 8.2.1.2.2.

Load combinations of dead load and wind load shall be determined by the method detailed in Clause 8.2.1.2.4.

An outreach arm shall be designed so that, under dead load with luminaire and outreach arm extension, where fitted, the luminaire fixing spigot, spigot angle shall not be less than 5 degrees nor greater than 7 degrees.

The deflection of the outreach arm when fitted to a fixed non-deflecting spigot, under the serviceability limit state, shall be calculated in accordance with AS/NZS 1170 and shall not exceed 4% of the nominal horizontal outreach length.

8.2.1.2.14 Slip Base Mount Design Parameters

All slip base mounts shall be designed to withstand, without permanent deformation, the worst combination of the following loadings –

- a) dead load due to pole, outreach arm, extension and luminaire; and
- b) wind load on pole, outreach arm, extension and luminaire.

The design strength of mounts shall be calculated in accordance with the requirements of AS 4100, AS 3600, AS/NZS 1594, AS/NZS 3678 and/or AS/NZS 4065 as appropriate.

Design parameters are detailed in Attachment 3 "Slip Base Mount Design Parameters" to this Standard.

The wind loading shall be determined by the method detailed in Clause 8.2.1.2.2.

Load combinations of dead load and wind load shall be determined by the method detailed in Clause 8.2.1.2.4.

8.2.1.3 Pole Fabrication

8.2.1.3.1 General Fabrication Requirements

Steel used in the construction of poles, outreach arms and extensions shall comply with the requirements listed in Table 8.2.1.3.1.

Table 8.2.1.3.1 – Steel Requirements for Poles and Ancillary Equipment

Item Description	Steel Grade	Steel Thickness
Pole – base plate mounted	250 minimum	3 mm minimum
Pole – slip base	250 minimum	3 mm minimum
Hinged Pole	250 minimum	3 mm minimum
Pole – Energy absorbing	250 minimum	3 mm minimum
Outreach arms	250 minimum	
Outreach arm extension	350 minimum	
Luminaire head frame	250 minimum	
Slip base mount	250 minimum	

Steel shall comply with the requirements of AS/NZS 1594 and/or AS/NZS 3678. Poles, outreach arms, outreach arm extensions, luminaire head frames and slip base mounts shall be fabricated in accordance with MRTS78 *Fabrication of Structural Steelwork*.

Tolerances shall be in accordance with AS 1798 unless otherwise shown in the Drawings.

Welding shall be in accordance with AS/NZS 1554.1. Welding certificates shall be provided when requested by the Administrator.

All steel assemblies shall be permanently and legibly identified by means of a stainless steel or aluminium plate. The marking plate shall be stamped and located as shown in the Drawings and full details of the plate and method of fixing shall be provided.

In addition to the above requirement for marking, all joint use traffic signal and road lighting poles shall have a warning plate permanently and legibly identified, by means of a stainless steel or aluminium plate. The warning plate shall be stamped and located as shown in the Drawings and full details of the plate and method of fixing shall be provided.

All steel items shall be hot dip galvanised in accordance with AS/NZS 4680. The average coating mass, other than on threads of bolts, shall not be less than 600 g/m².

All poles shall have a uniform taper and/or be as slim as possible, and continuous with the outreach arm.

8.2.1.3.2 Slip Base Mounts

All slip base mounts shall be constructed in steel in accordance with the requirements shown in the Drawings and this Standard. Electrical components used for the disconnect mechanism shall be as shown on Standard Drawing number 1389.

The slip base pole adaptor assembly shall include three M36 bolts, nuts, washers and shear washers.

Cable clamp brackets with associated set screw with half nut, flat washers, spring washer and wing nut shall be provided for both the slip base pole and mount.

8.2.2 Road Lighting Luminaires

Luminaires shall be supplied as –

- a) Side entry mounting dished prismatic visor and flat visor aero screen luminaires with integral control gear for use with high pressure sodium vapour 100 W, 150 W, 250 W and 400 W clear tubular lamps;
- b) high mast luminaires with integral control gear designed for use with high pressure sodium vapour 250 W and 400 W clear tubular lamps; or
- c) pedestrian crossing floodlights with integral control gear designed for use with high pressure sodium vapour 250 W and 400 W clear tubular lamps.

The luminaire shall be provided with at least the following degrees of protection when tested in accordance with Clause 5.7 of AS/NZS 1158.6 –

- a) Lamp Chamber – IP66; and
- b) Control Gear Chamber – IP24.

The equipment shall be exposed to the environmental conditions detailed in AS/NZS 1158.6.

