

Master Specification

Part RD-EL-D1

Design of Road Lighting

September 2024



Government of South Australia
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Document Management

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RD-EL-D1 Design of Road Lighting

1 General

- a) This Master Specification Part sets out the requirements for the design of road lighting systems (excluding Tunnel lighting and underpass lighting), including:
 - i) the documentation requirements, as set out in section 2;
 - ii) the Contractor's general responsibilities, as set out in section 3;
 - iii) the design requirements, as set out in section 4, including:
 - A. the electrical design requirements, as set out in section 4.2;
 - B. the lighting design requirements, as set out in section 4.3;
 - C. the road lighting design requirements, as set out in section 4.4;
 - D. the shared path lighting design requirements, as set out in section 4.5;
 - E. the pathway lighting design requirements, as set out in section 4.6;
 - F. the obtrusive lighting design requirements, as set out in section 4.7; and
 - G. the lighting design requirements for 'connecting elements' (as defined in AS/NZS 1158.3.1 Lighting for roads and public spaces, Part 3.1: Pedestrian area (Category P) lighting - Performance and design requirements, table 2.4 lighting subcategories for connecting elements) as set out in section 4.8; and
 - iv) the verification requirements and records, as set out in section 5.
- b) This Master Specification Part does not apply to the design of:
 - i) Tunnel lighting systems or underpass lighting systems (which are otherwise addressed in TUN-ME-DC3 "Tunnel Carriageway and Underpass Lighting");
 - ii) smart lighting control systems;
 - iii) electrical switchboards (which are otherwise addressed in RD-ITS-S2 "Roadside Electrical Switchboards" and TUN-ME-DC4 "Tunnel Equipment Cabinets");
 - iv) pits and conduits (which are otherwise addressed in RD-EL-D3 "Conduit Design for Road Lighting, Traffic Signals and ITS" and RD-EL-C3 "Supply and Installation of Conduits and Pits"); or
 - v) the lighting of public transport interchanges, railway stations or railway infrastructure.
- c) The design of road lighting systems and associated electrical infrastructure must comply with the Reference Documents, including:
 - i) AASHTO Manual for Assessing Safety Hardware (MASH);
 - ii) AEMO National Electricity Market Load Tables for Unmetered Connection Points;
 - iii) AGRD Part 6A: Paths for Walking and Cycling;
 - iv) AGRD Part 6B: Roadside Environment;
 - v) AR-EL-STD-0102 - Guidelines for the Protective Provisions Related to Electrical Safety and Earthing for the Adelaide Metro Electrified Rail Network;
 - vi) AS/NZS ISO 9001 Quality management systems - Requirements;
 - vii) AS/NZS 1158 Lighting for roads and public spaces;
 - viii) AS/NZS 1768 Lightning protection;

- ix) AS/NZS 2053 Conduits and fittings for electrical installations;
- x) AS/NZS 3000 Electrical installations (known as the Australian/New Zealand Wiring Rules);
- xi) AS/NZS 3008 Electrical installations - Selection of cables;
- xii) AS/NZS 3845 Road safety barrier systems and devices;
- xiii) AS/NZS 4282 Control of the obtrusive effects of outdoor lighting;
- xiv) CASA Civil Aviation Safety Regulations 1998;
- xv) CASA Civil Aviation Regulations 1988;
- xvi) Air Services Australia - Developments around airports;
- xvii) Department Asset Data Collection Standard (AM-PRC-005);
- xviii) Department Operational Instruction 20.25 Energy Management for Electrical Assets (available from: https://dit.sa.gov.au/standards/standards_and_guidelines);
- xix) Department Road Design Report - Electrical Services: Presentation & Technical Review Checklist (see Appendix 1: Electrical Services: Presentation & Technical Review Checklist);
- xx) Department Road Design Presentation Standards (available from: https://dit.sa.gov.au/standards/standards_and_guidelines);
- xxi) Department Standard Drawing S-4055, sheets 43, 54-58 and 73;
- xxii) Office of the Technical Regulator - Building safely near powerlines;
- xxiii) Office of the Technical Regulator - Working safely near overhead powerlines;
- xxiv) National Light Pollution Guidelines for Wildlife Including Marine Turtles, Seabirds and Migratory Shorebirds, Commonwealth of Australia, 2020;
- xxv) SAPN Lighting Tariff Manual No. 21;
- xxvi) SAPN Service & Installation Rules Manual No. 32;
- xxvii) SAPN Technical Standard - TS101 Public Lighting - Design and Installation; and
- xxviii) TP2-DOC-002020 Guideline for Low Voltage Electrical Earthing and Bonding for the Adelaide Metro Tram Network.

