Sunshine Coast Council

Electrical and Lighting Infrastructure Manual

Sunshine Coast COUNCIL

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Reference document

This document should be cited as follows:
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Electrical and Lighting Infrastructure Manual

Disclaimer

To the extent this document contains future plans, activities, policies and strategies, these matters are aspirational and subject to change at any time without notice.

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1. Background

1.1 Overview

The Electrical and Lighting Infrastructure Manual (ELIM) is Sunshine Coast Council's (Council) primary reference for the planning, design and construction of electrical, lighting and telecommunication infrastructure within Council controlled roadways, public spaces and thoroughfares. The ELIM is intended to be utilised by planners, designers, contractors, project delivery and maintenance personnel to ensure that electrical and telecommunications facilities within relevant Council's public spaces are built per an agreed set of corporate standards that considers local circumstances and stakeholder needs.

The ELIM outlines Council's minimum acceptable standards, which may be above the expectations of current industry standards. This manual is not intended to replicate all provisions of legislation and standards, nor to override specific requirements stipulated in a development approval. Services provided using this manual require a suitable qualified professional to provide project or site-specific solutions. Project-specific variations may be appropriate as a result of site, environmental or other constraints. Any variations to these standards must be approved by Council prior to commencement of variation works. Where there is a conflict between this manual and prescribed or legislative standards, users should seek guidance from Council.

In the short-term, the ELIM is intended to supersede the technical information contained in the following Council publications:

- *Sunshine Coast Planning Scheme 2014* Schedule 6; Table SC6.14.2A, Section SC6.14.6.26.
- *Urban Lighting Master Plan 2016* (Ver 2; Rev 3); Design Process, Equipment.
- *Open Space Landscape Infrastructure Manual* (LIM) – Electrical Embellishment, Technical Specifications, Technical Drawings.
- *Electrical Infrastructure within Road Reserves*; Standard Conditions and Specifications.

These publications will progressively be harmonised with ELIM content.

1.2 Planning and policy context

Sunshine Coast Council's vision is "to be Australia's most sustainable region – healthy, smart, creative". Council's strategies and plans support the attainment of these visions and objectives. They set the guidelines for allocating resources, decision making and funding that leads to the achievement of Council's vision and goals.

The Sunshine Coast Planning Scheme provides policy direction for land use, settlement patterns and housing, employment and industry and open space into the future. The planning scheme is a legal document regulating land use and development.

The ELIM has been prepared in line with existing Council documents, policies, plans, strategies, and manuals. The relationship between the Council Planning Scheme, the key instruments and the documentation adopted by Council is shown in Figure 1.

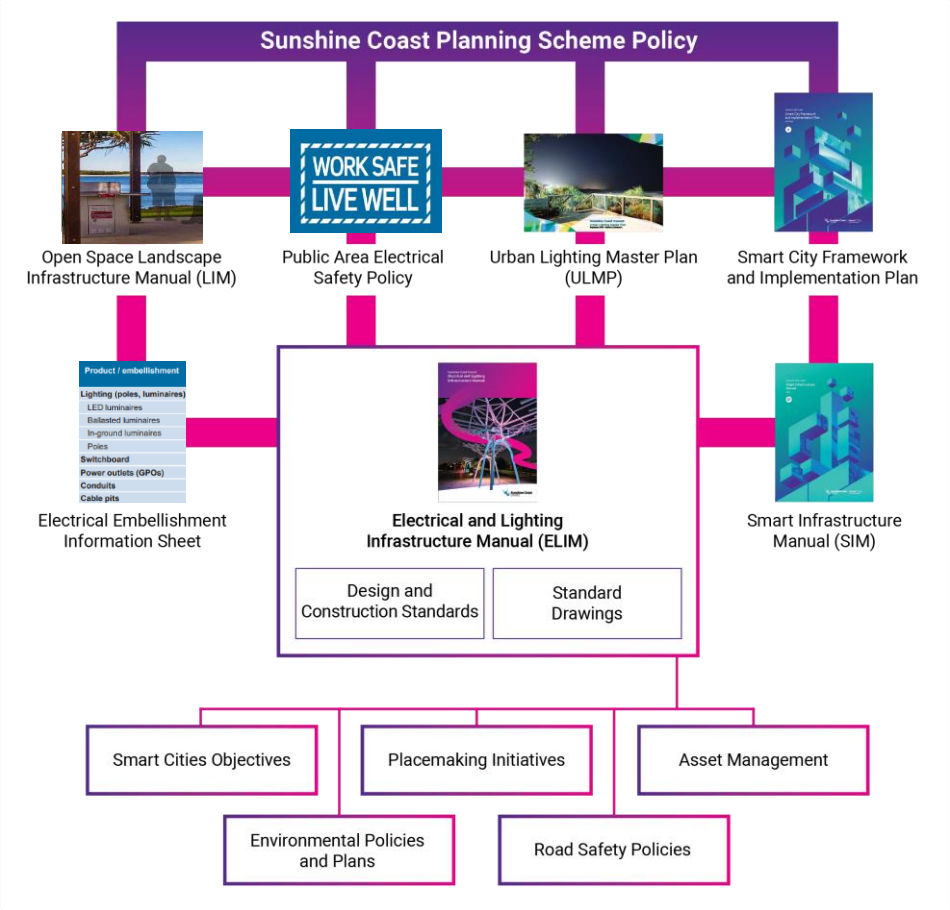


Figure 1: ELIM and relationship to the Sunshine Coast Council Planning Scheme

1.3 Application of the ELIM

The ELIM applies to all new and upgrade works on Council owned and managed electrical, lighting and telecommunications public area infrastructure, including:

- Rate 3 unmetered public lighting installations whereby Council is the Rate 3 customer.
- Metered public lighting installations whereby Council is the retail customer.
- Council controlled open space including recreation parks (Council wide, district and local), amenity reserves, linear parks, landscape corridors, recreation trails, streetscapes, and environment reserves (conservation, nature, bushland, natural and coastal reserves), and Environmental Operations (except for those listed below).

The ELIM does not apply to the following situations:

- Energy Queensland (EQL) electrical network infrastructure. This infrastructure is governed by EQL standards and guidelines.

- Third party (non-Council) telecommunications carrier reticulation (e.g., Telstra, NBN Co, etc).
- Rate 1, Rate 2 and Rate 4 unmetered public lighting installations. This infrastructure is governed by EQL standards and guidelines.
- Rate 3 unmetered public lighting installations on roads and car parks controlled by a public body other than Sunshine Coast Council. This would include areas controlled by the department of Transport and Main Roads (TMR) and Queensland Rail (QR). This infrastructure is governed by the standards and requirements of the relevant public body.
- Council's sports fields, precincts, aquatic centres, caravan and holiday parks. Infrastructure within these areas is governed under separate requirements controlled by Sunshine Coast Council's Property Management Branch (PMB).
- Private developments such as community title developments and private carparks. Note that ELIM requirements may be applied to a private development under relevant development conditions enforced through a Development Application (DA).

Temporary lighting installed for the purposes of construction and maintenance activities or events where control of the site is contractually delegated to a third party.

1.4 Structure and format

The ELIM is presented in sub-section format to allow readers to navigate to topics of relevance to suite the specific needs of the project or installation.

For telecommunications requirements in the public realm, the ELIM should be read in conjunction with the Smart Infrastructure Manual (SIM). Where relevant, this manual reference the SIM for specific technical requirements associated with telecommunications infrastructure that may be delivered in conjunction with electrical and lighting infrastructure.

2. General principles

2.1 Fundamental requirements

When planning, designing and installing electrical, lighting and telecommunications infrastructure for Council, the following principles must be adhered to:

- Compliance with applicable legislation and standards.
- Consideration of safety in design, including compliance with legislative requirements.
- Alignment with industry best practices following guidelines set by relevant industry bodies. For example, Engineers Australia (EA), the Electrical Safety Office (ESO), Australian Communications and Media Authority (ACMA), and Institute for Public Works Engineering Australia (IPWEA).
- Consideration of whole of life optimisation and cost effectiveness.
- Consistency of delivery and implementation across the region.
- Quality and detail of documentation (design and handover material), including statutory certifications.
- Adoption of construction risk minimisation strategies.
- Implementation of effective commissioning and handover processes and procedures.
- Optimisation of maintainability, including consideration of the suitability of materials and equipment installed within the local environment.

2.2 Legislation and standards

Designs and installations must comply with relevant legislation, standards, related documents, and published amendments.

A list of references is provided for information at Appendix A.

2.3 Qualification and licencing

Engineering qualification

Where the delivery of services or infrastructure under this manual requires the provision of engineering services, such services must comply with the *Professional Engineers Act 2002*.

In accordance with the Act, engineering services must be undertaken by (or under the direct supervision of) a Registered Professional Engineer of Queensland (RPEQ), with current registration in the relevant area of engineering practice competency.

Contractor licensing

The *Queensland Electrical Safety Regulation 2013* defines the minimum requirements for licensing and qualification of person undertaking electrical work in Queensland (Qualified Technical Person – QTP). All electrical works must be undertaken by a person holding the appropriate electrical licences as defined in the Regulation and having appropriate and relevant experience in the type of work to be performed.

All telecommunications cabling works must be undertaken by a contractor licenced under the *Australian Communications and Media Authority (ACMA) Telecommunications Cabling Provider Rules 2014*. Where a specific telecommunications vendor has been nominated, the contractor must hold relevant vendor installer accreditation.

2.4 Minor additions, alterations, and repairs

Minor alterations, additions and repairs are to be undertaken in accordance with the requirements of *AS/NZS 3000* and the ELIM. These works may be requested or directed by Council and do not specifically require the provision of engineering and design services (unless specifically requested by Council).

Examples of minor alterations, additions and repairs include:

- Like-for-like replacement of damaged equipment, including outlets, accessories, and light fittings.
- New final sub-circuits for an existing installation for standard equipment. For example, general power or shelter lighting which does not result in a significant increase in load or change to the distribution arrangement of the site.

The following handover requirements (in accordance with section 5 of this manual) apply for minor alteration, addition, and repair works:

- Testing and verification of affected components, including the provision of certificate for testing and safety.
- Provision of marked-up As-Constructed documentation where existing As-Constructed documentation is available.
- Update of asset information in Council's Asset Management System where access has been made available, including the maintenance activities undertaken by a Council appointed maintenance contractor.

Council may request further design and handover requirements depending upon the nature of the work involved.

2.5 Approved suppliers and alternatives

Where approved suppliers are specified, those suppliers are established on Council's considered design palettes or have delivered equipment which meets Council's acceptable levels of quality and sales or after-sales support.

Council may consider alternative products where it is demonstrated that such products comply with relevant performance requirements. Where alternative products are proposed, the following information must be provided to Council:

- Full technical product documentation or specifications, which may include relevant certifications and test reports.
- Statements to support supplier capability and commitment.
- Warranty statements with relevant terms and conditions.
- Where applicable, a complete and compliant redesign of the works package to demonstrate the equivalency of performance and design intent.

Submissions without supporting evidence will not be assessed until Council is satisfied with the information. Council may accept an alternative product provided the evaluation shows equal or better performance than the listed product, affords cost-benefit and maintenance advantages, and demonstrates equivalent or better local support.

2.6 Minimising impacts of vandalism

Increasing instances of vandalism and theft are resulting in increased maintenance and asset replacement costs to Council. To address such issues, Council may seek alternative design and implementation strategies to reduce impacts of vandalism and theft.

Such strategies may include:

- The use of aluminium cabling (in conjunction with appropriate warning signage).
- The use of "off-the-grid" solutions (eg. solar lighting).

- Utilisation of smart control and monitoring systems to provide real-time information regarding asset status and serviceability.
- Securing assets including the use of lockable pits.

In addition to the standard requirements outlined in the ELIM. Council may consider additional protection strategies for remote installations in sparsely populated or high-risk areas. Additional measures should be discussed and agreed with Council through the design process.

Image: Catenary lighting Caloundra

3. Design requirements

3.1 Design responsibility

Design and documentation services must be provided to demonstrate conformance with nominated standards, regulations and requirements as outlined in the ELIM and referenced material.

Design services must be provided by a qualified person (as defined in Section 2.3) with experience in the nature and type of works being undertaken.

The designer is responsible for coordination of electrical, lighting and telecommunications design elements with other features and services including:

- Other design disciplines including civil engineering, architecture and building design, landscape architecture, irrigation, and public utility services (as relevant).
- Existing features, infrastructure, and services relevant to the works area.
- Relevant future or master planned works if nominated by Council.

3.2 Safety in design philosophy

Designs are to comply with the safety in design obligations and requirements set out in the *Work Health and Safety Act 2011 and Work Health and Safety Regulation 2011*.

Design packages must include a meticulously documented safety in design risk assessment. This assessment should thoroughly examine potential safety risks that may occur throughout the lifecycle of the system and equipment. Council's review and confirmation of this assessment as part of the design process is mandatory.

The planning, design and implementation of electrical, lighting and telecommunications infrastructure must be undertaken to ensure safe access provisions are maintained for ongoing operation and maintenance.

3.3 AS/NZS 3000 compliance

Compliance with *AS/NZS 3000* is mandatory for all Council works. Design solutions should meet *AS/NZS 3000* – Electrical installations Part 2 without exception clauses.

Council may consider design solutions meeting *AS/NZS 3000* Part 1 with the use of exception clauses where they are proven to offer a lower risk or are a more cost-effective solution. Where an exception for *AS/NZS 3000* Part 2 is applied for, the RPEQ certified design must be submitted to Council with technical and engineering justification during the design development stage before any installation or construction occurs.

3.4 Design submissions

Design and documentation activities are to be undertaken to a sufficient level of detail to permit construction and installation of the intended works by a suitably qualified contractor. The design program and methodology (including design reviews and hold points) will be dependent on broader project and contract requirements; however, the following general principles apply to all electrical, lighting and telecommunications designs:

- Design documentation must include (at minimum) the following elements:
  - Appropriate legend of symbols utilised through the documentation package. Note that legends shall be relevant to the works package and not include extraneous/generic symbology not relevant to the works.
  - Layout plans detailing the scope/extent of the works using appropriate scaling and character size.

  - Schematic drawings (as required) to show the interconnectivity of systems and equipment provided under the works.
  - Detail drawings (as required) to shown specific construction/installation requirements that cannot be reasonably captured on a layout plan or specification notes.
  - Specification to describe the performance requirements, method of installation and minimum quality standards for all services and equipment to be delivered.
- Drawings prepared using a recognised Computer Aided Drafting (CAD) program.
- Drafting standards in accordance with *AS/NZS 1100* and *Sunshine Coast Council Drafting and Design Presentation Standards*, specifically:
  - Title block requirements.
  - Revision conventions.
  - Drawing/project numbering conventions.
- Documentation to be submitted electronically in the following formats:
  - Printable Document Format (.pdf).
  - AutoCAD drawing format (.dwg).
  - Hard copy (if requested by Council).
- A suitable document transmittal capturing the current and previous revisions.

Council may request additional design information to be provided including:

- Design calculations such as:
  - Electrical calculations (e.g., maximum demand, cable sizing, discrimination studies, and fault level calculations).
  - Lighting calculations demonstrating conformance with relevant standards.
  - Any other technical material deemed appropriate by Council.
- A design report summarising the basis of the design and other technical information relevant to the proposed works.
- Safety in design risk assessment (refer Section 3.2).
- A Bill of Quantities (BoQ) or project cost estimate for the proposed electrical, lighting and telecommunications elements. The BoQ or cost estimate should include a reasonable breakdown of items to facilitate budget planning and value management.

Records are to be maintained and securely held for a minimum of seven years from the date of document delivery to Council.

3.5 Design certification

Electrical and lighting design

All design submissions must include an RPEQ design certification. The RPEQ certification (refer Figure 2) must appear on the front sheet of each drawing package.

