

# Roads

## Master Specification

### RD-EL-S1 Supply of Lighting Components

#### Document Information

KNet Number:	13010904
Document Version:	3
Document Date::	August 2020

DEPARTMENT FOR  
INFRASTRUCTURE  
AND TRANSPORT



Government of South Australia

Department for Infrastructure  
and Transport

## Document Amendment Record

Version	Change Description	Date
1	Initial issue (formerly R50). Changes to crash test requirements in accordance with the latest Amendment (2017) of AS/NZS 3845. General document review and update.	02/07/19
2	Formatting for publishing	19/09/19
3	Section 9, the crash test for a vehicle with a mass ranging from 2000kg to 2270kg at 70 km/h has been changed to optional.	August 2020

## Document Management

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## RD-EL-S1 Supply of Lighting Components

### 1 General

- 1.1 This Part specifies the requirements for the supply of poles and associated components used for the support of lighting and / or signalling equipment. It includes slip base poles, energy-absorbing poles and combination road lighting and traffic signal poles / mast arms.
- 1.2 Unless specified otherwise on Department drawings or specification, the definitions in AS 1798, AS 2339 and AS 4677 apply to this Part.
- 1.3 Standards and documents referenced in this Part are listed below, and unless specified otherwise, includes all current published parts and amendments:
- a) AS 1111 ISO Metric Hexagon Commercial Bolts and Screws.
  - b) AS 1112 ISO Metric Hexagon Nuts.
  - c) AS/NZS 1158 Lighting for Roads and Public Spaces.
  - d) AS/NZS 1170 Structural Design Actions.
  - e) AS/NZS 1214 Hot-Dip Galvanized Coatings on Threaded Fasteners.
  - f) AS/NZS 1252 High-Strength Steel Bolts with Associated Nuts and Washers.
  - g) AS/NZS 1554 Structural Steel Welding.
  - h) AS/NZS 1594 Hot Rolled Steel Flat Products.
  - i) AS 1627 Metal Finishing – Preparation and Pre-Treatment of Surfaces.
  - j) AS 1798 Lighting Poles and Bracket Arms- Recommended Dimensions.
  - k) AS 2339 Traffic Signal Mast Arms.
  - l) AS/NZS 3678 Structural Steel- Hot Rolled Plates, Floor Plates and Slabs.
  - m) AS/NZS 3679 Structural Steel - Hot Rolled Bars and Sections.
  - n) AS/NZS 3845 Road Safety Barrier Systems and Devices.
  - o) AS 4100 Steel Structures.
  - p) AS/NZS 4600 Cold Formed Steel Structures.
  - q) AS 4676 Structural Design Requirements for Utility Service Poles.  
(Note: Although AS 4676 has been withdrawn from Standards Australia, the requirements of AS 4676 shall still apply to lighting pole structure design.)
  - r) AS/NZS 4677 Steel Utility Service Poles.
  - s) AS/NZS 4680 Hot Dip Galvanized (Zinc) Coatings on Fabricated Ferrous Articles.
  - t) AS 9001 Quality Management Systems – Requirements.
  - u) AASHTO Manual for Assessing Safety Hardware (MASH).
- 1.4 The following Department Drawings referenced in this Part are listed in Table RD-EL-S1 1-1, and include all current published amendments.

**Table RD-EL-S1 1-1 List of Department Drawings referenced**

Drawing No.	Sheet No.	Title
S-4055	30	Combination T-S Road Lighting Mast Arms & Existing Impact Absorbing (Energy-absorbing) Light Poles – Base Plate Mounted: Pile Footing and Anchor Details
	37	Existing Impact Absorbing (Energy-absorbing) Light Pole – Base Plate Mounted: Squat Footing and Anchor Details
	38	Slip Base Road Lighting Pole: Column and Outreach

Drawing No.	Sheet No.	Title
39		Slip Base Road Lighting Pole: Pole Base and Footing.
40		Energy-absorbing Road Lighting Pole - Standard & Combination Road Lighting Pole: Column and Outreach
41		Combination Traffic Signal and Road Lighting Mast Arm: Column and Outreach

- 1.5 Department Technical Standards and Guidelines including above drawings are available from the following web site: <https://www.dpti.sa.gov.au/standards>.
- 1.6 Where this Part specifies a higher standard than that required by the above Australian Standards, the requirements of this Part will take precedence.