2 Documentation

2.1 Design Documentation

In addition to the requirements of PC-EDM1 “Design Management”, the Design Documentation must include:

- a) design drawings for the road lighting system up to and including approved IFC Design Documentation in accordance with: Department Road Design Presentation Standards, including:
 - i) DP001 General Requirements;
 - ii) DP002 Title and Index; and
 - iii) DP013 Road Lighting;
- b) a copy of all approvals and calculations from SAPN and the OTR, as required by section 4.2.2c);

- c) SAPN's written confirmation of the approval of each power connection points as required by section 4.2.3a);
- d) details of luminaire product type, as required by section 4.3c);
- e) approval of the relevant municipal councils of the proposed selection of each road lighting asset type, as required by section 4.3d)ii);
- f) SAPN pole bracket check and evidence of suitability of Stobie poles, as required by section 4.3e)ii);
- g) details of all roadway lighting subcategories, as required by section 4.4a);
- h) where slip base or energy absorbing poles may present a hazard, details of the hazard and proposed treatment, as required by section 4.4k);
- i) where combination traffic signal and road lighting poles are installed at ELV traffic signal intersections, details of the dual voltage 230V AC and 42V AC voltages present stickers on relevant Design Drawings, as required by section 4.4m);
- j) where the Contractor proposes to use light poles or outreaches that do not currently form part of the Department Approved Products List, details of maintenance requirements, crash testing compliance and the process of purchasing replacements, as required by section 4.4n);
- k) shared path lighting subcategory, as required by section 4.5a);
- l) pathway lighting subcategory, as required by section 4.6a);
- m) documents required by RD-EL-S1 "Supply of Luminaires and Lighting Components"; and
- n) a statement of compliance confirming compliance with AS/NZS 1158 Lighting for roads and public spaces and using the calculation procedure specified in AS/NZS 1158.2 Lighting for roads and public spaces, providing:
 - i) all calculations, including details of the lighting design program used to prepare the calculations;
 - ii) maintenance factors used in the design;
 - iii) power system, voltage drop and earth fault loop impedance calculations;
 - iv) pole spacing calculations;
 - v) illuminance isolux drawing for the road and surrounding area with the relevant illuminance levels shown; and
 - vi) luminance based spacing calculation for straight road sections.

2.2 Quality Management Records

In addition to the requirements of PC-QA1 "Quality Management Requirements" or PC-QA2 "Quality Management Requirements for Major Projects" (as applicable), the Quality Management Records must include:

- a) the verification records required by section 5; and
- b) road lighting asset data to be recorded in accordance with:
 - i) agreed asset management systems;
 - ii) Department Asset Data Collection Standard (AM-PRC-005); and
 - iii) PC-EDM5 "Digital Engineering".

3 Responsibilities

The Contractor must, as part of the road lighting design process:

- a) source asset numbers from the Principal;
- b) liaise with the Principal, including with nominated technical services department representatives;
- c) where road lighting poles are to be installed on Principal owned roads and any poles are within close proximity to the “minimum safety clearance distance”, (as defined by the OTR - Building safely near powerlines) of:
 - i) overhead SAPN power lines, arrange swing and sag calculation with SAPN to ensure that all road lighting poles remain outside of the minimum safety clearance distance at maximum calculated power line swing and sag; or
 - ii) underground powerlines, the design must ensure that minimum safety clearance distances are achieved;
- d) determine suitable connection point locations in accordance with the requirements of SAPN Service & Installation Rules Manual No. 32;
- e) ensure Safety in Design requirements are met with respect to installation and maintenance personnel;
- f) for council owned assets and council areas, ensure the road lighting design complies with the respective council’s specification requirements; and
- g) where the council’s specification requirements are not available, seek endorsement from the respective council.