Figure 2: Design Certification Example

Certification of public lighting designs is to be in accordance with the requirements of *AS/NZS 1158.1.1* and *AS/NZS 1158.3.1*. This must include:

- Category P roads: Illuminance diagrams (Isolux plots) illustrating relevant contours for the lighting sub-category. Diagrams to clearly show both illuminance and point illuminance values demonstrating compliance to *AS/NZS 1158.3.1*, Table 3.3.
- Category V roads: Luminance calculations and illuminance diagrams (Isolux plots), illustrating relevant contours for the lighting sub-category. Diagrams to clearly show both illuminance and point illuminance values demonstrating compliance to AS/NZS 1158.1.1, Table 2.2.

The design submission must also include the obtrusive lighting compliance assessment results and certification, including a summary of assessment parameters. For example, zone selection, light technical parameters, and setback. For additional information, refer to ELIM sections 7.4 and 7.5.

Calculation of luminaire maintenance factor must be in accordance with the guidance provided in AS/NZS 1158 and utilise the following:

- Light source Lumen Depreciation (LLD) from TM21 and LM80 test results (at 40oC ambient – minimum).
- Luminaire Dirt Depreciation factor (LDD) based on a 60-month cleaning cycle.
- A minimum maintenance Factor of 0.8 must be applied.

Structural design

Structural design certification by an appropriately qualified structural engineer must be provided for light poles and associated footings. Manufacturer "standard" pole or footing certification (RPEQ) can be applied providing the site-specific requirements and installation conditions are addressed by the certification criteria. Where project specifications or site conditions dictate the use of a pole or footing that is not covered by a manufacturer standard certification, provide specific certification to suit the performance requirements of the installation.

3.6 Design of Rate 2 and Rate 3 installations

Rate 2 lighting installations on Council controlled roads must be designed and documented in accordance with EQL technical standards and specifications, using EQL standard equipment. Council has agreed with Energex the following additional elements for inclusion in Rate 2 designs and documentation for the Sunshine Coast region:

- LED Luminaire colour temperature: 3000K.
- LED luminaires to be fitted with 7-pin NEMA socket, photocell and DALI-2 driver.

Rate 3 lighting installations (where Council is the nominated Rate 3 customer) must be designed and documented in accordance with the requirements of the ELIM and also include the following additional information:

- An EQL project number allocated upon request by the EQL Subdivision and Street Lighting Department (as per *Energex Public Lighting Manual - Standard Conditions for Public Lighting Services*).

- A Rate 3 street lighting schedule as per EQL's *Works Plans Standards*, including provision for the 'date energised' to be shown (as per the *Energex Public Lighting Manual - Standard Conditions for Public Lighting Services*).
- In addition to consideration of the luminaire performance requirements in the ELIM, the design must utilise luminaire selections as listed on the *AEMO National Electricity Market Load Tables for Unmetered Connection Points*.

All works undertaken in TMR or QR controlled areas must be designed and documented to TMR or QR technical standards and specifications using TMR or QR standard equipment.

Image: Sippy Down art seat

4. Contract and construction requirements

4.1 Contract compliance and coordination

Contractor works must comply with relevant project briefs and requirements. The electrical services design and documentation must be developed in conjunction with all project and contract documentation.

Where works are undertaken in conjunction with other trade or builders works, coordinate all contracted services elements with associated works. Ensure works sequencing is coordinated to suit the overall construction program and to avoid re-work or disturbances to finished surfaces.

Obtain a set of architectural, structural, civil, landscape or other services documentation (as applicable) for review and coordination prior to commencement of construction.

4.2 Construction submissions

Shop and fabrication drawings

Manufacturer's shop drawings are required for the following components (where applicable to the scope of work):

- Switchboards (all types). Shop drawings of switchboards must include the following:
  - General arrangement and overall dimensions, including elevations with doors open, doors closed, and escutcheons removed.
  - Construction details including material type/thickness, IP rating, mounting, door swings, accessory types/materials, finishes etc.
  - Makes, types, ratings and model numbers as well as equipment items.
  - Type test certificates for components, functional units and assemblies, including internal arcing-fault tests and factory test data.
  - Certification to *AS/NZS 61439*.
  - Schedule of labels.
  - Single line schematic diagram.
- Poles and pole footings (including structural design certification).
- Lighting control schematics for RGB/W control systems.
- Non-standard (custom) construction, mounting, fixing elements.

Technical data

Technical product data should be available upon request, including any relevant product certifications and warranty information.

Where alternative equipment selections are proposed that differ from the approved design, the proposal must be supported by all necessary technical data to demonstrate that the alternative meets or exceeds the specified technical and performance requirements.

Samples

Where nominated in project documentation or otherwise requested by Council, provide samples of nominated equipment or materials for review. Samples should be considered for situations where technical data or design documentation cannot reasonably confirm the intended appearance, performance, operation or mounting of equipment.

4.3 Construction hold points

In addition to any required obligations under the contract, Table 1 provides a summary of the hold points that are to be applied to all works related to electrical, lighting and telecommunications installations covered under the ELIM. Activities listed that do not apply to the scope of work can be disregarded.

Table 1: Construction Hold Points

Construction Activity	Timing	Hold Point Release
Submission of switchboard shop drawings	Prior to switchboard fabrication	Review by Council
Submission of pole and footing shop drawings	Prior to ordering	Review by Council
Submission of lighting control schematics for RGB/W control systems	Prior to ordering	Review by Council
Excavation works and conduit installation	Prior to backfill	Photographic records reviewed by Council
Submission of testing and verification records	Prior to Defects or On-Maintenance inspection	Review by Council
Defects or On-Maintenance inspection	Prior to Practical Completion	Inspection by Council
Submission of handover / completion material	Within four weeks of Practical Completion	Review by Council
Completion of user training for control system elements	Within four weeks of Practical Completion	Review by Council
Final or Off-Maintenance inspection	Prior to Final Completion	Inspection by Council

Additional hold points may result from non-conformance with specified materials or procedures.

Hold point releases will be managed by Council and may include involvement from a nominated third-party such as a design engineer or otherwise qualified reviewer.

Photographic evidence of pit and conduit installation must be submitted to Council before backfilling commences. Photographic records are to be supplied as 'spot checks' and must be representative of the broader installation. The provision of photographic records does not replace the need for mandatory inspections, third-party review, and certification.

4.4 Defects liability

A quality guarantee for all works and materials against defects is required for a period of 12 months from the date of issue of the Certificate of Practical Completion. During the defect's liability period, the contractor is responsible for the following:

- Rectification of defects identified at practical completion.
- Completing obligations, including training and training materials, and operating and maintenance manuals.
- Periodic inspections of the installations at a duration of not more than six monthly intervals. This will include the performance of maintenance activities per standard requirements and manufacturer's recommendations.
- Promptly responding to service callouts if a defect arises through the site's operation, including the prompt rectification and any required troubleshooting to identify the cause of the defect.
- Replacement of defective equipment and components that cannot be repaired.

- Re-certification of the installation following any alterations required as part of defect rectification works. This must include re-testing and updating As-Constructed documentation, ADAC and Manuals as required.
- Refinement of programmable settings (such as lighting controls) to reflect updated user requirements.

Upon completion of the defect's liability period, the contractor must complete a final service of the installation in accordance with Council's *Periodic Testing and Verification Specification*, including:

- Full visual inspection of all components.
- Push button and injection testing of all Residual Current Devices (RCDs).
- Final adjustment of programmable settings (if required).
- Refer to the contract and development conditions for additional defects liability and warranty obligations.

4.5 General construction requirements

Existing services responsibilities

Before commencing any on-site works, investigations to identify and locate existing underground or overhead services that may impact on the works must be undertaken. All new works must maintain necessary clearances from existing services following applicable authority requirements and alignment standards.

Any damages to existing services resulting from contractor works or processes used to locate existing services must be rectified by the contractor at nil cost to Council. Remediation's that may be required for damages to existing Public Utility Plant (PUP) infrastructure must be forwarded onto the relevant PUP organisation and to be repaired by the PUP organisation (or an accredited third party) only.

It is the contractor's responsibility to exercise the appropriate duty of care required to identify any native title or cultural heritage management issues resulting from works.

Where redundant inground services are identified, they must be removed. Cables must be removed entirely from the source switchboard. Existing and new services within the works area must be surveyed and submitted to Council as part of the As-Constructed documentation.

Interruption to services

When works impact or disrupt the continuity of existing services within the site, the works are to be planned and completed at a time to cause the least inconvenience and impact to site operations and service beneficiaries. If existing services are disturbed during site works, they must be reinstated to their original condition.

Do not undertake any supply isolations without prior approval from Council. Where site operation is impacted by construction works, temporary power and lighting must be provided to maintain the operational requirements.

Site set-out

Final equipment locations, mounting heights and cabling pathways must be coordinated on-site (with other trade works and existing building and services elements) using dimensioned set-outs.

Check dimensions on site. No claims will be allowed for errors due to scaling off drawings.

Materials and uniformity

Unless specified otherwise, all materials and equipment must be new and be first quality, free from all damage and defects resulting from manufacture, transport or erection. Surfaces of equipment damaged during delivery or construction shall be replaced, touched up or repainted to Council approval.

Unless specified otherwise, uniformity of type and make of equipment must be maintained throughout the installation.

Corrosion prevention

Equipment must be suitably corrosion protected as required for a coastal or marine environment. Materials selection must be hot dipped galvanizing, 316 stainless steel, or marine grade aluminium.

The design and installation of equipment must reduce electrolysis from occurring between dissimilar metals. Protect dissimilar metals from electrolysis by using bituminised felt, neoprene gasket, Teflon tape, insulating union or equivalent means.

Fastenings, nuts and washers must be 316 grade stainless steel.

Labelling (generally)

Provision of accurate labelling is essential to ensure Council complies with its electrical safety obligations. Labelling requirements for specific equipment and components is nominated in the relevant sections of the ELIM. All labelling must meet the following general requirements:

- Permanent: labels must only be removable with the use of a tool.
- Machine printed / engraved: handwritten labels are not permitted.
- Legible: labels must be neat, legible and appropriately sized.
- Accurate: labels must provide an accurate reference to installed conditions.

Image: Pedestrian crossing, Palmwoods

5. Completion and handover

5.1 Testing and commissioning

The installation contractor must complete all required testing, functional and operational checks, and adjustments to fully verify the safety, compliance and correct operation of all components installed under the works. Testing and verification works must include (at a minimum) the following:

- Electrical: carry out mandatory inspection and testing in accordance with *AS/NZS 3000* Section 8 and the relevant requirements of *AS/NZS 3017*, including:
  - Visual inspection (to *AS/NZS 3000* Clause 8.2.2).
  - Earth system continuity (to *AS/NZS 3000* Clause 8.3.5).
  - Insulation resistance (to *AS/NZS 3000* Clause 8.3.6).
  - Polarity and phase sequence (to *AS/NZS 3000* Clause 8.3.7).
  - Correct circuit connections (to *AS/NZS 3000* Clause 8.3.8).
  - Earth Fault Loop Impedance (EFLI) verification (to *AS/NZS 3000* Clause 8.3.9).
  - Operation of RCDs (to *AS/NZS 3000* Clause 8.3.10).
- Lighting: carry out the following testing and verification on all installed lighting elements:
  - Test the operation of all luminaires installed, together with the associated control strategy (pre-set programs as well as manually adjustable control settings).
  - Undertake night-time aiming of adjustable luminaires to achieve lighting intent.
  - Adjust programmable parameters as required to suit Council's requirements.
- Structural: while no specific on-site structural testing is mandated, all structural elements must be installed and verified in accordance with approved structural documentation and manufacturer or engineering installation requirements.

Upon completion of testing and verification, submit full test reports to Council (in electronic format) for review prior to practical completion.

5.2 Supply authority coordination

Coordinate with the Supply Authority as required for installation of utility equipment or completion of service connections. Ensure all Principal's obligations have been completed in accordance with the relevant Connection Agreement or Supply Authority standard requirements. This includes any required metering arrangements (coordinated through Council's nominated metering provider).

5.3 Construction certification

Appropriate certification must be submitted to Council, clearly demonstrating that the installation complies with the approved design documentation and applicable standards. The certification must incorporate the agreed changes and the following:

- Installation has been completed per approved, certified design documentation, including all relevant electrical, lighting, and structural components.
- Electrical compliance in the form of a Certificate of Testing and Safety per *AS/NZS 3000* requirements and obligations of the *Electrical Safety Regulation*.

Form 12 or Form 16 inspection certification for the installation of poles and footings is not required unless requested as part of a project-specific application (such as a specialist engineered pole or footing type for a catenary lighting

installation). Certification of structural elements will be included as part of the requirement for certifying that the installation conforms with the approved design documentation (including structural design certification and relevant installation details).

5.4 User training

Where a programmable lighting control system is provided for the purposes of RGBW lighting control or other complex dimming and control solutions, user training must be provided to Council to demonstrate and instruct on the operation of the system. User training must be in accordance with the following:

- Facilitate training for up to five (5) nominated council staff.
- Conduct training following successful testing and commissioning of the installation.
- Coordinate venue and timing with Council. User training should typically be conducted on site using the installed system components.
- Facilitate training with a technical representative from the installers organisation competent with the operation of the installed system.
- Provide all required training materials and include copies of such material as part of handover records.

5.5 As-constructed records

Drawings

Accurate as-constructed drawings are critical to enable Council to fulfill its asset management obligations and maintain compliance with the expectations of the Electrical Safety Act. As-constructed drawings must be provided upon completion of all electrical, lighting and telecommunications works undertaken for; on behalf of; or contributed to Council. As-constructed documentation must be as follows:

- New installations and major upgrade / reconfiguration works:
  - AutoCAD (.dwg) and Printable Document Format (.pdf) formats submitted to Council.
  - Hard copy drawings included in the relevant supply switchboard, including single line schematics and site layout plans showing key equipment and conduit routes.
  - Revision Status: "AS-CONSTRUCTED":
  - Details of installation contractors included in title block information (include original design consultants' details as applicable).
  - Signed and dated by installation contractor (or qualified/competent person), with contact details provided.
  - Red-line markups are not permitted for these types of installations.
- Minor upgrade / reconfiguration works:
  - Red-line markup of design documentation or previous as-constructed drawings supplied electronically to Council in Printable Document Format (.pdf).
  - Hard copy drawings included in the relevant supply switchboard. This shall include single line schematics and site layout plans showing key equipment and conduit routes.
  - Notated with "AS-CONSTRUCTED" revision status.
  - Signed and dated by installation contractor (or qualified/competent person), with contact details provided.
- Rate 3 Public lighting installations:
  - As-constructed drawings in accordance with the above requirements.

- In addition to the above requirements, as-constructed Rate 3 documentation must be submitted (by the installation contractor) to EQL Subdivisions and Street Lighting group to enable EQL to record the date of energisation and add relevant unmetered lighting points to the unmetered customer account.

Test reports

Submit copies of all relevant test reports to Council (in electronic format) as part of handover records. Test reports must be in accordance with *AS/NZS 3000* Section 8 and *AS/NZS 3017*, and should generally include the following:

- Test type and result (refer Testing and Commissioning section).
- Relevant circuit information related to the test.
- Name and licence number of test technician.

Manuals

Where installations include plant, equipment or other components supplied and (in some cases) installed by third party providers such as the Original Equipment Manufacturer (OEM), or authorised supplier, ensure the following:

- Relevant technical data for installed equipment is provided to Council, together with manufacturer and/or suppliers details.
- In conjunction with technical data, provide operating manuals for operable system elements such as controllers and the like.
- All warranties for relevant items of installed equipment pass to Council as the warrantee.
- All product/equipment compliance certifications are provided to Council.

ADAC

On completion of installation works and prior to assets being accepted on maintenance (or upon expiration of relevant defects liability period/s) a current version ADAC XML file of the as-constructed installation is to be submitted for Council review and acceptance. The final as-constructed data should accurately reflect material types, specifications and other asset specific information.