## 2 Materials

- 2.1 Materials used in the structural components of light poles shall comply with AS 4677.
- 2.2 Steel used in mounting plates / base plates shall comply with the requirements of AS 3678, Grade 250 or Grade 350.
- 2.3 The columns and outreach arms shall be fabricated from steel coil conforming to AS 1594, Grade HA300.
- 2.4 Notwithstanding the above, phosphorous and silicon content must comply with the formula: %Silicon + (2.5 x %Phosphorous) < 0.09% by weight

## 3 Design and Testing of Lighting Poles and Mast Arms

### General

- 3.1 The poles shall be designed to comply with the following:
- the requirements of AS 4676 for strength and serviceability;
  - the requirements of AS 1170.2 for Terrain Category 2 (TC2) winds;
  - loading from luminaire of up to the maximum mass limit specified in Table 2.2 AS 1158.6 and a projected wind area of 0.2 square metres; and
  - under serviceability limit state, the deflection of the pole from vertical position shall not exceed 4% of vertical section height and the deflection of the outreach shall not exceed 4% of the nominal horizontal outreach length.
- 3.2 The Contractor shall provide shop drawings including welding details for every type of light pole and drawings detailing a suitable pile footing and the high strength anchor bolts.
- 3.3 The poles and associated components shall be manufactured under a quality system certified to AS 9001.
- 3.4 Submission of the evidence of compliance with AS 4676, AS 1170.2 and this clause, including structural design calculations (where not previously provided) shall constitute a **Hold Point**.

### Frangible Poles

- 3.5 There are two types of frangible poles, slip-base and energy-absorbing. The Contractor shall provide evidence of compliance with requirements of AS 1158, AS 3845.2 and Appendix R50A with regard to impact testing for frangibility and safety performance. Submission of the evidence of compliance shall constitute a **Hold Point**.
- 3.6 Crash testing is not required for slip-base poles, however the Contractor shall provide evidence of compliance with Department Drawing S-4055 Sheet 39 - Slip Base Road Lighting Pole: Pole Base and Footing. Submission of the evidence of compliance shall constitute a **Hold Point**.

- 3.7 Crash testing is required for energy-absorbing poles. Submission of the evidence of compliance with AS 1158, AS 3845.2 and Clause 9, including crash test documentation and calculations (where not previously provided) shall constitute a **Hold Point**.

## 4 General Requirements

### General

- 4.1 Unless specified otherwise by the Principal, all lighting components shall be manufactured to comply with AS 1798. Supplying of the pole design drawings with all associated equipment (door, panel mounting straps, brackets, bolts and washers) shall constitute a **Hold Point**.
- 4.2 Except for combination mast arm poles, the columns shall be supplied assembled as one section.
- 4.3 Outreaches and columns shall be separate units with no section exceeding 10 m in length. The columns and outreaches shall be such that for a specific pole type, any outreach can be assembled onto any column to form a pole. Traffic signal outreaches for combination mast arms shall be separate from the column and shall be such that they can be assembled onto any combination mast arm of the same type.
- 4.4 For gooseneck poles, the taper on an outreach shall be uniform from the tip to the lower extremity of the outreach. The taper of the outreach shall be similar to that of the vertical portion of the column, so that the transition from the vertical to the curved outreach is smooth and continuous.
- 4.5 For gooseneck poles, the straight end section of an outreach shall be perpendicular to the radius.