4 Design requirements

4.1 General

Where the Contractor proposes that the road lighting design includes power provided from unmetered supplies, the Contractor must ensure that all road lighting devices connected to unmetered connection points are approved by the AEMO National Electricity Market Load Tables for road lighting devices.

4.2 Electrical requirements

4.2.1 General

The Contractor must ensure that the design of the road lighting systems and associated electrical infrastructure complies with the electrical requirements set out in this section 4.2, including the following:

- a) the electrical design must provide sufficient electrical supply including an additional 20% power reserve over the design load to all road lighting systems and associated electrical infrastructure in accordance with:
 - i) this Master Specification Part; and
 - ii) the requirements of AS/NZS 3000 Electrical installations;
- b) where existing electrical infrastructure is re-used to supply new road lighting design elements, the existing electrical infrastructure must be assessed, and if required, upgraded by the Contractor to ensure compliance with the requirements of this Master Specification Part and the Contract Documents;
- c) where 3-phase distribution circuits are used, the 3 phases are balanced as closely as possible; and
- d) clearances from other Utility Services to the road lighting system and associated electrical infrastructure must be provided in accordance with:
 - i) the specific requirements of the respective Utility Service Authority;

- ii) the requirements of AS/NZS 3000 Electrical installations; and
- iii) the requirements of:
 - A. OTR - Building safely near powerlines; and
 - B. OTR - Working safely near overhead powerlines.

4.2.2 Clearance to electrical cables

With respect to clearances to electrical cables, the Contractor must ensure that:

- a) in relation to the road lighting system and associated electrical construction and maintenance activities:
 - i) a working clearance of 6.4 m is achieved; or
 - ii) if the working clearance of 6.4 m cannot be achieved, a working clearance and work method in accordance with the requirements of:
 - A. OTR - Building safely near powerlines; and
 - B. OTR - Working safely near overhead powerlines;
- b) clearances of new light poles to overhead and underground electrical cables (including transport related distribution cables) comply with requirements of SAPN and the OTR; and
- c) the Design Documentation includes a copy of all approvals and calculations from SAPN and the OTR.

4.2.3 Points of supply (SAPN connection points)

With respect to points of supply (including location of switchboards, where they are required), the Contractor must:

- a) determine the power connection points and reticulation for all road lighting system and associated electrical infrastructure in conjunction with SAPN and obtain SAPN's written confirmation of the approval of each connection point, which must be submitted as part of the Design Documentation;
- b) ensure that pits supplying consumer mains to an electrical distribution switchboard are equipped with secured lids as required by RD-EL-D3 "Conduit Design for Road Lighting, Traffic Signals and ITS";
- c) ensure that electrical supplies to road lighting luminaires are achieved by one of the following methods:
 - i) SAPN Stobie pole dedicated service fuse on the pole;
 - ii) SAPN green top distribution pillar;
 - iii) SAPN direct connect (underground);
 - iv) Stobie mounted road lighting switchboard;
 - v) ground mounted Department switchboard;
 - vi) submersible Department switchboard;
 - vii) in the case of combination lighting and signal poles at signalised intersections, signal controller extension housing in accordance with section 4.4w); and
 - viii) in the case of combination lighting and signal poles at pedestrian or koala crossings, via a circuit breaker from within the signal controller;
- d) ensure that switchboard drawings comply with Department Standard Drawing S-4055, sheets 43, 54-58, and/or 73;
- e) ensure that any metered switchboard is ground mounted;

- f) ensure that ground mounted switchboards are located in accordance with applicable AGRD guidelines and with the switchboard door opening away from the road;
- g) where an existing lighting installation requires an upgrade and the existing installation incorporates a “green top” fibreglass or plastic electrical distribution pillar, this is replaced with a Department Type A switchboard; and
- h) where a point of supply design is also required to provide supply to a traffic signal design, a dual purpose switchboard is used and an isolation pit is included between the switchboard and the signal controller.