The digital ADAC XML file must be a complete and detailed digital record of what was constructed, as this information is used by the Council in the management of the assets.

Refer to Sunshine Coast Council publication: *Guidelines for Creation and Submission of ADAC for ADAC* preparation requirements.

5.6 Keying

Electrical and telecommunication access hatches must be accessible via the use of tamper proof fixings. Event power hatches and Switchboard enclosures must be accessible via a lockable, hinged access door keyed to Council's requirements.

Electricity Metering section – Energex 929 lock

Distribution section – SCC Parks 30 lock

Event Power section – Parks 30 lock

If Council have approved the use of unique keying for access to controlled equipment, then a minimum of two (2) copies of keys must be provided as part of handover.

6. Electrical supply, metering and tariff arrangements

6.1 Scope

Electrical infrastructure delivered within Council controlled spaces can be provisioned in a variety of different ways to suit the intended application of the installation. This section of the ELIM outlines the high-level considerations for planning and implementation of electrical supply to suit the operational requirements of the public space.

The regulatory environment allows electricity network connection to Council electrical and public lighting installations under the following supply arrangements:

- Unmetered Supply Tariff (Rate 1, Rate 2, Rate 3 and Rate 4). These tariffs are typically for the exclusive use by public bodies (such as Council) where the supply authority charges the customer on a "per-point" basis without the need for metering of electricity consumption for those loads. The types of loads able to be connected under these arrangements is limited and controlled by the supply authority and Australian Energy Market Operator (AEMO).
- Metered connections. These connection types utilise metering equipment to record electricity consumption and demand and subsequently charge the customer for actual usage. There are much fewer restrictions on equipment and load groups connected under a metered supply arrangement.

Alternative arrangements for electricity supply may include photovoltaic solar.

The following ELIM sub-sections provided guidance on the application of these supply strategies to suit the nature of the installation.

6.2 Unmetered supply tariff

Unmetered supply arrangements should be considered where the electrical installation is exclusively provided for road or public lighting assets. Equipment connected under any of the unmetered tariff arrangements must be listed on the *AEMO National Electricity Market (NEM) Load Tables for Unmetered Connection Points*. Where the proposed installation or equipment is not approved under the *AEMO NEM Load Tables for Unmetered Connection Points*, a metered connection will be required.

Table 2 provides a summary of relevant unmetered tariff arrangements.

Table 2: Unmetered supply tariffs

Tariff	Description	Ownership	Provisioning	Maintenance
Rate 1	Non-contributed (Rate 1) public lighting is supplied, installed, owned, and maintained by the EQL. The tariff includes components supply, installation and recovery over time where EQL has incurred the cost of installing the public lighting.	EQL	EQL	EQL
Rate 2	Contributed (Rate 2) public lighting is provisioned by the Public Body (Council) on behalf of EQL. EQL owns and maintains the public lighting infrastructure.	EQL	Council	EQL
Rate 3	Unmetered (Rate 3) public lighting is supplied, installed, owned, and maintained by the Public Body (Council).	Council	Council	Council
Rate 4	Public Body (Council) funded replacement of existing Rate 1 lighting asset with new LED lighting asset (pole and reticulation remain unchanged).	EQL	EQL (Council funded)	EQL

As established within the *Urban Lighting Master Plan* (ULMP), new unmetered public lighting installations within the Sunshine Coast region should typically be provisioned under a Rate 3 arrangement in order to allow Council to maintain better control of the asset and help fulfill broader Smart City objectives. The exceptions to this position are as follows:

- For small scale installations (typically <5 lighting points) where surrounding lighting assets are connected under a Rate 1 or Rate 2 arrangement. In such instances, a Rate 2 arrangement would be considered appropriate.
- Where existing electricity network provisions would prohibit or impede the ability for Council to safely maintain the lighting asset. For example, where overhead electricity network infrastructure dictates the need to mount lighting assets directly to network poles. This would need to be provided under a Rate 2 arrangement.

In addition to the requirements set out in the ELIM, Rate 3 installations must also be provided in accordance with *Energex Standard Conditions for Public Lighting Services* and the approved luminaires documented in the *AEMO NEM Load Tables for Unmetered Connection Points*.

Rate 2 lighting design must be undertaken by a design consultant accredited by Energex under Energex *Work Category Specification (WCS) 47.3 - Public Lighting Rate 2 Design*.

Construction and installation of Rate 2 lighting must be undertaken by a contractor accredited by Energex under *WCS 37 - Public Lighting Installations*. Additional WCS accreditations may be required depending on the nature of the installation.

6.3 Metered supply

Where the electrical infrastructure and equipment to be installed would not otherwise be permitted under an unmetered tariff, the installation must be provisioned under a metered supply arrangement. This would include installations that contain provisions such as:

- General power distribution for market and event purposes.
- Connections to specific equipment such as Council Smart City or telecommunications equipment, barbecues, irrigation equipment, etc.
- Connections to public amenities blocks. Note that public amenity blocks are managed by Council's Property Management Branch who mandate specific electrical requirements separate to those covered in the ELIM. Public areas that include amenities blocks utilising a shared connection with broader site lighting and electrical equipment need to be coordinated with Property Management Branch.
- Lighting equipment that is not approved for unmetered connection (and is not listed on the AEMO Load Table). This would typically include installations that incorporate decorative / feature lighting elements.

Where a metered supply strategy is deemed to be required, supply provisioning must be made in accordance with the *QLD Electricity Connection Manual* (QECM) and *QLD Electricity Metering Manual* (QEMM). Site load requirements must be determined, and all necessary EQL applications must be lodged by the designer or contractor.

Where a metered supply strategy is implemented within a park and garden area, all pathway and other open space lighting within that lot boundary should be connected to the metered supply. Dual supply arrangements (metered and unmetered) are not desirable within the same lot.

Where street lighting is required in road reserve adjacent to a park and garden lot, an unmetered (Rate 3) supply can be considered for the street lighting installation. Where this strategy is implemented, the Rate 3 switchboard must not be shared with the metered supply switchboard.

6.4 Alternative supply systems

General

Alternative supply systems can be utilised on a case-by-case basis where mains connected options (either metered or unmetered) are otherwise deemed to be prohibitive from a cost or risk perspective. The use of alternative supply systems must be reviewed with and agreed by Council, with analysis to include whole-of-life considerations associated with performance, maintenance, and cost aspects. The following sub-sections set out the minimum technical requirements associated with potential alternative supply system types.

Photovoltaic solar

Solar installations would typically include:

- Standalone solar lighting poles, with localised battery storage.
- Central solar "power station" with extra low voltage (ELV) reticulation to lighting.

Solar lighting products must be provided by a specialist solar lighting manufacturer who can warrant all components of the system (including poles, solar modules, chargers, luminaires, controllers etc). Table 3 sets out suggested minimum performance requirements for solar lighting installations. Requirements shall be refined in conjunction with the specialist supplier to suit the intended lighting application.

Table 3: Minimum Performance Requirements for Solar Lighting

Item	Requirement
PV Module	Monocrystalline with mechanism to deter perching of birds (for pole top panels). Tempered glass with anodized aluminium alloy, IP56+ junction box. Integrated bypass diodes to limit effects of shading. PV modules must have minimum 10-year design life.
Battery Type	Batteries must be suitable for the environment in which they are to be installed. Batteries must have 10-year design life. Lithium: LiFePO4 with integrated battery management system and minimum 3000 cycles @ 85% depth of discharge.
Charge Controller	Maximum power point tracking (MPPT), matched to PV module and battery type Include standard protection against reverse polarity, surges, short-circuit, overload, under/overvoltage and overtemperature. IP56 (min) or installed within IP56 (min) enclosure. Minimum 10-year design life.
Autonomy	Minimum 3 days of autonomy at nominated operating profile (dusk-dawn).
Control and Monitoring	Compatible with Council's Central Management System (CMS). Remote performance monitoring management application in the form of web access or through application.

Diesel generator

Diesel generator supply can be used for temporary lighting purposes with approval from Council, however, must not be utilised for permanent installations.

7. Public lighting

7.1 Scope

This section of the ELIM provides guidance and direction on requirements for the design and provisioning of public lighting within areas defined by ELIM section 1.3.

Appropriately design and installed public lighting infrastructure is critical to ensure Council meets public safety and operational needs as well as balancing requirements for environmental factors and maintenance.

7.2 Public lighting categories

Public lighting installations throughout the Sunshine Coast region can be broadly categorised as follows:

- Roadway Lighting: Lighting installation within road reserve:
  - Category V (to *AS/NZS 1158.1.1*) – Lighting on roads where the visual requirements of motorists are dominant.
  - Category PR (to *AS/NZS 1158.3.1*) – Lighting on roads where the visual requirements of pedestrians are dominant.
  - Category PX (to *AS/NZS 1158.4*) – Lighting for designated pedestrian crossings.
- Pathway lighting between residential lots: category PP to *AS/NZS 1158.3.1*.
- Open space lighting: lighting to areas such as public pedestrian/cycle pathways through parks / open spaces, public activity areas and outdoor carparks (Categories PP, PA, PC and PE to *AS/NZS 1158.3.1*).
- Feature/Decorative Lighting: lighting elements intended to enhance the overall aesthetic amenity of a public space.

Final category selection is to be confirmed with Council as the designated controlling authority for the space.

The following subsections provide a baseline for the minimum technical and performance requirements for the various components of a lighting installation in accordance with the above categories.

7.3 Public Lighting Electrical Supply Requirements

Electrical supply and servicing requirements are outlined in section 6.

7.4 Minimising adverse effects of lighting

General requirements

All lighting installations in the public realm (irrespective of their function) must incorporate good design and installation practices to minimise adverse effects of artificial lighting on the surrounding environment. Adverse lighting effects may include:

- Effects on residents, including spill light and glare (discomfort or disability).
- Effects on transport system users resulting from sources of disability glare.
- Effects on transport signalling systems resulting from disability glare or competing light sources.
- Effects on the night sky resulting from excessive sky glow.
- Effects on the natural environment including flora and fauna.

Minimisation of these lighting impacts must be considered through application of the following general principles:

- All pole top luminaires must be installed with zero-degree tilt.

- All pole top luminaires must be provided with aero-screen (full cut-off) visor/diffuser.
- Appropriate pole heights should be chosen to balance compliance obligations with minimisation of glare and spill light.
- Luminaires should be selected in accordance with *AS/NZS 1158.3.1* as follows:
  - Limitation of luminous intensities – to *AS/NZS 1158.3.1* Table 3.8.
  - Limitation of discomfort glare - to *AS/NZS 1158.3.1* Table 3.9.
  - Limitation of upward waste light - to *AS/NZS 1158.3.1* Table 3.10.
- All luminaires (other than those providing a decorative function) must have a correlated colour temperature (CCT) of 3000K unless otherwise approved by Council.
- All lighting designs must take guidance from *AS/NZS 4282* Appendix A, with *AS/NZS 4282* compliance required as described in ELIM Section 7.4.2.
- Where installation geometry permits, luminaire placements and orientation should be chosen to minimise direct view of light sources from neighbouring residential properties or otherwise sensitive areas.
- All pole top luminaires must be provided with 7-pin NEMA (or Zhaga Book-18) socket and DALI-2 / D4i compliant driver to facilitate Council installation of Light Point Controller (LPC) to provide remote dimming and switching capability.
- The use of glare shields should be considered on a case-by-case basis to meet the objectives described in Table 2. The following requirements apply to glare shields:
  - Front-facing glare shields are not permitted unless lighting compliance (V-Category / P-Category) can still be demonstrated and certified.
  - Manufacturer fitted glare shields are preferred where the manufacturer has provided photometric data for luminaires with glare shields.
  - Custom fabricated/fitted glare shields are subject to a shop drawing review and approval process and should not impact on luminaire warranties or serviceability. Where a custom glare shield is proposed, submissions must include a summary of how shielding has been factored into the design.

Compliance obligations

AS/NZS 4282 outlines the process for assessment of the impacts of obtrusive effects of outdoor lighting. The requirements of *AS/NZS 4282* must be applied to all Council controlled public lighting installations that are located adjacent to residential developments or otherwise identified environmentally sensitive area. Environmental zones and associated technical parameters must be chosen in accordance with *AS/NZS 4282*, with guidance from *AS/NZS 1158.1.1*, *AS/NZS 1158.3.1* and Table 4.

Table 4: AS/NZS 4282 Environmental Zone Selection Guide

Installation Type	Lighting Category to AS/NZS 1158	Environmental Zone to AS/NZS 4282
Street lighting – major road	Category V	Zone V
Street lighting – minor road	Category PR	Zone R1, R2, or R3 Note 1
Pedestrian crossing lighting	Category PX	Zone RX
Pedestrian or cycleway lighting in road reserve and between residential lots	Category PP	Zone R1 or R2
Pedestrian or cycleway lighting in park	Category PP	Zone A0, A1, A2, A3 or A4
Public activity area lighting	Category PA	Zone A0, A1, A2, A3 or A4
Car park lighting	Category PC	Zone A0, A1, A2, A3 or A4

Notes:

1. Zone must be chosen to suit the nature and location of the public lighting installation together with consideration of property setback as described in *AS/NZS 4282*. Setbacks for greenfield residential developments should be as nominated in the relevant planning conditions or guidance should be taken from *AS/NZS 4282*.
2. Where *AS/NZS 4282* compliance cannot be achieved without compromising compliance with *AS/NZS 1158*; the requirements of *AS/NZS 1158* should take precedence. In such cases, the resultant obtrusive lighting non-conformance must be raised with Council and described or qualified as part of design certification.

AS/NZS 4282 assessment results and certification must be provided as part design submissions. This must include a summary of relevant assessment parameters utilised. Where a large installation contains a number of "typical" elements, assessment and certification can be provided on the basis of the "typical" area.

Pedestrian crossing lighting

In addition to general compliance with AS/NZS 4282 obtrusive lighting associated with pedestrian crossing lighting installations must be minimised via implementation of one or more of the following strategies:

- Pole heights chosen to be as low as practicable for lighting compliance, whilst maintaining relevant clearances above the carriageway.
- The use of specific pedestrian crossing (left or right-throw), or forward-throw optical distributions to avoid the need to tilt or aim the luminaire. Luminaires must be installed with zero-degree tilt.
- Provision of glare shielding as required to minimise direct visibility from neighbouring residential premises.

7.5 Environment and ecology

Dark sky principles

As part of Council's vision of being Australia's most sustainable region, Council recognises the natural value of the night sky and shares the community's vision to maintain an environmentally responsible approach to outdoor lighting. Through the adoption of the *ULMP* in 2016, Council implemented a public lighting strategy that aimed to balance public safety obligations with good-practice principles for preserving the integrity of the night-time environment.

This whole-of-region approach leverages responsible lighting principles from DarkSky International (formerly the International Dark Sky Association), Australasian Dark Sky Alliance (ADSA) and the Illuminating Engineering Society (IES) to ensure public lighting installations are sympathetic to the natural environment. The five principles that have been incorporated into Council lighting policy are summarised in Table 5.

Table 5: Responsible Lighting Principles (Source: *DarkSky International*)

Principle	Description	Council Application
Useful All light should have a clear purpose	Before installing or replacing a light, determine whether light is needed. Consider how the use of light will impact the area, including wildlife and the environment. Consider using reflective paints or self-luminous markers for signs, curbs, and steps to reduce the need for permanently installed outdoor lighting.	Lighting provided within Council-controlled public spaces is intended to fulfill a defined operational purpose to enhance the public safety or usability of a space.