### Spigot

- 4.6 The luminaire fixing spigot shall be straight, unthreaded Grade C250 CHS with a minimum clear aperture of 32 mm nominal bore and shall project 125 mm from the tip of the outreach in line with the axis of the outreach.
- 4.7 Spigot upcast angle (Loaded at 10kg) shall be: 0°.

### Service Access Opening

- 4.8 The opening shall have a suitable lift out cover (door). The cover shall be made weatherproof and shall fit flush with the face of the column. A built-in locking device shall be incorporated, using an M8 dome-head stainless steel bolt with Allen key fitting. All opening covers shall be interchangeable for poles of the same type.
- 4.9 For combination pole with mast arm, access door opening shall be opposite to Traffic Signal Outreach. For slip base poles, refer to Drawing No. S 4055, Sheet 39 for the orientation of access door opening.

### Wall Thickness

- 4.10 The road lighting columns and the outreaches shall have a minimum wall thickness of 3 mm.

### Identification Plate

- 4.11 All lighting columns shall be permanently and legibly marked with an identification plate securely fixed to the column in accordance with AS 4677. The plate shall include manufacture date, model type and manufacturer.

## 5 Manufacture

### General

- 5.1 Unless specified otherwise, poles shall be manufactured in accordance with AS 2339, AS3678, AS3679 and AS 4677.

- 5.2 For gooseneck poles, bends shall be free of kinks and ripples in excess of 2 mm in amplitude. The maximum deviation from the true shape at any point on the curve shall be checked by means of an internal template, which allows for the diametrical taper of the outreach. When placed against the inside of the outreach any gaps between the outreach and the template shall not exceed 1 % of the radius and the rate of gap increase shall not exceed 1 in 50.
- 5.3 The manufacture of poles and outreaches shall be such that after assembly and standing, the vertical axis is straight and within 0.4 degrees perpendicular to the top mounting plate and the outreach is set in the plane of the vertical axis. For Combination Mast Arms, the traffic signal mounting pipe shall be vertical under fully loaded (approx. 15 kg) condition.
- 5.4 Components shall be manufactured within the following tolerance:

**Table RD-EL-S1 5-1 Component Tolerances**

Component	Tolerance
Mounting plates / base plates:	2.0 mm
Slotted holes for base plate anchor bolts:	1.0 mm

- 5.5 One side of the square base plate shall be at right angles to the outreach.

## Welding

- 5.6 All welding shall comply with AS 4677. All welds shall be Category SP and prequalified in accordance with AS 1554.1. Where intermittent fillet welds are used for attachment of reinforcement at door openings, gaps between welds shall not exceed 35 mm in length.
- 5.7 The column to base plate, inner seal weld shall be flush with the lower face of the base plate. Any deformation caused during fit-up shall be repaired.

## 6 Protective Treatment

### Cleaning

- 6.1 Prior to galvanising, all sharp edges and burrs resulting from cutting and drilling shall be removed. The columns, outreaches and footing units shall be chemically cleaned and fluxed so that the surface of the steel is completely free from rust and mill scale and is suitable for hot-dip galvanising.

### Hot-Dip Galvanising

- 6.2 Columns, outreaches, mounting plates and footing units shall be hot-dip galvanized after fabrication in accordance with AS 4680. Threads of bolts and nuts shall be cleaned by centrifuging, brushing or similar process after galvanising in accordance with AS 1214. The M8 dome-head bolt for aperture cover shall be stainless steel.
- 6.3 Galvanized Components shall have a bright zinc appearance and not show evidence of "white rust".

### Repair of Galvanized Components

- 6.4 Areas of galvanized components damaged during transport, handling or storage or left bare by cutting or welding subsequent to galvanising shall be cleaned of any weld slag, heavy wire brushed and painted with two coats of an organic zinc rich paint, as approved under APAS 29/16, which shall be applied before rusting occurs.
- 6.5 Damage to components galvanized after fabrication has been completed shall only be repaired by methods permitted by AS 4680, Appendix E Renovation of Damaged or Uncoated Areas.