4.2.4 Earthing

With respect to earthing, the Contractor must ensure that:

- a) earthing systems for the road lighting system and associated electrical infrastructure are provided in accordance with SAPN requirements for the specific installation and the requirements of AS/NZS 3000 Electrical installations; and
- b) electrical and road lighting elements maintain appropriate segregation from adjacent earthing systems (i.e. tram or train earthing system) in accordance with the requirements of:
 - i) AR-EL-STD-0102 - Guidelines for the Protective Provisions Related to Electrical Safety and Earthing for the -Adelaide Metro Electrified Rail Network; and
 - ii) TP2-DOC-002020 Guideline for Low Voltage Electrical Earthing and Bonding for the Adelaide Metro Tram Network.

4.2.5 Lightning protection

The Contractor must ensure that:

- a) all luminaires and switchboards are fitted with surge protection devices; and
- b) all light poles are earthed in accordance with the requirements of AS/NZS 3000 Electrical installations and AS/NZS 1768 Lightning protection.

4.2.6 Public lighting tariff and metering

The Contractor must ensure that:

- a) dedicated unmetered road lighting supplies are connected via the energy only tariff as described by the SAPN Lighting Tariff Manual No. 21;
- b) road lighting supplies with connected equipment not listed on the AEMO unmetered load tables are connected via a metered tariff supply;
- c) road lighting luminaires mounted on Stobie poles are connected via the public lighting customer tariff as required by the SAPN Lighting Tariff Manual No. 21;
- d) tariff arrangements for council owned road lighting luminaires are:
 - i) in accordance with the respective council's specification requirements; or
 - ii) where there is no such requirement, approved by the relevant council; and
- e) SAPN infrastructure, or infrastructure that is to be vested to SAPN, is in accordance with the relevant SAPN standard requirements, including:
 - i) SAPN Service & Installation Rules Manual No. 32,
 - ii) SAPN Technical Standard - TS101 Public Lighting - Design and Installation; and
 - iii) SAPN Lighting Tariff Manual No. 21.

4.2.7 Electrical cables

In relation to electrical cables associated with the road lighting system and associated electrical infrastructure, the Contractor must ensure that:

- a) all circuits and sub circuits, including any sub-mains feeds associated with the design, are sized in accordance with the requirements of AS/NZS 3008 Electrical installations - Selection of cables and AS/NZS 3000 Electrical installations;
- b) voltage drop and earth fault loop impedance calculations are performed as a single-phase calculation; and
- c) voltage drop calculations are calculated from the point of supply to the final subcircuit.

4.2.8 Circuit protection

- a) The Contractor must ensure that the road lighting system and associated electrical infrastructure includes protection devices providing full discrimination and cascade protection and grade with the electricity distributor's incoming supply protection system and the downstream site protection devices.
- b) RCDs must not be used for road lighting.

4.3 Lighting requirements

The Contractor must ensure that:

- a) the design of road lighting systems and associated electrical infrastructure complies with the lighting requirements set out in this section 4.3;
- b) in relation to lighting requirements, the road lighting design:
 - i) illuminates all infrastructure forming part of the Works to the required category as set out in AS/NZS 1158 Lighting for roads and public spaces:
 - A. for the lighting category as set out in the Contract Documents; or
 - B. where not specified in the Contract Documents, as agreed with the Principal as part of the Design Basis;
 - ii) minimises the whole of life costs to the Principal (taking into account the cost of construction, maintenance, repairs, energy consumption and replacement);
 - iii) is appropriate for the site-specific conditions;
 - iv) minimises the effect of obtrusive light on adjacent residencies in accordance with the requirements of AS/NZS 4282 Control of the obtrusive effects of outdoor lighting; and
 - v) considers occupational health and safety requirements for installation and ongoing maintenance;
- c) luminaires proposed in the road lighting design:
 - i) are on the Department Approved Products List; or
 - ii) where the road lighting design cannot achieve compliance with AS/NZS1158 Lighting for roads and public spaces using the luminaires on the Department Approved Products List, are alternative luminaires that allow the road lighting design to comply with AS/NZS1158 Lighting for roads and public spaces (with details of such alternative luminaires submitted for approval as part of the Design Documentation);
- d) council owned road lighting assets (including luminaires and light poles) are:
 - i) in accordance with the respective council standards and specifications; or
 - ii) where there is no such standard or specification, is subject to approval by the respective council, evidence of which must be included in the Design Documentation;