Principle	Description	Council Application
Targeted Light should be directed only to where it's needed	Use shielding and careful aiming to target the direction of the light beam so that it points downward and does not spill beyond where it is needed.	Adoption of *AS/NZS 1158* lighting guidelines in conjunction with *AS/NZS 4282* requirements helps to ensure lighting is provided only where needed to fulfill safety or operational objectives. This is further enhanced by adoption of implementation strategies such as: Zero-degree tilt to ensure upward waste lighting is minimised. Use of shielding as appropriate. Designs undertaken by appropriately qualified professionals.
Low Light Levels Illumination should be no higher than necessary	Use the lowest light level required. Be mindful of surface conditions, as some surfaces may reflect more light into the night sky than was intended.	Careful consideration of appropriate lighting levels in accordance with the recommendations of *AS/NZS 1158* to ensure lighting suits the operational profile and risk factors specific to the area.
Controlled Light should be used only when it is useful	Use controls such as timers or motion detectors to ensure that light is available when it is needed, dimmed when possible, and turned off when not needed.	Adoption of CMS controls to facilitate the use of dimming and switching profiles to minimise lighting impacts wherever possible to suit the operational profile of the area.
Colour Use warmer-colour lights where possible	Limit the amount of shorter wavelength (blue violet) light to the least amount needed. Light where you need it when you need it, in the amount needed, and no more.	Adoption of 3000K standard colour temperature for whole-of-region lighting installations.

Dark sky designation

In addition to the whole-of-region lighting strategies already outlined in the previous sections of the ELIM, Council is exploring opportunities to seek formal designation of dark sky places in accordance with the International *Dark Sky Places* (IDSP) certification program managed by DarkSky. Additional requirements for Dark Sky Place/s (if designation proceeds) will be amalgamated into the ELIM as the process progresses.

Wildlife sensitive areas

In conjunction with broader dark sky lighting principles being adopted throughout the region, Council has committed to reducing the impacts of public lighting on local fauna species. The ULMP adopted by Council in 2016 recognises the impact that artificial lighting can have on nocturnal fauna species. To minimise these impacts, a layered, geographical approach has been adopted to implement appropriate controls to achieve wildlife sensitive lighting outcomes. These measures are summarised in Table 6.

Table 6: Wildlife Sensitive Lighting Control Measures

Layer	Application	Control Measures
1	Whole-of-region	Planning: • Is lighting required to fulfill an operational or safety need? • Are lighting requirements and levels appropriate to meet the identified operational or safety need? • Have the operational or safety needs of the site been profiled to ensure lighting operation aligns with usage profiles? Design: • Designs to be undertaken by appropriately qualified professionals. • Design to be in accordance with agreed performance requirements and standards outcomes. • Luminaire selections to comply with the ELIM, including use of 3000K colour temperature and provision of CMS control nodes to facilitate remote switching and/or dimming of lighting. • Pole heights designed as low as practicable to achieve compliance with light technical parameters whilst minimising light spill. Implementation: • Luminaires installed with zero-degree tilt to minimise upward waste and obtrusive light. • Luminaires installed with appropriate shielding to minimise obtrusive light. • Lighting control operation tested and adjusted to suit agreed operating profiles. Operation: • Lighting controls implemented, modified, and reviewed as necessary to align with evolving operational needs of the site.
2	Area within 100m of defined wildlife sensitive area (buffer zone)	All measures as per Layer 1. Additional control measures: • Luminaire selection from ADSA Approved register. • Orientation of all lighting components away from wildlife area. • Full shielding of light sources from designated wildlife area. This could include: – Location of pole top lighting chosen to ensure physical barrier between light source and wildlife area such as vegetation or other structures. – Shelter and amenities lighting selections and mounting coordinated with structural elements to ensure light source is not directly visible from wildlife area. – Use of proprietary or custom shielding as required.

Layer	Application	Control Measures
3	Area directly within or adjacent to defined wildlife sensitive area	All measures as per Layers 1 and 2. Additional control measures: • Luminaire selection from ADSA Prized Wildlife register. • Provision of presence-based lighting control through use of secondary control node (Zhaga Book-18 socket with presence detection). • Use of light sources with appropriate spectral composition to reduce wavelengths between 400-580nm (ultra-violet, violet and blue wavelengths). Where appropriate, this should include use of control technologies to facilitate switching between "standard" (e.g 3000K) and "wildlife" modes.

All lighting for wildlife sensitive areas must be carefully coordinated with Council to ensure balanced outcomes are achieved to fulfill both public operation and safety considerations as well as wildlife sensitive lighting outcomes.

Council supports and endorses the recommendations of the National Light Pollution Guidelines for Wildlife and Sunshine Coast Council Marine Turtle Conservation Plan.

7.6 Luminaires

Minimum technical requirements

The following mandatory requirements (Table 7) apply to luminaires for Council public lighting installations. Evidence of conformity to these requirements must be made available to Council upon request.

Image: Pathway lighting, Nambour

Table 7: Luminaire Performance Requirements

Criteria	Category V Installation	Category P Installation	Dark Sky Area	Wildlife Sensitive Area	Feature/ Decorative Lighting
Lamp Technology	LED	LED	LED	LED	LED
Luminaire Efficacy	> 110 lm/W	> 110 lm/W	N/A	N/A	N/A
Lamp life Note 1	L90-B10 @ 100,000hrs (40oC ambient)		Project Specific	Project Specific	Project Specific
Colour Temperature Note 2	3000K	3000K	Project Specific	Project Specific	Varies
Colour Rendering Index	≥ 70	≥ 70	N/A	N/A	N/A
Driver	DALI-2	DALI-2 / D4i	DALI-2 / D4i	DALI-2 / D4i	Project Specific
Driver Adjustment	350mA, 550mA, 750mA, 1000mA	350mA, 550mA, 750mA, 1000mA	N/A	N/A	N/A
Dimming	DALI	DALI	DALI	DALI	DALI / DMX
Primary Control Socket Note 3	7-Pin NEMA	7-Pin NEMA	7-Pin NEMA	7-Pin NEMA	N/A
Secondary Control Socket Note 3	Not Applicable	Zhaga Book18	Zhaga Book18	Zhaga Book18	N/A
IP Rating (min.)	IP 66	IP 66	IP 66	IP 66	IP 65 IP 67 (in-ground)
IK rating (min.)	IK 08	IK 08	IK 08	IK 08	IK 09 Note 4
Electrical Class	Class I	Class I / Class II	Class I	Class I	Class I
Leakage Current	< 1mA	< 1mA	< 1mA	< 1mA	< 1mA
Total Harmonic Distortion (THD)	<20% at full load				
Power Factor	> 0.9 at full load				
Surge Protection	10kA (integral)				Project Specific
Statutory Compliance	EMC: Compliance in accordance with ACMA requirements Electrical safety: SAA compliance				
Warranty Note 5	≥ 10 years	≥ 10 years	≥ 10 years	≥ 10 years	≥ 5 years
Energex Approval	Required for Rate 2 installations		N/A	N/A	N/A
AEMO Approval	Required for Rate 3 installations		N/A	N/A	N/A
ADSA Approval and Category Note 6	Not Applicable	Preferred ADSA Approved	Required ADSA Prized	Required ADSA Prized Wildlife	N/A

Notes:

1. Lamp life based on a 20-year life expectancy with expected operating profile of 10 hours per night; 365 days per year.

2. 4000K can be considered on a case-by-case basis (subject to approval from Council) where a CPTED or safety risk assessment has been carried out that demonstrates a preference for 4000K colour temperature.

   Colour temperature for wildlife or dark sky designated areas to be in accordance with ADSA recommendations.

   Colour temperature for decorative lighting elements should be coordinated to suit the intended application. The use of coloured light sources is permitted for decorative applications.

3. Refer section 7.9 for requirements associated with control node provisioning.
4. Additional vandal protection mechanisms may be required for decorative lighting elements subject to safety-in-design risk assessment (eg. Wire cages etc).
5. Luminaire warranties must include associated control gear.
6. Alternative luminaire selections not currently on the ADSA approved list will be considered where performance requirements of ADSA certification can be demonstrated as being achieved.

Pre-approved luminaires

For reference and application (as deemed acceptable) a list of luminaires is provided at Appendix B. This list represents luminaires that have been installed within the Sunshine Coast region and have had proven track record of performance and maintenance support. This list is not considered exhaustive but can be used as a guide for luminaire selection.

Alternative selections are allowable providing they meet the minimum technical performance requirements outlined in this ELIM and are agreed with Council during the planning phases of the project.

7.7 LED power supplies and drivers

All LED luminaire types are to be supplied with drivers that are:

- Approved by the luminaire manufacturer.
- Supplied with EMC and SAA compliance certification.
- Come with a warranty equivalent to that of the luminaire the driver supports, or a minimum of five years, whichever is the greater.

Pole top lighting must be supplied with DALI-2 compliant drivers, with the driver wired to the NEMA socket. For pole top luminaires installed with secondary control nodes, drivers must be DALI-2 / D4i compliant.

7.8 Luminaire and accessory mounting

Luminaire mounting and associated power supply, drivers, and other equipment must be designed and supplied to meet Council's requirements listed in Table 8.

Table 8: Luminaire mounting requirements

Requirement	Description
Safe access	Luminaire and accessories mounted to permit safe access for installation, operation, and maintenance. Provision to be made to adequately separate live components from those requiring unrestricted access.
Vandal resistant	Luminaires mounted in such a way to minimise the risk of vandalism or interference from members of the public. This may be achieved through suitable equipment IK ratings, appropriate fixings or additional shielding and protection.
Manufacturer compliance	Luminaires and accessories installed to manufacturer specifications. Ensure mounting system used does not compromise manufacturer warranties.

Requirement	Description
Corrosion resistance	Accessories and fixings are appropriate for use in the local environment. Luminaire fixings are to be 316 grade stainless steel or nominated by the manufacturer for application in the specific area (i.e., coastal environment). Contact between dissimilar metals to comply with the requirements of AS/NZS 1664.
IP integrity	Mounting strategy to maintain the IP integrity of the luminaire and accessory. Where the IP rating of the equipment itself is not suited to the intended mounting location, then a suitably rated IP enclosure with labelling is to be supplied (with appropriate ventilation provisions where applicable).
Aesthetic	Components should be located and mounted in such a way to ensure they are as visually unobtrusive as possible within the surrounding environment.

The practice of locating drivers within cable pits should be avoided. Where unavoidable, drivers must be suitably mounted in an accessible location towards the top of the pit. The driver IP rating is to be compliant with the in-pit location.

For pole mounted luminaires, ensure spigot dimensions are coordinated with the luminaire.

7.9 Lighting Control Principles

Central Management System (CMS)

Council is deploying a Telensa CMS for the purposes of remotely monitoring and controlling the public lighting network across the Sunshine Coast region. Deployment of CMS equipment and LPCs is being undertaken directly by Council and their nominated contractor/s engaged under an existing maintenance contract.

To facilitate transition to the CMS the following requirements represent minimum mandatory "enabling" elements to facilitate Council fit-off and commissioning of LPCs:

- All pole top luminaires must be provided with a capped 7-Pin NEMA receptacle (with ancillary control pins wired to the DALI-2 driver).
- All pole top luminaires must be provided with a DALI-2 compliant driver.

Installation contractors must coordinate with Council for provisioning of LPC's as part of the commissioning and handover process. LPC's will be installed and registered on the Council CMS by a Council appointed maintenance contractor, however, responsibility for commissioning and confirmation of correct lighting operation remains the responsibility of the installation contractor. Make all necessary allowances for coordination with Council and their appointed maintenance contractor for LPC provisioning.

Secondary control and or sensor nodes

In conjunction with Council's evolving Smart City Framework and Implementation Plan, and to fulfill specific operational requirements for certain types of public lighting installations, secondary control/sensor nodes may be required for pole top luminaires. Secondary nodes provide the ability for Council to install devices for dynamic, presence-based control of lighting as well as sensors for environmental monitoring applications.

Secondary nodes are required for pole top luminaires installed in the following applications:

- Designated dark sky areas.
- Designated wildlife sensitive areas.
- Other applications as directed by Council.

Secondary nodes must be Zhaga Book18 compliant and fitted to the underside of the luminaire. Luminaires provided with secondary nodes must have Zhaga-D4i certification.

Installation contractors must coordinate with Council for provisioning of secondary nodes as part of the commissioning and handover process. Secondary nodes will be installed by a Council appointed maintenance contractor, however responsibility for commissioning and confirmation of correct lighting operation remains the responsibility of the installation contractor. Make all necessary allowances for coordination with Council and their appointed maintenance contractor for secondary node provisioning.

Image: Central Management System gateway install, Caloundra

Lighting control selection

Lighting controls for lighting elements must be in accordance with Table 9 and the following general principles:

- Selection to suit the intended lighting application and operation.
- Equipment to be of proven technology suited for installation in the proposed environment.
- Controls to be easy to use, practical, functional, and able to be operated by Council technical staff.

Table 9: Lighting Control Strategy

Control Strategy	Category V Installation	Category P Installation	Dark Sky Area	Wildlife Sensitive Area	Feature/ Decorative Lighting
Light Point Controller (LPC) Note 1	Required	Required	Required	Required	N/A
LPC with Presence Detection Note 2	N/A	Project Specific	Preferred	Preferred	N/A
Centralised PE cell and time clock Note 3	Allowable	Allowable	Allowable	Allowable	Preferred
Local (luminaire) PE cell Note 4	Allowable	Allowable	Not Allowable	Not Allowable	N/A
Programmable Control System Note 5	Not Preferred	Not Preferred	Not Preferred	Not Preferred	Allowable

Notes:

1. Refer Section 7.9.1. LPC provisioning must be coordinated and confirmed with Council prior to design finalisation. Where Council determines LPC provisioning is not required, an alternative allowable control strategy is to be implemented.
2. Refer Section 7.9.2. Presence detector to be fitted to Zhaga Book18 node and configured to operate in conjunction with LPC.
3. Where Council determines that LPC control is not warranted or achievable, centralised PE and timeclock is allowable as described.
4. Local PE cell mounted to the luminaire permitted where LPC control is deemed unachievable and centralised control cannot be provided. For example, Rate 3 installation without a standalone switchboard.
5. Programmable control systems can be implemented on a case-by-case basis where the project brief includes requirements for decorative lighting embellishments utilising colour changing (RGB/W) lighting.

Lighting control for solar lighting installations must be coordinated with the solar lighting provider and Council. Control intent should be to provide dusk-dawn control, with additional functionality to provide scheduled dimming and switching.

Lighting control for vehicle and pedestrian underpasses must be as follows:

- Vehicle underpass: 24-hour metered supply and switched in per the requirements of *AS/NZS 1158.5*.
- Pedestrian underpass: 24-hour metered supply and not switched.

Centralised PE cell and time clock

Photoelectric (PE) and time clock components must be connected in series to prevent lighting from operating during daylight hours. A manual bypass control circuit to bypass the PE and time clock combination and allow system maintenance during the day must be provided. The bypass must be a 3-position (Auto/On/Off) rotary type switch. A PE cell – time clock lighting control schematic is shown for reference in Figure 3.

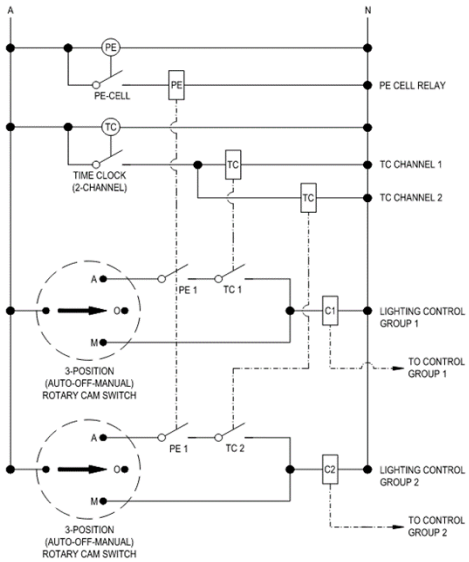


Figure 3: Photoelectric Cell Time Clock Schematic

Control circuits and devices must be located within the supply switchboard. User adjustment and setting controls and operated devices are to be accessible without the need to remove switchboard escutcheons or expose the authorised person to live components. Control wiring, contacts and relays shall be suitably rated for the intended purpose. Where the PE cell is mounted at the switchboard, it must be in a position where it will not be vandalised and affected by ambient light.