Luminaires other than pedestrian crossing floodlights shall be designed and constructed in accordance with the requirements of AS/NZS 1158.6, and shall have photometric performance to AS/NZS 1158.1.1 and AS/NZS 1158.2. Luminaires for pedestrian crossing floodlights shall be designed and constructed to AS/NZS 60598.2.5, and shall have photometric performance to AS/NZS 1158.4.

Top entry access to the control gear chamber is preferred for road lighting luminaires.

Luminaires shall not be individually controlled by a photoelectric cell. However, all luminaires, except pedestrian crossing floodlights, shall be capable of mounting a photoelectric cell (base only), if required. Allowances shall be made in the design of the luminaire for a photoelectric cell socket complying with Clause 3.10.1 (b) of AS/NZS 1158.6.

All luminaires shall be fitted with a metal oxide varistor (MOV) type surge suppressor with a minimum energy absorption capacity of not less than 320 joules, across the active and neutral terminals to provide high voltage surge protection for the luminaire components.

Luminaires shall be design such that the stated photometric distribution of the luminaire shall be maintained throughout its life.

Aero screen luminaires shall have a clear flat toughened glass visor.

Visors for Category V luminaires (except aeroscreen types) shall not be manufactured from glass.

There shall be no electrical connections between the neutral block and the luminaire body.

All Category V road lighting luminaires and pedestrian crossing floodlights shall be fitted with a skirted lamp holder suitable for E39/41 and E40/41 lamps.

All Category V road lighting luminaires and pedestrian crossing floodlights shall be supplied complete with appropriate lamps

The lamps shall be packaged in separate containers to prevent breakage during transport.

The following details of luminaires shall be provided to the Administrator –

- a) overall power factor (steady running conditions);
- b) starting current (amps); and
- c) running current (amps).

Additionally, details of the method employed to ensure that the lamp holder/lamp configuration shall not move during the expected life of the luminaire, so that the lamp shall not impact the visor during normal service conditions (e.g. installations on bridges), shall be submitted.

Luminaires shall comply with the relevant spigot fixing sizes detailed in Clause 4.1 of AS 1798. The depth of the spigot entry shall be as specified in Table 2.2 of AS/NZS 1158.6.

The control gear and termination assembly shall comply with Section 3 of AS/NZS 1158.6

Top entry access to the control gear chamber is preferred for road lighting luminaires.

Power factor correction capacitors shall be incorporated in the luminaires to provide operation at a nominal power factor of not less than 0.85. In addition to the requirements of Clause 4.1.1 of AS/NZS 1158.6 the capacitor shall have the following features –

- a) 280 V rating;
- b) Hermetically sealed;
- c) Metal can housing;
- d) Incorporate internal safety feature in event of capacitor failure; and
- e) Minimum 85°C temperature rating.

The lamp ignitor shall be a timed ignitor with an internal electronic timer to automatically switch off high voltage pulses after 11 minutes of attempting to strike the lamp and shall also comply with the requirements of Clause 3.3 of AS/NZS 1158.6.

The electrical interference produced by the luminaire shall not exceed the limits prescribed in AS/NZS CISPR 15.

8.2.3 Terminal Panels

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

The terminal panel shall be suitable for operation on a 230 volt + 10% - 6%, 50 Hz \pm 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 etc 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 number 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) sufficient care shall be taken to reduce undue stress and vibration while the pole is being erected; and
- c) for road lighting luminaires, the luminaire shall be fixed to the outreach arm spigot such that, when the pole is installed in its upright position, the luminaire is correctly aligned with respect 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 the luminaire ballast or other 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 shown on Standard Drawing number 1406. The aiming point shall be as detailed in the Drawings.

9.2 Installation of Poles – Rate 3

Base Plate Mounted pole installation for crossfalls up to and including 1:2 shall be erected in accordance with Standard Drawing number 1392.

Base Plate Mounted pole installation details for crossfalls greater than 1:2 shall be erected in accordance with Standard Drawing number 1393.

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

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

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

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

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

9.3 Pole Markings – Rate 3

Pole markings shall be as stated in the Drawings or, where not so 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 Regions store or other designated location. Care shall be taken in the transportation of the luminaires such 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 subsequent to 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 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 re-installed in accordance with the requirements of this Standard.

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 such that they arrive in a sound serviceable condition without any further damage.

Any damage that occurs due to removal or handling subsequent to 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, e.g. rust, 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 Standard.

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 number 1399.

Where base plate mounted poles are located in a concrete median barrier, the supply cable shall be daisy-chained from the terminal block on the luminaire terminal panel of each road lighting pole in accordance with Standard Drawing number 1431.

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

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

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

Luminaire head-frames wiring, excluding 4 x 400 W luminaires shall comply with Standard Drawing number 1409.

Luminaire head-frames wiring for 4 x 400 W luminaires shall comply with Standard Drawing number 1410.