- e) if existing SAPN Stobie poles are proposed to be used for mounting luminaires:
 - i) bracket checks for the suitability of proposed mounting height and outreach are arranged with SAPN; and
 - ii) evidence of the suitability of the existing Stobie poles being used for mounting luminaires is included in the Design Documentation;
- f) existing Stobie poles which are no longer used for power distribution are not used for provision of new road lighting;
- g) the road lighting design avoids:
 - i) placement of light poles directly under powerlines;
 - ii) interference with other Utility Services and structures (such as verandas);
 - iii) property crossovers (including driveways); and
 - iv) obscuring traffic signals and signage; and
- h) the road lighting design complies with the following:
 - i) luminaire maintenance factors of 0.8 must be used for LED luminaires. If the design utilises any other form of lighting technology and the technology is approved by the Principal, the maintenance factor must be calculated in accordance with AS/NZS 1158.1.1 Lighting for roads and public spaces;
 - ii) clearances from other Utility Services must be provided in accordance with the specific requirements of:
 - A. the respective Utility Service Authority;
 - B. AS/NZS 3000 Electrical installations; and
 - C. the following Reference Documents:
 - I. OTR - Building safely near powerlines; and
 - II. OTR - Working safely near overhead powerlines;
 - iii) pole setbacks must be measured from the centre of the pole to the face of kerb or edge of path or bitumen;
 - iv) all asset IDs must be sourced from the Principal;
 - v) pole and luminaire numbering must comply with the following:
 - A. poles and luminaires must be numbered from left to right, and then top to bottom on drawings;
 - B. for double outreach poles, the following must be applied:
 - I. for roads running east-west, the luminaires on the north side must be identified with an 'a' suffix and those on the south side must be identified with a 'b' suffix; and
 - II. for road orientations other than east-west orientation, luminaires on the west side must be identified with an 'a' suffix and those on the east side must be identified with a 'b' suffix; and
 - C. for multiple outreach poles, the luminaires must be identified in a clockwise direction starting with the most northerly luminaire as 'XXXXa', then 'XXXXb', 'XXXXc' 'XXXXd' etc where XXXX is the pole number; and
 - vi) circuit designations must comply with the following requirements:
 - A. designations must specify the luminaire, switchboard, phase, and circuit numbers feeding the luminaire;

- B. a single circuit number must be used for single phase installations (e.g. 1, 2, 3, 4) whereas an R, W or B with the circuit designator number after it indicates 3 phase installations (e.g. R1, R2, W1, W2, B1, B2);
- C. as Stobie pole luminaires are directly connected, circuit numbers are not required. The circuit designator must specify "SAPN"; and
- D. where lighting power for a combination lighting and signal pole is fed from a signal controller, the circuit designator must specify the traffic signals controller asset ID, e.g. "TSxxx".

4.4 Road lighting

The Contractor must ensure that the following road lighting requirements are satisfied:

- a) all roadway lighting subcategories must be:
 - i) derived from AS/NZS 1158 Lighting for roads and public spaces, in accordance with the requirements set out in section 4.3b)i); and
 - ii) included in the Design Documentation;
- b) council roadway lighting subcategories must:
 - i) be in accordance with the respective council's minimum specification; or
 - ii) where there is no such requirement, be derived from AS/NZS 1158 Lighting for roads and public spaces and approved by the relevant council;
- c) luminaires must be full cut-off type, mounted horizontally and have an upcast angle of 0° degrees for luminaires mounted on Department and SAPN poles;
- d) the design must use either 10.5 m or 12.0 m poles in accordance with AS/NZS 1158 Lighting for roads and public spaces (clause 1.2 Table 8.1) with either single or dual 3.0 m or 4.5 m outreaches, unless constrained by clearance requirements for overhead cables;
- e) for luminaires intended to be mounted on Stobie poles, the designed mounting height must be approved by SAPN;
- f) at roundabouts with a centre island diameter greater than 8.0 m, a 4 way outreach on a 12.0 m pole mounted centrally in the roundabout may be included in the design if the design complies with AS/NZS 1158 Lighting for roads and public spaces;
- g) road lighting poles may only be designed in centre median areas where the median has a minimum width of 2.0 m;
- h) the relative risks to motorists and pedestrians must be considered when selecting road lighting pole types (i.e. rigid, energy absorbing, slip base poles);
- i) slip base poles must be used exclusively except as set out in section 4.4j);
- j) energy absorbing poles must be used in the following situations:
 - i) within 20 m on the approach side to a bus stop; and
 - ii) in areas of high pedestrian activity (as defined in AS/NZS 1158.1.2 Lighting - Roads and Public Spaces, Part 1.2: Vehicular traffic (Category V) lighting — Guide to design, installation, operation and maintenance) where the speed limit is 50 km/h or lower;
- k) in locations where either slip base or energy absorbing poles may present a hazard (including in median jersey barriers, on bridges or in close proximity to rail lines), details of the hazard and proposed treatment must be submitted as part of the Design Documentation;
- l) combination traffic signal and road lighting poles, including mast arms, must be used where possible at traffic signal sites to minimise the number of poles around an intersection;
- m) where combination traffic signal and road lighting poles are to be installed at ELV traffic signal intersections, the Design Documentation must state that dual voltage 230V AC and 42V AC