Photoelectric cell requirements

Photoelectric (PE) cells for public lighting control must meet the minimum requirements in Table 10.

Table 10: PE Cell Requirements

Requirement	Description
Type	Electronic solid type
Material	UV stabilised polycarbonate
Receptacle Compatibility	Luminaire and pole-mount: NEMA 7-pin – ANSI C136.10 and ANSI C136.41 Switchboard mount: To Suit the mounting location and application
IP rating	≥ IP65.
Operating temperature	– 20 deg C to + 70 deg C.
Sensor	Filtered silicon photodiode.
Failure mode	On.
Load rating	≥ 500W.
Power consumption	≤ 0.25W.
Design life	≥ 15 years.
Warranty	≥ 7 years.

Time clock requirements

Time clocks for public lighting control must meet the minimum requirements in Table 11.

Table 11: Programmable Time Clock Requirements

Requirement	Description
Type	General purpose digital time clock.
Programmable	24 hours per day, 7 days per week.
Mounting	DIN rail mounted in supply switchboard.
Battery backup	≥ 5 years.
Operating voltage	Standard mains supply (per AS/NZS 3000).
Digital display	Time, Day, and Program.
Override	Manual.
Switching current	≥ 5A.
Breaking capacity	AC-1, ≥ 10A.
Operating temperature	– 20 deg C to + 70 deg C.
Channels	2 / 4 channel independently programmable.

Decorative and feature lighting control systems

The use of colour changing lighting elements should generally be avoided where possible to minimise the cost and complexity of control system components. Such control systems can result in higher-than-expected ongoing maintenance and operational costs to Council.

Where briefed by Council, or otherwise required to achieve broader landscape or placemaking outcomes, decorative lighting control systems must be chosen in the following order of preference:

1. Static white luminaires with central PE cell and time clock controls.
2. Static colour luminaires with central PE cell and time clock controls.
3. Static luminaires, white and coloured, with dimming controls.
4. RGB/W colours changing luminaires with programmable scene selection.

Control of static installations must comply with the requirements outlined in the previous sections of the ELIM. Decorative and feature lighting must be controlled separately from functional lighting within the same installation (e.g., pathway lighting). This requirement applies to time clock settings and maintenance bypass facilities.

Decorative or feature lighting installations requiring dimming or RGB/W programmable control systems must comply to the specifications listed in Table 12.

Table 12: Decorative and Feature Lighting Control System Requirements

Requirement	Description
Supplier engagement	Control systems must be provided by a specialist system supplier who can provide the following minimum service level: Scoping and requirements planning with the Designer to ensure the product can meet the desired performance requirements and functionality. Detailed design for all system components, including interfaces and cabling, including supply of shop drawings and schematics. Supply of system components, support and provision of advice to the Contractor through installation. Direct involvement with system programming and commissioning activities. Provision of user training. Provide ongoing technical support to Council beyond the completion of defects liability or warranty periods.
Equipment suitability	All lighting control equipment, including associated cabling, cable joints and network-based elements must be suitably rated for installation within the environment it is installed. Control systems specific for interior use, or for building applications are not permitted.
User interface	User interfaces must be accessible without the need to remove switchboard escutcheons or otherwise expose the user to live components. User interfaces must be able to be operated by a non-technical person to achieve the desired control intent.
System programming and addressing	System programming must be fully resolved prior to handover, with pre-set scenes or shows configured to suit nominated user requirements.
User training	User training must be supplied for all programmable system elements.

8. Poles and pole accessories

8.1 Scope

This section of the ELIM covers aspects associated with the selection, supply and installation of lighting poles and associated components. Poles represent a significant component of ongoing maintenance expenditure to Council and need to be suitably coordinated and provisioned to ensure suitability for their purpose and environment as well as minimising long term maintenance effort.

Image: Rate 3 LED street lighting

8.2 Pole location and alignment

Poles for street and area lighting installations must be located in accordance with the following guidelines:

- Setbacks must comply with clear zone requirements outlined in *AS/NZS 1158.1.2* Clause B6, with the following additional guidance:
  - Minimum setback of 0.7m to the front face of the pole.
  - Where installation geometry prevents compliance with minimum setbacks, a risk assessment must be performed in conjunction with relevant traffic engineering to evaluate potential safety risks associated with the reduction.
- Pole mounting types must be appropriately chosen in conjunction with setback requirements and road typology.
- For local roads with pedestrian pathways on one side, lighting should be installed in a single sided arrangement on the same side as the pedestrian pathway (where installation geometry, inclusive of required setbacks permits this arrangement).
- Street lighting poles must be installed in line with abutting property boundaries or on truncation points at intersections.

- Roundabout lighting poles should be located on the approach side of each intersecting street. Poles mounted centrally within the roundabout are not permitted unless alternative arrangements cannot be achieved.
- Lighting poles must be coordinated with new and existing trees, taking guidance from *AS/NZS 1158.1.2* Clause 8.8 and the following:
  - Locate poles suitably clear of tree plantings wherever possible to avoid shadowing effects or other maintenance implications.
  - For large trees, pole heights should be chosen to ensure luminaires are located ≥ 1m under the lower canopy height.
  - For small trees, pole heights should be chosen to ensure luminaires are located ≥ 2m above the upper canopy height.
  - Utilise extended outreaches where necessary to avoid impacts of vegetation.
  - Where additional guidance is required for clearance from trees, Council's arborist should be contacted for advice.

8.3 Pole selection

Pole selection is dependent on a number of factors including:

- Geographic location and associated Council placemaking considerations.
- The lighting function the installation will perform (e.g., road reserve, pathway, park).
- Additional Council requirements (e.g., smart cities infrastructure provisioning).

Pole type selection should be in accordance with Table 13.

Table 13: Pole Type Selection Guidelines

Pole Type	Roadway Lighting			Open Space Lighting		
	Category V (Major Road)	Category P (Minor Road)	Streetscape or Town Centres Note 2	Pathway	Carpark	Public Activity Area
Mounting height Note 1	9-12m	5-8m	6-8m	4-6m	5-8m	4-8m
Large tapered	Preferred		Allowable			
Small tapered		Preferred	Allowable		Allowable	
Multifunction			Preferred			Allowable
Stepped		Allowable	Allowable	Allowable	Allowable	Allowable
Circular or Pipe			Allowable	Allowable	Allowable	Allowable
Mid-Hinged	Special application only Note 3					

Notes

1. Typical luminaire mounting height, including outreach uplift for stated application. Effective mounting heights should be minimised wherever possible to reduce the likelihood of obtrusive lighting.
2. Streetscapes and town centre works are subject to broader place-making considerations. Pole and equipment types must be coordinated to suit overall place-making objectives whilst maintaining compliance with minimum performance requirements outlined in this manual.

3. Mid-hinged poles should only be used for special applications where access restrictions dictate the use of a hinged pole for safe access to equipment.

Special applications or precincts may dictate the use of specific (or custom) pole types not listed above. For such areas, equipment selections must be coordinated with Council to suit the overall architectural and operational intent for the space. Regardless of adopted pole type, all poles and outreaches must comply with the minimum technical and performance requirements outlined in this manual and referenced standards.

Joint-use lighting and traffic signals poles will typically be either large tapered or multi-function pole types. Requirements for joint use poles are provided in ELIM section 8.11.

8.4 Outreach selection

Outreaches should be chosen to suit both lighting and architectural intent. Figure 4 to Figure 10 provide an overview of typical outreach types to be adopted. Outreaches shown are provided for reference only. Alternative outreaches may be considered to suit specific requirements of an installation, such arrangements must be coordinated with Council.

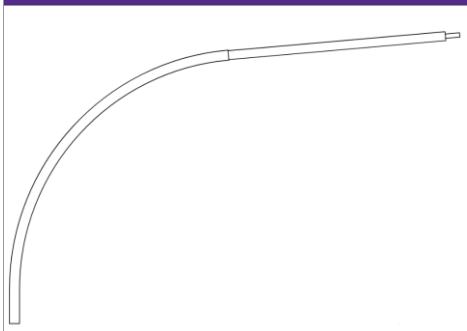
Large Curved	Details	
	Application	Category V roads (major roads) and large carparks.
	Typical length	1.5 - 4.5m
	Typical uplift	2.0m
	Pole type suitability	
	Large tapered	Allowable
	Small tapered	Allowable
	Multifunction	N/A
	Stepped	N/A
	Circular or Pipe	N/A

Figure 4: Outreach Type 1: Large Curved

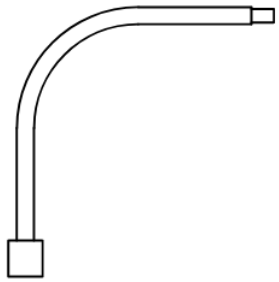
Standard Curved	Details	
	Application	Category P roads (minor roads) and carparks
	Typical length	0.5m
	Typical uplift	0.5m
	Pole type suitability	
	Large tapered	N/A
	Small tapered	Allowable
	Multifunction	N/A
	Stepped	Allowable
	Circular or Pipe	Allowable

Figure 5: Outreach Type 2: Standard Curved

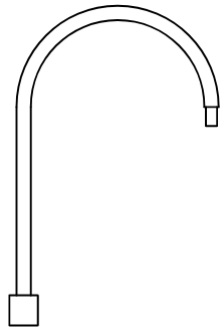
Decorative 1	Details	
	Application	Category P (minor roads), streetscapes, town centres, pathways, public activity areas.
	Typical length	0.5m
	Typical uplift	0.5m
	Pole type suitability	
	Large tapered	N/A
	Small tapered	N/A
	Multifunction	N/A
	Stepped	Allowable
	Circular or Pipe	Allowable

Figure 6: Outreach Type 3: Decorative 1

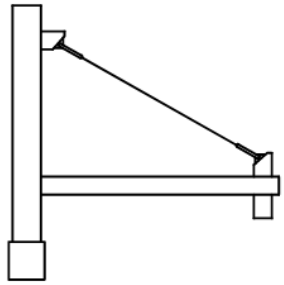
Decorative 2	Details	
	Application	Streetscapes, town centres and public activity areas.
	Typical length	0.5 – 1.5m
	Typical uplift	Nil
	Pole type suitability	
	Large tapered	N/A
	Small tapered	N/A
	Multifunction	N/A
	Stepped	Allowable
	Circular or Pipe	Allowable

Figure 7: Outreach Type 4: Decorative 2

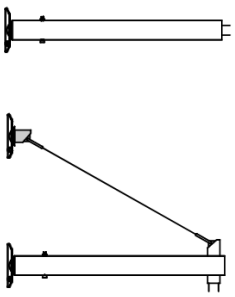
Multifunction Outreach	Details	
	Application	Streetscapes, town centres and public activity areas.
	Typical length	0.5 – 1.5m (wire option)
	Typical uplift	Nil
	Pole type suitability	
	Large tapered	N/A
	Small tapered	N/A
	Multifunction	Allowable
	Stepped	N/A
	Circular or Pipe	N/A

Figure 8: Outreach Type 5: Multifunction Outreach

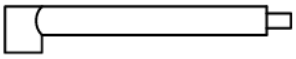
Standard Straight	Details	
	Application	Streetscapes, town centres, pathways, carparks, and public activity areas.
	Typical length	0.5 – 1.5m
	Typical uplift	Nil
	Pole type suitability	
	Large tapered	N/A
	Small tapered	Allowable
	Multifunction	N/A
	Stepped	Allowable
	Circular or Pipe	Allowable

Figure 9: Outreach Type 6: Standard Straight

Direct Pole Top Mount (nil Outreach)	Details	
No reference image	Application	Streetscapes, town centres, pathways, carparks, and public activity areas
	Typical length	Nil
	Typical uplift	Nil
	Pole type suitability	
	Large tapered	N/A
	Small tapered	Allowable
	Multifunction	N/A
	Stepped	Allowable
	Circular or Pipe	Allowable

Figure 10: Outreach Type 7: Direct Pole Top Mount

8.5 Pole and Outreach Material Selection

Pole and outreach material selection will depend on local environmental conditions and will utilise the following material types:

- Hot-dipped galvanised (HDG) steel.
- Aluminium.
- Composite fibre.
- Timber (only permitted for use as property poles for the termination of overhead service connections in accordance with the QECM).

The following environmental zones (Table 14) should be considered when selecting pole material.

Table 14: Pole Material Selection Guide

Location of the pole	Corrosivity Category [Note 1]	HDG steel	Aluminium	Composite Fibre
0 – 50m from shoreline	CX	Note 2	Acceptable	Acceptable
50 – 100m from shoreline	CX	Note 2	Acceptable	Acceptable
100 – 500m from shoreline	C5	Acceptable	Acceptable	Acceptable
500m – 1km from shoreline	C4	Acceptable	Acceptable	Acceptable
0 – 50m from coastal waterway	C4	Acceptable	Acceptable	Acceptable
All other locations	C3	Acceptable	Acceptable	Acceptable

Notes:

1. Corrosivity categories have been derived from *AS 4312* Table 2.1.
2. Where specific design or engineering requirements do not allow the use of an alternative pole type in coastal areas (i.e., the structural loading), the suitability using HDG steel poles will be assessed by Council upon application. The evaluation and outcome will be determined on a case-by-case.

8.6 Pole and Outreach technical specifications

General design criteria

Poles and outreaches must be designed, manufactured, and certified by a pole supplier with demonstrated competency and relevant pole fabrication experience specific to the intended application. Poles must conform to the requirements in Table 15.

Table 15: General pole and outreach design requirements

Criteria	Requirement
Structural compliance	*AS/NZS 1170 (Parts 0, 1 and 2)*, and *AS 1798*
Importance level	*AS/NZS 1170.0* - Level 1 (failure would not typically endanger human life)
Wind region	*AS/NZS 1170.0* - Region B
Terrain category	Must meet project specific requirements for location and assessed in accordance with *AS/NZS 1170.0*
Service life	Not less than 25 years
Deflection	Maximum of five percent of height at serviceability wind speeds, measured at the base of the outreach arm fixing spigot where relevant. Deflection to be calculated to *AS/NZS 1170.2*
Traceability of material	The manufacturer must ensure there is traceability between the material testing certificates and the material used in the product. Evidence of material traceability must be provided upon request by Council or its nominated representative.
Corrosion protection	To minimise corrosion, all poles and outreaches must be suitable for the environment in which they are to be installed in accordance with the principles of *AS 4312* and *AS 2312*.
Certification	Poles must be RPEQ certified by a suitably qualified structural engineer.

HDG steel pole and outreaches

Steel poles and outreaches must conform to the requirements in Table 16.

Table 16: HDG steel pole and outreach technical requirements

Criteria	Requirement
Grade and thickness	TMR *MRTS97* and *AS/NZS 1594*
Fabrication	TMR *MRTS78*, *AS 4100*, and *AS/NZS 5131*
Welding	To *AS/NZS 1554.1*
Tolerances	To *AS 1798*
Galvanising	To *AS/NZS 4680* with galvanised coatings selected to suit the nominated Corrosivity Category defined in *AS 4312* and *AS/NZS 2312.2*.
Finish and coating	Natural: *AS/NZS 4680* | Powder Coat: AS 4506

Aluminium poles and outreach (including aluminium clad)

Aluminium poles and outreaches must conform to the requirements in Table 17.

Table 17: Aluminium pole and outreach technical requirements

Criteria	Requirement
Grade and thickness	Minimum Marine grade wrought alloy 6000 series to AS/NZS 1734 and AS 1874
Fabrication	To TMR MRTS79 and AS/NZS 1664
Welding	To AS/NZS 1665
Tolerances	To AS 1798
Anodising	To AS 1231
Finish and coating	Natural: *AS 1231* | Powder Coat: *AS 3715*

Timber property poles

Timber poles must conform to the requirement in Table 18.