## 7 Transportation and Storage of Galvanized Components

- 7.1 Components shall be stored in accordance with the recommendations of AS 4680, Appendix F.

## 8 Hold Points

8.1 The following is a summary of Hold Points for the documents referenced in this Part:

**Table RD-EL-S1 8-1 Hold Points**

Document Ref.	Hold Point	Response Time
3.4	Evidence of compliance with AS 4676, AS1170.2 and submission of design calculations	10 Working Days
3.5	Evidence of compliance with AS 1158, AS 3845.2 and Appendix R50A	10 Working Days
3.6	Slip base poles: Evidence of compliance with Department Drawing S-4055 Sheet 39 - Slip Base Road Lighting Pole: Pole Base and Footing	10 Working Days
3.7	Energy-absorbing poles: Evidence of compliance with Appendix R50A "Frangible Crash Test Requirements" and AS 1158 and AS 3845.2.	15 Working Days
4.1	Pole design drawings with all associated equipment (door, panel mounting straps, brackets, bolts and washers)	15 Working Days



## 9 Appendix 1: Energy-Absorbing Pole Crash Test Requirements

- 9.1 Crash testing shall be based on AS3845.2 and AASHTO Manual for Assessing Safety Hardware (MASH).
- 9.2 Test pole configuration and installation shall be representative of in-service pole installations and be installed as per Department standard drawing S-4055, sheet 30 or 37, as applicable to the type of the pole.
- 9.3 Test shall be conducted by NATA or ILAC accredited MASH/AASHTO testing facility, unless otherwise approved by the Principal.
- 9.4 The Principal shall reserve the right to accept any pole type where satisfactory evidence indicates that the crash test requirements are substantially, but not precisely, met.

### Crash Tests

- 9.5 The crash test required for energy-absorbing poles is: 1100kg vehicle at 50 km/h with the same evaluation criteria MASH 1-40 as per AS3845.2 Table 9.2.
- 9.6 Optional crash test preferred to be undertaken in addition to Clause 9.5 for energy-absorbing pole is a vehicle with a mass ranging from 2000kg to 2270kg at 70 km/h, with the same evaluation criteria as per MASH 1-41 and AS3845.2.
- 9.7 Note: All tests to be conducted with typical luminaires attached.

### Test Evaluation

- 9.8 Evaluation, based on the factors detailed in Table 5-1 of MASH, shall include the following:
  - a) Test article should collapse in a predictable manner as per 1158.1.2.
  - b) Acceptable test article performance.
  - c) Energy-absorbing: The pole should remain attached to the base structure and absorb any impact energy by progressively deforming and entrapping the impacting vehicle, as illustrated in AS 1158.1.2. The final position of the pole should not be expected to be on the road.
  - d) Occupant Risk from detached elements or intrusions.
  - e) No part of the pole / luminaire should penetrate the occupant compartment.
  - f) There should be limited deformation of the occupant compartment - refer MASH Section 5.3.
  - g) Pole elements that could present a hazard to other traffic or pedestrians (including luminaires, access doors and electrical components) should remain attached to the pole.
  - h) The vehicle should remain upright. Roll and pitch are not to exceed 75 degrees.
  - i) The Occupant Impact Velocities should not exceed 12 m/s.
  - j) The Occupant Ride Down Acceleration should be less than 15 G preferably and not exceed 20 G.

### Test Documentation

- 9.9 A report shall be prepared detailing the crash tests. It shall contain:
  - a) a description of the tested pole installation, including drawings;
  - b) details of the test conditions, including type and mass of vehicle;
  - c) details of the tests, testing procedure and test equipment, including vehicle speed, pole and vehicle deformation and trajectory, supplemented with videos, sequential photographs and

detail photographs including before and after pictures of the base mounting, door and door reinforcing, impact zone and the front of impacting vehicle;

- d) calibration test certification of all measuring equipment;
  - e) an assessment of the performance compared with the evaluation factors listed above; and
  - f) a conclusion and recommendation about the acceptability of the pole.
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