- voltages present stickers must be included near the opening of the door of the combination pole;
- n) all proposed road lighting poles and outreaches must form part of the Department Approved Products List or otherwise submitted for approval as part of the Design Documentation, including, details of maintenance requirements, crash testing compliance and the process of purchasing replacements;
 - o) road lighting poles must be located so that the level of lighting is not compromised by any existing or proposed trees or structures;
 - p) road lighting pole setback and placement must be in accordance with AS/NZS 1158 Lighting for roads and public spaces;
 - q) pole types and placements must comply with the road design and safety barrier system requirements of the Contract Documents;
 - r) road lighting poles and luminaires must be aligned linearly;
 - s) road lighting pole outreaches must be aligned perpendicular to the road;
 - t) road lighting poles must not be located in front of traffic or pedestrian barriers;
 - u) where road lighting poles are to be installed behind non rigid barriers, allowances must be made for the deflection of the barrier on impact and the vehicle's roll allowance;
 - v) in instances where road lighting is in the vicinity of airports, the height and placement of light poles and light spill from luminaires must comply with CASA requirements (including the *Civil Aviation Safety Regulations 1998*, *Civil Aviation Regulations 1988* and the Air Services Australia Developments at and around airports);
 - w) road lighting luminaires installed on combination or combination mast arm poles at signalised intersections must be powered from the traffic signal controller extension housing;
 - x) where an extension housing cabinet does not currently exist, an extension housing cabinet must be retrofitted to the existing traffic signal controller;
 - y) road lighting luminaires installed on combination or combination mast arm poles at pedestrian or koala crossings must be powered via a circuit breaker from within the signal controller;
 - z) circuit breakers in road lighting poles must be double-pole 6A type C, except when the luminaires are fed directly from a photo electric cell in the switchboard in which case it must be double-pole 4A type C; and
 - aa) circuit breakers for road light poles mounted to the back of bridge parapets structures must be located within an adjacent void accessible from the relative ground level such that maintenance access to such circuit breakers does not require elevated work platforms or reaching over bridge parapets.

4.5 Shared path lighting

The Contractor must ensure that the following shared path lighting requirements are satisfied:

- a) the Contractor must derive shared path lighting subcategories from AS/NZS 1158 Lighting for roads and public spaces with the selected categories included in the Design Documentation;
- b) council shared path lighting subcategories must:
 - i) be in accordance with the respective council's minimum specification; or
 - ii) where there is no such requirement, be derived from AS/NZS 1158 Lighting for roads and public spaces and approved by the relevant council; and
- c) light poles for shared paths must be set back at least 1 m from the edge of the shared path in accordance with the requirements of AGRD Part 6A: Paths for Walking and Cycling.

4.6 Pathway lighting

The Contractor must ensure that the following pathway lighting requirements are met:

- a) pathway lighting categories must be derived from AS/NZS 1158 Lighting for roads and public spaces, with the selected categories included in the Design Documentation;
- b) council pathway lighting subcategories must:
 - i) be in accordance with the respective council's minimum specification; or
 - ii) where there is no such specification, the pathway lighting subcategories must be derived from AS/NZS 1158 Lighting for roads and public spaces and approved by the relevant council; and
- c) light poles for pathways must be set back at least 0.5 m from edge of the pathway in accordance with the requirements of AGRD Part 6A: Paths for Walking and Cycling.