Table 18: Timber pole technical requirements

Criteria	Requirement
Compliance	To *QECM* and *AS/NZS 3000* requirements
Type	Round hardwood with full-length CCA preservative treatment (minimum depth of 20mm) and accordance with *AS 1604.1* and *AS 3818.11*
Height	To suit required clearances for overhead service connection (within *QECM* limits)
Design load	5kN (minimum)
Mounting	Buried in ground
Accessories	Metal cap on top to prevent water accumulation. Mains connection box to *QECM* requirements.
Other	Incoming Consumers mains cabling to be installed in rigid, UV stabilised conduit (fixed with 316ss saddles) and provided with additional mechanical protection via galvanised steel (or 3mm aluminium) hat section installed from finished ground level to a height of 1.5m (or to the bottom of a pole mounted main switchboard / metering cubicle – whichever is the lower).

Composite fibre poles

Composite fibre poles are emerging as a viable option for areas subject to highly corrosive environments. There are currently no Australian standards for the manufacture and installation of such equipment. Composite fibre pole products were developed through manufacturer's research and development activities and third-party research and testing. Composite fibre poles shall conform to the design requirement in Table 19.

Image: Solar light with composite pole

Table 19: Composite fibre pole technical requirements

Criteria	Description
Structural Properties	Meets general design criteria in section 8.5.1.
Proven Technology	Sourced from a manufacturer with demonstrated experience and capability in fibre composite technologies. Composite fibre equipment to have been installed elsewhere in similar environmental conditions.
Pole attachment and fixings	Where equipment such as Wi-Fi points or CCTV cameras are to be installed, the manufacturer is to advise the pull through strength of the fixing, and the need of any internal supports. If this information is not provided or made available, the use of an alternative pole type is to be considered.

Mid-hinged poles

Mid-hinged poles should only be considered where standard access to pole mounted equipment is deemed to be unsafe due to the proximity of obstructions or hazards, or where equipment is likely to require regular access for operation or maintenance.

Where the use of mid-hinged poles is considered warranted, poles should be provided to manufacturer standard requirements, complete with all required accessories such as counterweights, locking devices, rope cleats and the like.

Ensure the location and orientation of the pole is coordinated with local obstructions to enable full range of swing and safe access to the intended at-ground servicing location (including consideration of clearances from overhead electrical lines where relevant).

8.7 Access hatches and internal equipment

Access hatch guidelines

Access hatches must be provided for all pole types to allow for the installation and mounting of in-pole equipment, such as:

- Electrical terminations, isolators, and protection devices.
- Telecommunications equipment such as AC-DC power supply units, fibre optic patch panels, industrial fibre-ethernet switches.
- Event power outlet provisions.

Electrical hatches are mandatory for all poles. Telecommunications and event power hatches will be agreed with Council to fulfil smart cities or event requirements on a case-by-case basis. The installation of telecommunication and event power provisioning is typically limited to town centres and other public activity areas with high service demand and regular events.

Pole access hatches must be appropriately sized for the intended equipment mounting and meet the requirements outlined in Table 20.

Table 20: Pole hatch minimum dimensions

Pole Type	Pole Hatch Dimensions - (H) x (W) mm		
	Electrical	Telecommunication	Event outlet [Note 1]
Large tapered	400 x 110	700 x 110 [Note 2]	N/A
Small tapered	250 x 70	N/A	N/A
Multifunction	500 x 110	700 x 110	250 x 110
Stepped	400 x 90	400 x 90	N/A
Circular or Pipe	250 x 70	N/A	N/A
Mid-hinged	400 x 90	N/A	N/A

Notes:

1. Where required, event outlets can be located within a dedicated hatch section or a dedicated "lockbox" semi-recessed into the pole structure.
2. Telecommunications hatches for large, tapered poles are limited to joint-use traffic signal poles only.

Pole access hatches dedicated to specific equipment types must be independently accessible to ensure the following:

- Unqualified or unauthorised personnel are not exposed to live electrical components.
- Controlled access is maintained.

Electrical and telecommunication access hatches must be accessible via the use of tamper proof fixings. Event power hatches and enclosures must be accessible via a lockable, hinged access door keyed to Council's requirements.

Pole hatches must be located and oriented to ensure safe access is maintained and maintenance activities can be undertaken without encroaching onto vehicle carriageways. Table 21 summarises requirements for access hatch location.

Table 21: Pole hatch location requirements

Pole Location	Location of Pole Hatch
Road – verge	Hatch located on rear of pole on the verge or pathway side.
Road – median	Hatch located on side of pole to allow access longitudinally with median.
Road or pathway (Bridge balustrade)	Hatch located on forward facing side, coordinated to ensure balustrade does not impede access. Provide an internally mounted stainless-steel plastic-coated wire between the terminal panel strap and the access hatch cover to prevent the cover from inadvertently falling onto the carriageway.
Pathway	Hatch located on pathway side of pole.

8.8 Equipment mounting and internal wiring

In-pole IP enclosures

Where the following conditions exist, in-pole equipment should be installed in an IP rated enclosure to provide additional protection against inadvertent contact with live parts and additional protection against environmental impacts:

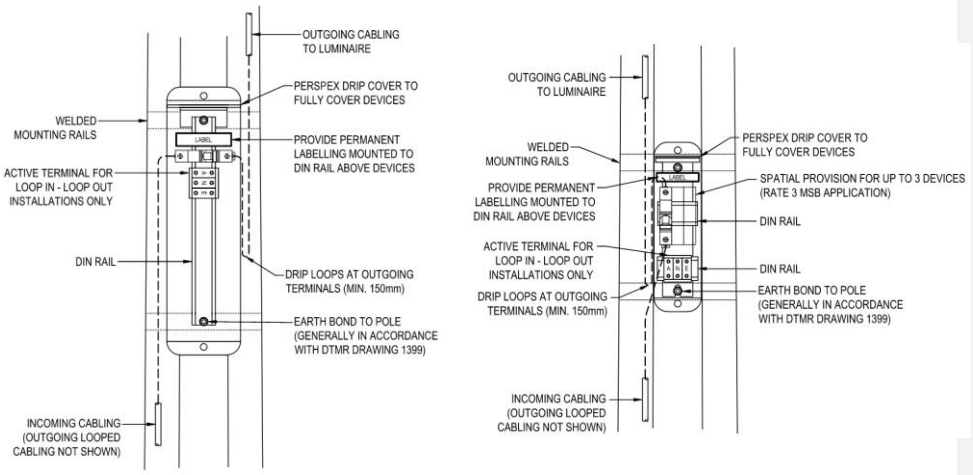
- Where electrical terminations are accessible by parties other than a licenced electrical contractor. This should only apply to custom pole installations where communications and electrical access hatches cannot be suitably separated.
- For pole types that do not provide adequate internal protection against the effects of moisture. Previous experience suggests that multi-function pole types typically fall into this category. These pole types also have additional internal clear space to install a suitably rated IP enclosure for housing electrical terminations and circuit protection devices.

Where utilised, IP rated enclosures should be sized to suit required internal protection devices and equipment and incoming and outgoing cabling.

Terminal panels

Internal equipment must be securely mounted within the access hatch. The mounting location and orientation must consider cable terminations, minimum cable bend radius to achieve manufacturer recommendations, and drip loop requirements.

As a minimum requirement, electrical equipment must be mounted on an in-pole gear tray or terminal panel with drip shield to fully cover installed devices in accordance with Figure 11. The installation is to adopt TMR or EQL standard terminal panels where possible.



Terminal Panel Type 1

Terminal Panel Type 2

Figure 11: In pole Terminal Panel General Arrangement

Internal wiring

Internal wiring must comply with the following requirements:

- Cabling must be double insulated, with insulation maintained through to the termination point. Additional heat shrinks (coloured to suit phase designation) should be provided as required to ensure conductors are not exposed.
- Drip loops must be provided for rising cabling that extend a minimum of 150mm below the corresponding terminal. Drip loops must not be located directly above other equipment or terminals.
- Allow adequate cable length to facilitate the withdrawing of cabling and devices from the pole.
- Ensure in-pole electrical cabling is suitably segregated from other cabling system classes in accordance with *AS/NZS 3000* and *AS/CA S009*.
- An equipotential bond of not less than 4 mm2 cross-sectional area should be provided to conductive poles.

8.9 Pole attachments and accessory mounting

Pole selection, design and fabrication must take into consideration all required attachments and accessories that may be required. Devices and equipment attached to the pole may include banners, Wireless Access Points (WAP), CCTV cameras or other items as nominated by Council.

Equipment being proposed for attachment to a Council pole must consider the following:

- Structural loading and capacity implications. Advice from the pole provider should be sought for mounting of non-standard accessories.
- Safe access to allow mounted equipment to be operated and maintained. Preference should be given to accessibility without the use of elevated work platforms.
- All fixings and mounting accessories must be coordinated with the pole material to ensure corrosion protection is not compromised.
- Attachment finishes must be coordinated with pole finish to maintain consistency.

- Minimum clearances must be maintained above vehicle and pedestrian access routes to ensure attachments do not impede movement or create a safety risk.
- Where mounted equipment includes cabled connections from within the pole, the attachment must provide for concealed cable entry. Surface mounted cabling and ducting are not permitted.

The connection of equipment to Rate 3 poles is generally not permitted without prior approval from Council. Where applicable, relevant details must be provided to Council for review, including size, type of equipment, assessment demonstrating the attachment meets Council's general requirements, and any other information to help support the assessment.

8.10 Pole footings and mounting

Pole mounting selection

Pole mounting must be selected to suit the installed location and pole type. Selection of suitable mounting arrangement must take into consideration safety considerations, maintainability, and aesthetics. Guidance for mounting types is provided in Table 22.

Table 22: Pole mounting selection guidelines

Mounting Type	Roadway Lighting			Open Space Lighting		
	Category V (Major Road)	Category P (Minor Road)	Streetscape or Town Centres	Pathway	Car park	Public Activity Area
Base plate	Allowable	Preferred	Allowable	Allowable	Allowable	Allowable
Slip-base	Preferred	N/A	N/A	N/A	N/A	N/A
Sub-surface base plate	N/A	N/A	N/A	N/A	N/A	Allowable
Direct buried	N/A	N/A	Allowable	Allowable	Allowable	Allowable

Notes

- Slip base mounting must be in accordance with AS/NZS 1158.1.2 Appendix B. Where the lighting installations adjoin an area that is anticipated to include high pedestrian traffic movements (e.g., major pedestrian pathways, slip-based mounting should not be used).
- Sub-surface base plate mount is typically only available for multifunction pole types. Where required to achieve landscape or architectural objectives, these mounting types must be provisioned to pole manufacturer requirements.
- Directly buried poles are only permitted for composite fibre pole types where the nature of the installed environment would represent a high corrosion risk to exposed metal components (such as a metallic base plate).

General Footing Requirements

Pole footings must suit local environmental conditions, structural design criteria outlined within the ELIM, and the following general requirements in Table 23.

Table 23: Pole General Footing Requirements

Criteria	Description
Compliance	To AS 3600 and AS 2159
Design conditions	To suit localised ground conditions. Undertake all required geotechnical investigations. Where manufacturer standard footings are used, ensure ground conditions conform to manufacturer design criteria.
Certification	Where the footing differs from manufacturer standard footing, custom footing design certified by a suitably qualified (RPEQ) structural engineer must be provided. For manufacturer standard footings, manufacturer structural certification is to be made available upon request.
Foundation cages and accessories	All required installation and mounting accessories as governed by nominated standards or pole manufacturer requirements must be provided. Rag bolt protrusions must not extend more than 20mm above retaining nuts.
Base plate mounted poles	Crossfall ≤ 1:2: TMR *Standard Drawing 1392*; or *EQL UDCM* Vol. 1 Folder 2 Page 840. Crossfall > 1:2: TMR *Standard Drawing 1393* Manufacturer installation details are permitted provided they are of an equivalent performance standard.
Slip based mounted poles	No Crossfall: TMR *Standard Drawing 1380*, or *QLD Public Lighting Construction Manual* Volume 1 Folder 5 Pages 9-4 and 9-5. Crossfall ≤ 1:6: TMR *Standard Drawing 1381*, or *QLD Public Lighting Construction Manual* Volume 1 Folder 5 Pages 9-6 and 9-7. Crossfall 1:6 ≥ 1:3: TMR *Standard Drawing 1382* and *1429*, or *QLD Public Lighting Construction Manual* Volume 1 Folder 5 Pages 9-8 and 9-9 (or 9-11 and 9-12).
Sub surface base plate	Installed to manufacturer standard requirements. Ensure all metallic sub-surface elements are coated with a suitable two-pack epoxy finish equal to Dulux Durebild STE or equivalent.
Direct buried (composite pole type)	Installed to manufacturer standard requirements.
Coastal Locations	Provide marine-grade coating/protection to rag-bolt assemblies in areas within 1km of the shoreline that are subject to coastal influence.

8.11 Combined road lighting and traffic signal poles

At signalised intersections, joint use poles (JUP) and combination mast arms (CMA) should be used to minimise road furniture as much as possible. JUP and CMAs must be installed in accordance with TMR standard drawings and specifications. Where JUP and CMAs are proposed for a multi-function pole installation, the principles of TMR standards must be applied, with additional guidance and coordination undertaken with the pole provider to ensure dual-use provisions can be accommodated. Servicing and reticulation to JUP and CMAs must consider the following principles:

- Road lighting electrical supplies must not be connected to traffic signal installations.
- Traffic signal electrical supplies must not be connected to road lighting installations.
- Road lighting and traffic signal installations must have separate consumer mains.
- Earthing arrangements should be coordinated to suit final locations of the road lighting switchboard in relation to the traffic signal controller.

8.12 Catenary lighting pole and footing requirements

Catenary lighting must not be installed without prior approval by Council.

Due to the unique structural characteristics of a catenary installation, poles, footings, and associated accessories for catenary lighting applications must be designed, supplied, and installed by specialist Contractor experienced in tensile cable installations.

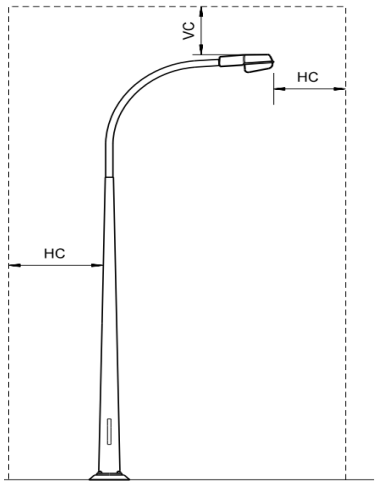
The general principles of structural compliance, materiality, fabrication, and corrosion protection outlined within the ELIM and referenced standards must be applied as minimum performance requirements for a catenary installation. In addition, the following Council requirements apply for the consideration of catenary lighting:

- Maximum catenary loading associated with proposed lighting and other suspended elements, including consideration of potential future requirements.
- Structural loading associated with tensile cabling and associated impact on pole and footing construction.
- Clearances from lowest catenary sag point to the finished ground level below.
- Safe access provisions to poles, in-pole equipment, and catenary mounted equipment.
- Additional routine and preventative maintenance requirements to be performed throughout the installation's life. These activities may include inspection for critical connections or assessment for the need to re-tension the catenary wire.

8.13 Pole clearances from overhead electrical services

Pole locations must be coordinated to maintain clearances from overhead electrical infrastructure in accordance with the *QLD Public Lighting Construction Manual* | Construction Practices | Clearance Between Lighting Structure & Overhead Line (Vol. 1; Folder 3; Page 14-1) – as referenced in Figure 12.

Clearances must factor in the location of relevant outreaches and equipment and be calculated for maximum and minimum conductor temperature, sag and blow out conditions.