Pole wiring in a combination traffic signal mast arm shall comply with Standard Drawing number 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 mm² (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 (e.g. not painted, bolts tight, not corroded, etc.).

Where the pole interface with ground is not of low electrical resistance, an earth stake shall be 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. The neutral conductor shall not be connected to earth at any pole on the bridge. For details refer to standard drawing number 1707.

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 Standard 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 Standard 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. Where requested, the tests shall be undertaken on each item in the presence of the Administrator. Test certificates shall be supplied in accordance with Clause 7.3; **Witness Point** and
- f) compliance testing of poles, which test shall be undertaken on a Type test basis in accordance with the requirements of Clause 7.2.

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) where existing switchboard loads are amended, calculations for the new individual circuit voltage drops based on the new current loading;
- d) where existing switchboard loads are altered, amended schedules and labelling;
- e) a Record of Inspection and Tests; and
- f) accurate as-constructed drawings.

11 PACKAGING

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.

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.

All luminaires 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. Where individual items weigh in excess of 20 kg, mild steel straps and metal crimp joiners shall be used. Pallets shall be in accordance with the requirements of AS 4068.

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

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

12 SUPPLEMENTARY REQUIREMENTS

The requirements of MRTS94 *Road Lighting* are varied by the supplementary requirements given in Clause 3 of Annexure MRTS94.1

ATTACHMENT 1 – ROAD LIGHTING POLE DESIGN PARAMETERS

MAJOR ROAD POLE											
Poles				Equipment on Poles							
Pole Type	Vertical Section		Outreach Arm		Luminaire		Aerial Cable		Traffic Signals		
	Height (metres)	Figure No.	Type	Figure No.	Mass (kg)	Sail Area (m ²)	Aerial Cable Conn. Req ¹	Max Loading (kN)	Type	Mass (kg)	Sail Area (m ²)
Base plate mounted	7.0	4, 5	3 m double plus	2	2 x 15	2 x 0.17	Yes	1.0	N/A	N/A	N/A
	8.5		2 x 1.5 m								
	10.0		extensions								
	13.0										
Base plate mounted Joint Use	7.0	4, 5	3 m double plus	2	2 x 15	2 x 0.17	No	N/A	2 x 6 aspect 300 mm incl. target boards plus pedestrian lantern	89	2.00
	8.5		2 x 1.5 m								
	10.0		extensions								
Slip Base	7.0	6, 7	3 m double plus	2	2 x 15	2 x 0.17	No	N/A	N/A	N/A	N/A
	8.5		2 x 1.5 m								
	10.0		extensions								
	13.0										
Energy absorbing	7.0	8	3 m double plus	2	2 x 15	2 x 0.17	No	N/A	N/A	N/A	N/A
	8.5		2 x 1.5 m								
	10.0		extensions								
	13.0										
Hinged	10.0	9	4 way adaptor luminaire head frame	3	4 x 15	4 x 0.17	No	N/A	N/A	N/A	N/A
	13.0										

ATTACHMENT 2 – OUTREACH ARMS AND EXTENSION AND LUMINAIRE HEADFRAME DESIGN PARAMETERS

Component	Figure No.	Outreach Arm		Outreach Extension	Luminaire	
		Length (metres)	Mass (kg)		Sail Area (m ²)	
Single Outreach	2	1.5	15	1.5 metres	2 x 15	0.17
		3.0	2 x 15			
Double Outreach	2	3.0	refer to Standard Drawing number 1335			
		1.5	2 x 15	1.5 metres	2 x 0.17	
3.0						
Outreach Arm Extension		1.5	15	N/A		0.17
Luminaire Head frame – 1 way Adaptor	3	0.3	15			0.17
Luminaire Head frame – 2 way Adaptor			2 x 15			2 x 0.17
Luminaire Head frame – 3 way Adaptor			3 x 15			3 x 0.17
Luminaire Head frame – 4 way Adaptor			4 x 15			4 x 0.17

ATTACHMENT 3 – SLIP BASE MOUNT DESIGN PARAMETERS

Mount		Pole		Equipment on Poles								
				Outreach Arm		Luminaire		Aerial Cable		Traffic Signals		
Flange PCD (mm)	Figure No.	Vertical Section Height (metres)	Figure No.	Type	Figure No.	Mass (kg)	Sail Area (m ²)	Aerial Cable Conn. Req'd	Max. Loading (kN)	Type	Mass (kg)	Sail Area (m ²)
350	7	7.0	6	3 metre double plus 2 x 1.5 metre extensions	2	2 x 15	2 x 0.17	N/A	N/A	N/A	N/A	N/A
		8.5										
		10.0										
		13.0										
500												