4.7 Obtrusive lighting

The Contractor must ensure that:

- a) as far as is reasonably practical, the road lighting design minimises the effect of obtrusive light on adjacent residences in accordance with AS/NZS 4282 Control of the obtrusive effects of outdoor lighting;
- b) the road lighting design minimises the effect of obtrusive light in accordance with Dark Sky Alliance best practice lighting principles; and
- c) the road lighting design minimises the effect of obtrusive light in accordance with the National Light Pollution Guidelines for Wildlife Including Marine Turtles, Seabirds and Migratory Shorebirds, Commonwealth of Australia, 2020.

4.8 Lighting on connecting elements

The Contractor must ensure the following requirements for lighting on connecting elements are satisfied:

- a) lighting subcategories for connecting elements must be:
 - i) derived from AS/NZS 1158 Lighting for roads and public spaces, in accordance with the requirements set out in section 4.3b)i); and
 - ii) documented in the Design Documentation;
- b) lighting on connecting elements returned to councils must:
 - i) be in accordance with the respective council's minimum specification; or
 - ii) where there is no such requirement, be derived from AS/NZS 1158 Lighting for roads and public spaces, and approved by the relevant council;
- c) where luminaires are mounted on lighting poles, the luminaires must:
 - i) comply with RD-EL-S1 "Supply of Luminaires and Lighting Components";
 - ii) be installed on light poles with a height of 4.5 m to 6 m; and
 - iii) where outreach arms are required, be installed on outreach arms no greater than 0.5 m in length;
- d) where luminaires other than pole-mounted type are used, the luminaires must:
 - i) have an ingress protection rating of not less than IP65 in accordance with AS 60529 Degrees of protection provided by enclosures (IP Code);

- ii) have an impact protection rating of not less than IK10 in accordance with IEC 62262 Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code);
 - iii) use vandal-resistant fasteners;
 - iv) have a correlated colour temperature of 4,000 K unless the design specifies an alternative colour temperature to meet project or site-specific requirements;
 - v) have a colour rendering index greater than 70;
 - vi) have a luminous efficacy of greater than 120 lm/W;
 - vii) have 0% upward waste light ratio;
 - viii) be installed with mechanical and vandal-resistant fixing and mounting accessories;
 - ix) not use adhesive fixing or mounting installation;
 - x) be removable for maintenance without damaging luminaires and mounting surfaces;
 - xi) be provided with the design documentation required by RD-EL-S1 “Supply of Luminaires and Lighting Components”; and
 - xii) be installed to ensure luminaires can be maintained without the need for lane closures or traffic management.
- e) luminaires installed on connecting elements that are not returned to councils must be controlled by:
- i) a smart lighting system listed on the Department Approved Products List with condition monitoring, if the smart lighting system network coverage is available at the project site; or
 - ii) a control method used on the road lighting on the same road section, if the project site is not covered by a smart lighting system network;
- f) connecting element lighting must comply with the obtrusive lighting requirements in section 4.7; and
- g) in instances where road lighting is in the vicinity of airports, the height and placement of light poles and light spill from luminaires must comply with CASA requirements (including the Civil Aviation Safety Regulations 1998, Civil Aviation Regulations 1988 and the Air Services Australia Developments at and around airports).

5 Verification requirements and records

The Contractor must supply written verification as part of the Quality Management Records that the requirements listed in Table RD-EL-D1 5-1 have been complied with.

Table RD-EL-D1 5-1 Verification requirements

Section reference	Record
Appendix 1: Electrical Services: Presentation & Technical Review Checklist	Electrical Services: Presentation & Technical Review Checklist (see Appendix 1: Electrical Services: Presentation & Technical Review Checklist).
PC-SI1 “Site Surveys”	Position verification certificates for road lighting assets as required by PC-SI1 “Site Surveys”.