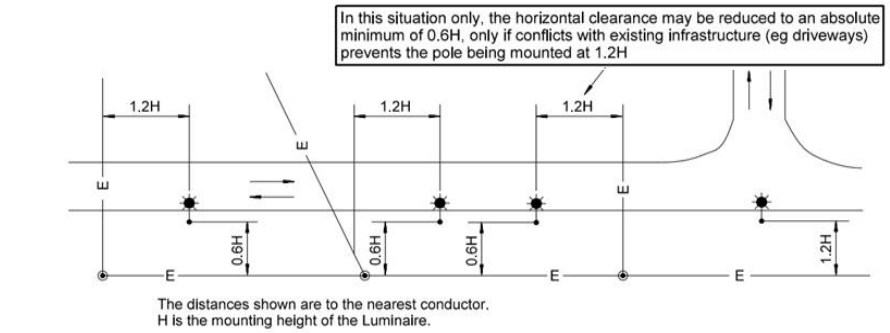


CLEARANCE FROM:	MINIMUM DISTANCE	
	VERTICAL "VC"	HORIZONTAL "HC"
COMMS CABLE	0.05m	0.05m
LV SERVICE[2]	1.2m	1.2m
INSULATED LV or SCREENED HVABC	0.9m[4]	0.3m
LV UNINSULATED (BARE LV < 1000V)	3.0m[4]	1.5m
BARE >1000V ≤ 33kV, or CCT	3.3m[4]	1.5m
BARE >33kV ≤ 66kV	3.3m[4]	3.0m
BARE >66kV ≤ 132kV	4.9m[4]	4.6m
BARE >132kV ≤ 330kV	5.8m[4]	5.5m

NOTES:
1. Clearances shall be maintained under the following conditions:-
   a) maximum and minimum conductor temperature.
   b) blow out conditions.
2. Clearance for LV service not attached to the street light.
3. Either the vertical clearance or the horizontal clearance must be maintained.
4. Vertical clearance is for new constructions & includes additional 0.3m margin. For minimum statutory requirements reduce by 0.3m.

Figure 12: Minimum separation of lighting structure and overhead line

Where slip-based poles are installed, dynamic clearances from overhead lines must comply with the requirements of the *QLD Public Lighting Construction Manual* | Construction Practices | Dynamic Clearance of Slip Base Pole from an Overhead Line (Vol. 1; Folder 3; Page 14-2/3) – as referenced in Figure 13.



NOTES:
1. The greater of the dynamic or horizontal statuory electrical clearance shall apply. Refer dwg 1-3-14-1.

The recommended minimum horizontal clearance of a slip base pole from an overhead line is 0.6H, where H is the mounting height of the luminaire. If the overhead line transverses the direction of traffic flow the clearance for slip base pole should be increased to 1.2H. This situation occurs at an intersection or when an overhead line crosses the carriageway.

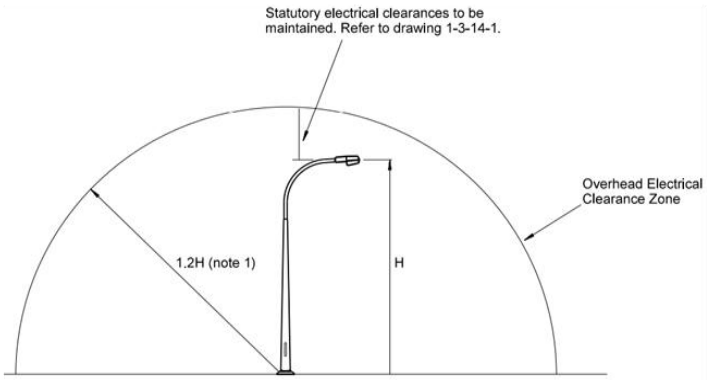


Figure 13: Dynamic clearance for slip base poles from overhead conductors

Where installations dictate assessment of clearances in accordance with the above requirements, assessment results and certification of clearance requirements must be included as part of design certification. If, during construction, a pole location requires adjustment from the certified design, clearances must be re-verified with re-certification included as part of the as-constructed documentation.

8.14 Pole labelling requirements

General pole labelling requirements

Provide labelling to all internal components including:

- Circuit reference, including supply switchboard.
- Supply function for multi-service poles (e.g., lighting, Smart Cities or event power).
- Multiple sources of supply labelling (where applicable).
- MEN and main earth labelling per *AS/NZS 3000*.

Rate 3 pole labelling requirements

In accordance with *EQL Standard Conditions for Public Lighting Services*, all Rate 3 lighting must be provided with labelling indicating the unmetered Rate 3 connection arrangement, together with unique pole identification number (as allocated by EQL as part of the Rate 3 design development and approval process).

Table 24 summarises the labelling requirements for Rate 3 poles.

Table 24: Labelling requirements for Rate 3 lighting poles

Function	Text	Size	Colour		Location
			Text	Background	
Rate 3 ID	"SCC3"	60mm	White	Green	Above pole ID.
Pole ID	"W....." Note 1	50mm	Black	White	2,700mm from base of pole.
MSB ID Note 2	"MSB"	35mm	Black	White	Below pole ID.

Notes:

1. Pole ID allocated through the Rate 3 design and approval process.
2. "MSB" label is only required where Rate 3 pole is configured as a main switchboard.

9. Switchboards, cabinets, and enclosures

9.1 Scope

This section of the ELIM provides guidance for the selection and provisioning of switchboards for public lighting and electrical applications. Consistency of switchboard provisioning will ensure switchboards are suitable for their intended operational function as well as helping Council meets its ongoing maintenance obligations.

Image: Switchboard examples

9.2 Switchboard general arrangement

Selection Criteria

Switchboard selection depends on several factors and considerations, including:

- Connection tariff type (unmetered or metered).
- Geographic location, including Placemaking considerations.
- Associated requirements such as events and smart cities infrastructure provisioning.

To suit the intended application, switchboards must be chosen in conjunction with the following subsections. These subsections provide an overview of the general arrangement and equipment provisioning but must be read in conjunction with broader ELIM requirements and standard drawings.

All general arrangements shown are representative only and subject to development and review of switchboard shop drawings.

Unmetered switchboard selection guide

Small Rate 3 lighting installations of up to four poles on a single circuit, can be supplied directly from the EQL network to a Rate 3 lighting pole and do not require provision of a standalone switchboard. In these small installations, the first pole is the Main Switchboard (MSB) in accordance with *AS/NZS 3000* and must be provided with the following:

- Main earth, M.E.N connection and labelling.

- Appropriately rated main switch.
- Labelling to indicate MSB designation and earthing elements to *AS/NZS 3000*.

In-pole equipment is as described in Section 8 of the ELIM. For larger installations where multiple circuits or circuits of more than four poles are required, the following switchboards (Figure 14 and Figure 15) must be utilised for unmetered (Rate 3) lighting applications.

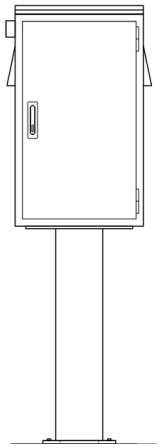
Post Top Mount (Unmetered)	**Details**		
	Application	Rate 3 lighting installations	
	Nominal size:	H	(W)	D
		1,000mm	600mm	300mm
	Provisioning		
	Mounting	Pole top	
	Metering	Not applicable	
	Distribution	18 Pole Din rail mount	
	Other	Generally in accordance with *TMR Standard Drawings 1623*, *1627* and *1628*.	
	Event Power	32A 3Φ	15A 1Φ	10A 1Φ
		-	-	-

Figure 14: Unmetered 1Φ and 3Φ Post Top Switchboard

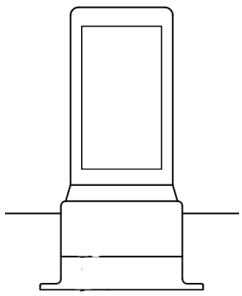
Pillar Mount (Unmetered)	**Details**		
	Application	Rate 3 lighting installations [Note 1]	
	Nominal size:	H	(W)	D
		760mm	450mm	330mm
	Provisioning		
	Mounting	Ground mount	
	Metering	Not applicable	
	Distribution	12 Pole Din rail mount	
	Other	Generally in accordance with *TMR Standard Drawing 1430*.	
	Event Power	32A 3Φ	15A 1Φ	10A 1Φ
		-	-	-

Figure 15: Unmetered 1Φ Pillar Mount Switchboard

Note 1: Pillar mount switchboards are not a preferred installation type. Pillar switchboards should only be utilised where broader installation factors prevent the use of a post-top mount switchboard (e.g. Aesthetic considerations where a post-top switchboard would impact on landscape intent).

Metered switchboard selection guide

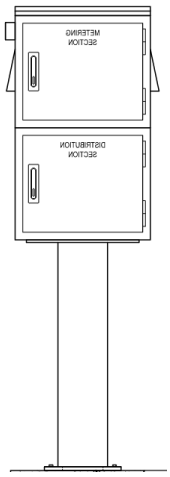
Post Top Mount (Metered)	Details		
	Application	Small, metered lighting installations in road reserve or where flooding may be an issue in a parks and gardens location.	
	Nominal size:	H	(W)	D
		1,000mm	600mm	300mm
	Provisioning			
	Mounting	Pole top		
	Metering	Whole Current to QECM/QEMM		
	Distribution	18 Pole Din rail mount		
	Other	Not applicable		
	Event Power	32A 3Φ	15A 1Φ	10A 1Φ
		-	-	-

Figure 16: Metered 1Φ Post Top Switchboard

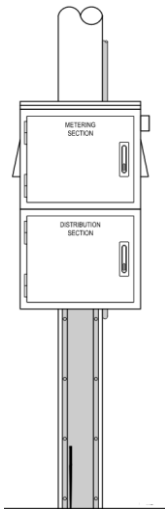
Property Pole Mount (Metered)	Details		
	Application	Small, metered installations in park or garden application where timber property pole is provided for overhead service termination.	
	Nominal size:	H	(W)	D
		700mm	600mm	300mm
	Provisioning			
	Mounting	Pole mounted		
	Metering	Whole Current to QECM/QEMM		
	Distribution	18 Pole Din rail mount		
	Other	Not applicable		
	Event Power	32A 3Φ	15A 1Φ	10A 1Φ
		-	-	-

Figure 17: Metered 1Φ Pole Mounted Switchboard

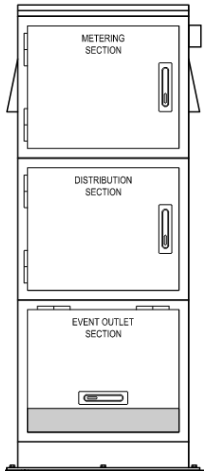
1Φ Main Switchboard (Standard)	Details		
	Application	Small, metered installations (typically in parks/gardens location) with event power requirements.	
	Nominal size:	H	(W)	D
		1,500mm	600mm	350mm
	Provisioning			
	Mounting	Plinth		
	Metering	Whole Current to QECM/QEMM		
	Distribution	24 Pole Din rail mount		
	Other	Not applicable		
	Event Power	32A 3Φ	15A 1Φ	10A 1Φ
		-	2	2

Figure 18: Metered 1Φ Main Switchboard (Standard)

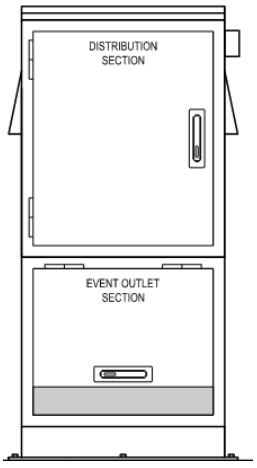
1Φ Distribution Switchboard	Details		
	Application	Distribution switchboard with additional event outlet provisioning for minor event usage.	
	Nominal size:	H	(W)	D
		1,200mm	600mm	350mm
	Provisioning			
	Mounting	Plinth		
	Metering	Not required		
	Distribution	24 Pole Din rail mount		
	Other	Not applicable		
	Event Power	32A 3Φ	15A 1Φ	10A 1Φ
		-	2	2

Figure 19: 1Φ Distribution Switchboard

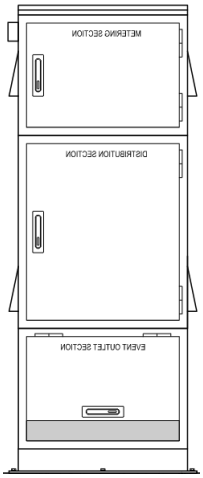
3Φ Main Switchboard (Standard)	Details		
	Application	Metered installations with anticipated maximum demand <80A/phase.	
	Nominal size:	H	(W)	D
		1,800mm	700mm	400mm
	Provisioning			
	Mounting	Plinth		
	Metering	Whole Current metering to QECM/QEMM		
	Distribution	36 Pole MCB Chassis		
	Other	Not applicable		
	Event Power	32A 3Φ	15A 1Φ	10A 1Φ
		1	2	2

Figure 20: Metered 3Φ Main Switchboard (Standard)

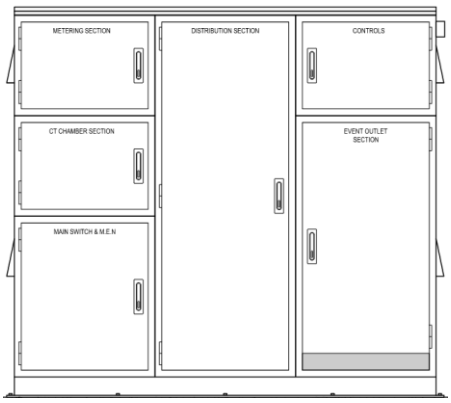
3Φ Main Switchboard - Large Installations	Details			
	Application	Metered installations with anticipated maximum demand >80A/phase.		
	Nominal size:	H	(W)	D
		1,800mm	2,100mm	400mm
	Provisioning			
	Mounting	Plinth		
	Metering	CT metering to QECM/QEMM		
	Distribution	48 - 60 Pole MCB Chassis		
	Other	Not applicable		
	Event Power	32A 3Φ	15A 1Φ	10A 1Φ
		2	4	4

Figure 21: Metered 3Φ Main Switchboard (Large Installations)

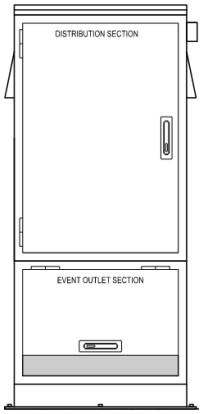
3Φ Distribution Switchboard	Details		
	Application	Metered installations with anticipated maximum demand >80A/phase.	
	Nominal size:	H	(W)	D
		1,500mm	700mm	400mm
	Provisioning			
	Mounting	Plinth		
	Metering	Not Required		
	Distribution	24 Pole MCB Chassis		
	Other	Not applicable		
	Event Power	32A 3Φ	15A 1Φ	10A 1Φ
		1	2	2

Figure 22: Metered 3Φ Distribution Switchboard

9.3 Smart cities equipment cabinet

Where a requirement for the inclusion of smart cities equipment provisions has been briefed or confirmed by Council, a separate compartment must be included as part of the switchboard design. Smart cities equipment cabinets are not relevant for Rate 3 unmetered installations.

Smart cities equipment cabinets (and associated cabling zones) must be fully segregated from adjacent electrical distribution sections to enable access to communications equipment and cabling by non-licenced operators. The smart cities cabinet section is to be incorporated onto the side of the standard switchboard types described in Section 9.2 as part of the custom switchboard design and manufacture process.

Table 25 summarises Council's requirements for smart cities compartments.