Section reference	Record
2.1n)	<p data-bbox="555 226 1426 286">A statement of compliance confirming the Contractor's compliance with AS/NZS 1158 Lighting for roads and public spaces, providing:</p> <ul data-bbox="555 293 1426 678" style="list-style-type: none"><li data-bbox="555 293 1426 360">a) all calculations, including details of the lighting design program used to prepare the calculations;<li data-bbox="555 376 1426 409">b) maintenance factor used in the design;<li data-bbox="555 425 1426 486">c) power system, voltage drop and earth fault loop impedance calculations;<li data-bbox="555 501 1426 535">d) pole spacing calculations;<li data-bbox="555 551 1426 611">e) illuminance isolux drawing for the road and surrounding area with the relevant illuminance levels shown; and<li data-bbox="555 627 1426 660">f) luminance based spacing calculation for straight road sections. <hr data-bbox="600 730 1034 734"/>

6 Appendix 1: Electrical Services: Presentation & Technical Review Checklist

	<p>Government of South Australia Department of Planning, Transport and Infrastructure</p>	<p>Transport Services Division</p> <p>ROAD DESIGN Operational Procedures & Forms</p>
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ELECTRICAL SERVICES: Presentation & Technical Review Checklist

Project No: _____ Patches: _____

Consultant (if applicable) _____

Description _____

TRAFFIC CONTROL

Refer to Presentation Review Checklist

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TRAFFIC SIGNALS- DP011

TS notes

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Legend

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Phase diagram

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Sign schedule

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Line marking

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Traffic control signs and code

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Critical dimensions

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Design vehicle noted

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Show 'No Stopping Any Time' zones

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Trimmed survey

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Pole numbers

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Tactile not on TS drawing

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TS/PC design uses Combo's wherever possible

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TRAFFIC SIGNAL CONDUIT- DP012

TS Ducting Notes		
Legend		
Line marking on		
Circuit Details or referenced to Lighting/Supply Dwg Legend		
TS Pole numbers on		
Pole schedule added		
Conduit size and type		
TS pits S & D located correctly, no pits (apart from detector) in islands.		
Detector pits located at back of loop locations wherever possible		
Switchboard location & ID Numbers added OK		
Connection points SAPN, Stobie or U/G specified		
Isolation Pits located >5m from TS Controller		
TS/PC design uses Combo's wherever possible		
Telstra Connection or 3G		
UPS Added (New Installs only or as specified)		
SC orientated correctly		

ITS-DP0 (tba)

Legend added as either sheet or individual sheet		
Network Schematic added (where reqd)		
Circuit Details or referenced to appropriate Dwg		
Pole schedule added		
Conduit size and type		
Pits located & displayed correctly, e.g. size or secure or lockable		
ITS Isolation Pits added adjacent equipment		
Switchboard location & ID Numbers added Metered? e.g. PDB-M?		
Connection points SAPN, Stobie or U/G specified		
Circuit Details or referenced to Lighting/Supply Dwg Legend		
On drawings display Upstream Device-Downstream Device-Cable Type Comms Type e.g. fibre (No)/radio+ any Elect feed.		
ID Asset codes added e.g. VMS?/CMS?/VSS?/AWS?		
Outstations displayed correctly (inc orientation and connections)		

LIGHTING- DP013 & LD 001

Electrical Notes legend		
Legends		
Luminaire Nos added		
Cable sizing OK		
1phase/3phase appropriate		
Light pole structure numbers & cct designators		
Cct loading OK		
Cct details OK		
Poles		
TS/PC design uses Combo's		
SB/IA pole used at the correct location		
Clearances to HV OK or OTR response		
Poles not in conflict zones		
Pole setback OK for road speed		
Cables Conduit U/G		
Pits OK & Lockable where CM used		
1x50, 1x80 used OK + spares		
Sw/Bd in good location- for TS/PC use common Distribution		
50m spacing's between poles or pits max		
Cable sizing OK e.g. 6,10 or 16mm		
Light schedules & Luminaire & pole type table		
Light Luminaires correctly labelled & referenced to correct sheet		
Line marking on		
Symbols showing new lighting & upgrades		
Symbols showing existing lighting to remain		
Symbols showing conduit (including size)		
Switchboard location & ID Number OK		
Connection points SAPN, Stobie or U/G specified		
Luminaire sizing & pole 'H' appears to be OK for the application		
Bracket Check feedback required		
Asset numbers added.		

Checked Designer

Signed..... Technical Reviewer.....

Designer..... Issues Addressed.....