Table 25: Smart City cabinet requirements

Item	Characteristic
Size	400mm (W) x 750mm (H) x 400mm (D).
Telecommunications equipment mounting	19 inches telecommunications rack mounting rails (8 RU) to allow vertical mounting of rack mountable equipment.
Power supply	2 x 1Φ 10A switched socket outlets (SSO).
Ventilation	Thermostatically controlled ventilation fans with weather fins and filters.
Access	Front and rear access doors.
Cable zone	The compartment directly beneath the smart cities' equipment zone must be dedicated to the reticulation of telecommunications cabling. No electrical cabling shall be installed or run through this zone. The extension is fully segregated by fixed internal partitions.
Escutcheons	Not applicable.

Due to increased depth requirements for smart cities equipment, the overall switchboard cabinet depth can be increased accordingly. General arrangement details for the smart cities' cabinet are shown in Figure 23. Note that this general arrangement is representative only and subject to development and review of switchboard shop drawings.

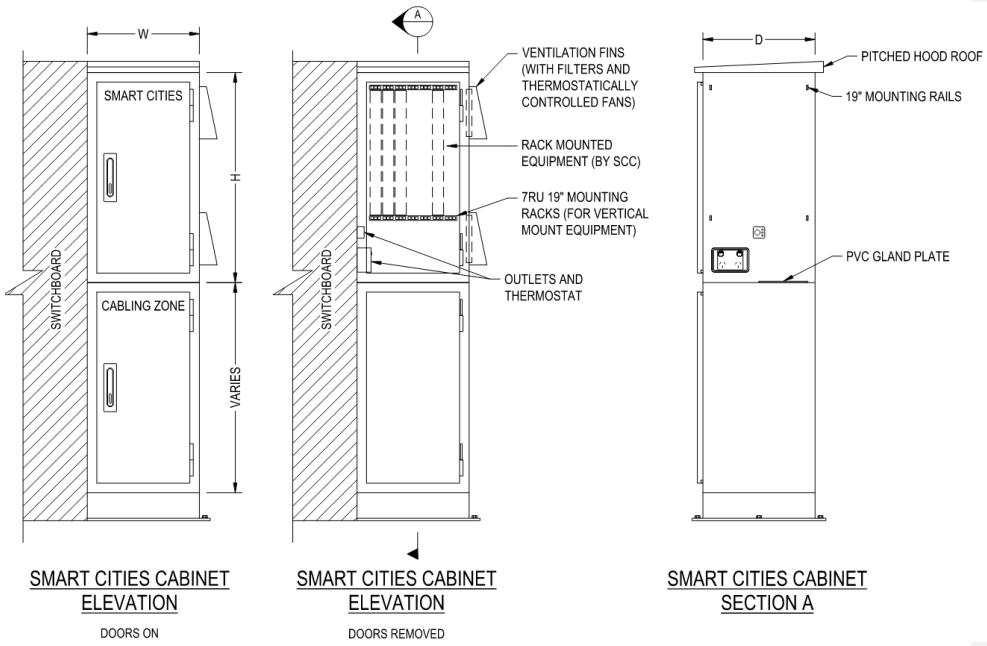


Figure 23: Smart cities telecommunications cabinet details

9.4 Switchboard construction

General

Switchboards must be provided by a specialist switchboard manufacturer with proven experience in the design and fabrication of switchboards for the required application. Switchboards must be fully compliant with *AS/NZS 3000*, *AS/NZS 61439* (design verified assembly) and the *QECM/QEMM*.

Shop drawings are required for all switchboard types for review by Council or their nominated third party prior to fabrication.

Evidence of *AS/NZS 61439* design verification must be provided by the switchboard manufacturer as part of the switchboard shop drawing review process. In conjunction with the general requirements nominated below, a complete "User Requirements" table from *AS/NZS 61439.1* has been provided for reference at Appendix C.

Commented [A1]: remove

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Switchboard cabinets

Switchboard cabinets must comply with the general requirements in Table 26. These requirements do not apply to pillar-style switchboards for limited Rate 3 applications.

Table 26: Switchboard cabinet requirements

Item	Requirement
Cabinet material	Fabricate from sheet metal of rigid folded and welded construction. Marine grade aluminium, or 316 grade stainless steel suitable for an external environment within coastal zone.
Material thickness	2.0mm (minimum)
Cabinet finish	Rate 3 pole top switchboard: Natural stainless All other switchboards: Exterior: Powder-coat Dulux Woodland Grey Interior: Powder-coat Gloss White Thermoset powder coating to *AS 4506* or two-pack liquid coating of *AS/NZS 3750.13* primer and proprietary or epoxy acrylic full gloss spray finish.
Equipment connection	Front connected
Cable entry	Bottom entry
IP rating	IP56
Form of separation	Form 2 (minimum) to *AS/NZS 61439.2*. Higher forms of separation may be requested through a design process.
Spare take off capacity	25% (minimum)
Busbars / Chassis Applies to 3Φ switchboards with >18 pole capacity	General: Incorporate proprietary insulated busbar or chassis systems for the interconnection of isolators, circuit breakers and other circuit protective devices. Fault rating: To meet the calculated fault current, whichever is the greater for 1 second, or minimum rating ≥ 18kA per second.
Equipment layout	Position equipment to provide safe and easy access for operation and maintenance. Group devices by function. Allow space for cable entry and termination.
Temperature	Suitable for 50°C ambient
Ventilation	Required to maintain design operating temperatures. Telecommunications sections: Provide thermostatically controlled fans. Other sections: Passive ventilation.
Arc fault containment	Provide ventilation ducts and covers to allow the escape of hot gases generated under fault conditions.
Inspect proofing	Ventilation openings must be covered with non-combustible and corrosion resistant 1mm x 1mm mesh.
Earth continuity	Effectively bond all exposed conductive parts to ensure earth continuity to the protective earthing system. Where surface finishes impede earth continuity, strip painted surfaces and provide bolted/lugged connection. Re-coat lugged connection with corrosion resistant material. Examples include hinged doors, escutcheons, and conductive plinths.
Mounting plinth	Provide channel plinth with toe-out profile, nominal 75 mm high x 40 mm wide x 6 mm thick, for mounting complete assemblies on site. Drill M12 clearance holes in assembly and channel and bolt assemblies to channel. Material: Aluminium (selected to minimise galvanic corrosion with cabinet). Provide equipotential bond to mounting plinth.

Item	Requirement
Cable entries	Provide cable entry facilities within assembly cable zones for incoming and outgoing power and control cabling. Provide sufficient clear space within each enclosure next to cable entries to allow incoming and outgoing cables and wiring to be neatly run and terminated, without unnecessary bunching or sharp bends.
Cover and gland plates	Cover plates: Provide 150mm maximum width cover plates butted together and covering the continuous cable entry slot. Gland plates: Provide removable gland plates fitted with gaskets to maintain the degree of protection.

Switchboard doors, hardware, and escutcheons

Switchboard doors and hardware elements must comply with the following Council requirements in Table 27.

Table 27: Switchboard doors and hardware requirements

Item	Requirement
Door layout	Maximum width = 800mm. Minimum swing = at least 120°. Door stays are required.
Door construction	Provide single right-angle return on all sides and fit resilient neoprene seal to provide the degree of protection and prevent damage to surface finish.
Hinges	Provide corrosion resistant 316 grade stainless steel pintle hinges or integrally constructed hinges to support doors. For removable doors, stagger pin lengths to achieve progressive engagement as doors are fitted.
Door hardware	Provide corrosion resistant 316 grade stainless steel pad-lockable swing-type handles, operating a latching system with latching bar and guides strong enough to withstand explosive force resulting from fault conditions within the assembly.
Locking	Handles to be pad-lockable
Door mounted equipment	Protect or shroud door mounted equipment and terminals to prevent inadvertent contact with live terminals, wiring, or both.
Escutcheon plates	Provide removable hinged lift-off type escutcheon plates with neat circuit breaker toggle cut-outs allowing interchange ability of one, two and three pole circuit breakers. Provide corrosion resistant 316 grade stainless steel lifting handles and knurled knobs. Provide circuit breaker blanks or blanking in-fill pole covers for unused circuit breaker toggle cut-outs.
Earthing	Provide equipotential bonding connection to hinged doors and escutcheons with multi-stranded, flexible earth wire (minimum 4mm2), or braid of equal cross-sectional area.

Location and mounting guidelines for switchboards

Switchboards are to be located and installed to achieve the following general principles:

- Compliance with *AS/NZS 3000*, the *QECM* and *QEMM*,

- Provided with sufficient clearances to allow for safe, unimpeded access for authorised personnel. Minimum clearances must comply with *AS/NZS 3000* and consider adjacent environmental factors such as ground levels.
- Protected against unauthorised access.
- Protected against the risk of impact from vehicles.
- Located clear of major pedestrian thoroughfares to minimise the impact on pedestrian and cyclist movements.
- Protected against hazardous environmental conditions (e.g., direct salt spray, tidal influences, extreme temperatures, and hazardous services).

Switchboards, including pillar mount type, must be installed on a concrete pad incorporating a dedicated earth pit to house the earth stake and main earthing connection. Refer to Figure 24, showing the general requirements. Concrete pad dimensions are to suit the size and type of switchboard.

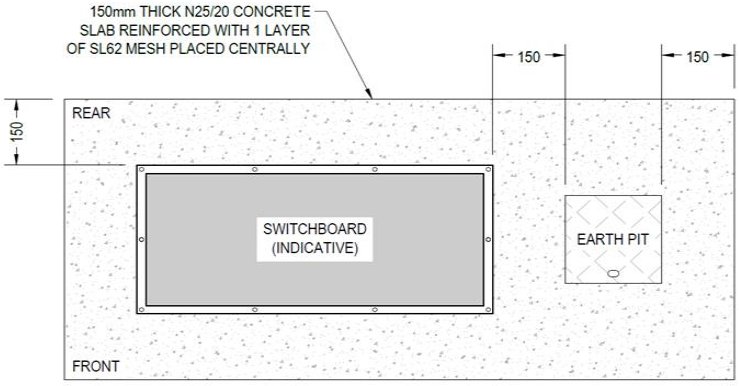


Figure 24: General Switchboard Mounting Intent

Switchboards located in road reserve must meet the following requirements:

- Located adjacent to the property boundary, with door facing towards the roadway.
- Located in the appropriate service alignment.

Located outside of defined clear zones per *AS/NZS 1158.1.2*. Where this is not possible due to the geometry of the installation, additional protection of the switchboard should be considered in conjunction with broader road safety considerations for the site.

9.5 Switchboard labelling

Cabinet labelling

Switchboard labelling must meet the following Council requirements, specified in Table 28.

Table 28: Switchboard labelling requirements

Item	Requirement
Font style	Helvetica medium
Lettering	Upper case
Label thickness	≤ 1.5mm (where exceeded, label edges must use radius or bevel)

Item	Requirement
Lettering heights	Major equipment nameplates: 40mm Minor equipment nameplates: 20mm Main switches: 10mm Outgoing electrical functional units: 8mm Danger, warning and caution notices: 10 mm for heading 5mm for text Automatic controls electrical equipment and instruments: 5mm Minor lettering: 3mm
Labels on switchboard assemblies	Provide the following: Asset ownership: Rate 3 switchboards: "SCC3" Metered switchboards: "SCC" Switchboard designation: For example "MAIN SWITCHBOARD" or "DISTRIBUTION SWITCHBOARD - X". Manufacturer compliance and ID plate. Specific compartment labelling (where necessary).
Labels on assembly interiors	Internal compartment designations: Provide labelling to identify internal compartment designation for example: "CT CHAMBER" or "DISTRIBUTION SECTION".
Equipment labelling	Provide equipment labelling as follows: Main Switch. MEN location. Earth stake location. All outgoing circuits and submains. Lighting control components. Surge diverters. Other equipment as relevant to the installation.
Danger, warning and caution notes	Fault current limiters: In assembly sections containing fault current limiter fuses provide caution notices fixed next to the fault current limiters, stating that replacement fuse links are to match the installed fuse link ratings, make and characteristics. Provide separate label stating make and fault current limiting fuse ratings. Insulation and shrouding: For insulation or shrouding requiring removal during normal assembly maintenance, provide danger notices with appropriate wording for replacement of insulation shrouding before re-energising assemblies. Multiple sources of supply: Where a secondary source of supply is provided to the switchboard provide labelling to indicate multiple supply sources. Positioning: Locate notices so that they can be readily seen, next to or, if not practical, on busbar chamber covers of functional units and behind the front cover of functional units. Provide circuit identification labels in the cabling chamber of each functional unit, located next to external terminations.

Circuit schedules

A typed and laminated circuit schedule must be provided inside the switchboard door in a dedicated circuit schedule holder. The circuit schedule must show and identify the following:

- Switchboard name
- Upstream distribution supply location, including mains or submains cable size.
- Location of earth stakes and main earth connection.
- Circuit numbers.
- Neutral and Earth link numbers.
- Ratings of for all switches, circuit breakers and fuses.
- Load types and load locations, i.e., circuit description.
- The installer and person who updated the schedule, i.e., history, dates and name.

An electronic copy of the circuit schedule must be provided to Council in Microsoft Excel format (*.XLS or *.CSV) to enable future modifications.

9.6 Switchboard components

Switchboard chassis

Three phase switchboard chasses must comply with the following requirements:

- Standard: *AS/NZS 61439.1*.
- Current rating: 250A (typical).
- Short circuit fault current rating: 20kA for 0.2s.
- Provision for bottom and top main switch connection.
- Busbar insulation coating in phase colours.
- Suitable for mounting within an enclosure.
- Number of poles suitable for the application including 25% (minimum) spare take-off.

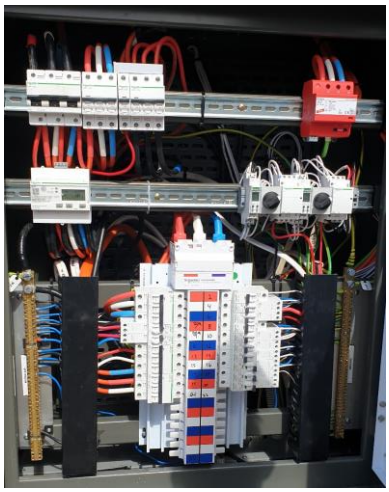


Image: Switchboard components

DIN rail

Provide DIN rails for mounting of switchgear and control gear to suit the switchboard construction and performance requirements of the installation. DIN rail should be slotted, 1mm thick aluminium or stainless-steel, with dimensions 35mm (H) x 7.5mm (D).

Earth and neutral bars

Earth and neutral bars must comply with the following requirements:

- Standard: *AS/NZS 3000*.
- Minimum current rating to match switchboard fault rating.
- Sufficient tunnels to match the nominated switchboard pole capacity, including specified spare capacity.
- Two screws per tunnel.
- Two stud connections for Protective Earth-Neutral (PEN) cables and the MEN link.
- Minimum of two mounting holes.
- Neutral bar provided with insulated mounting feet.

Main switches

Main switches must comply with *AS/NZS 3000* and the following:

- Circuit Breaker Type: To *AS/NZS IEC 60947.2* requirements, providing overload protection of the Consumers Mains.
- Switch disconnector, fuse, or fuse switch disconnector: To *AS/NZS IEC 60947.3*.
- Suitably rated for the required isolating functions and fault conditions.

Switch disconnectors (isolators)

Switch disconnectors must comply with the following requirements:

- Standard: *AS 60947.3*
- Single or three phase appropriate to suit installation requirements.
- Load and short circuit current capacity suitably rated for the application.
- Lockable in the open position.
- Minimum utilisation category *AC-22A*.
- Provided with shrouded terminals.

Fuses and fuse links

Low voltage fuse links must comply with the following requirements:

- Standard: *IEC 60269* (utilization category gG).
- High Rupture Capacity (HRC) type.

Miniature circuit breakers

Miniature circuit breakers must comply with the requirements in Table 29.

Table 29: Miniature circuit breaker characteristics

Item	Characteristic
Standard	*AS/NZS 60898.1*
Mounting	DIN rail or chassis mount
Number of protected poles	Active only (unless otherwise specified)
Protection against external influences	Unenclosed
Terminal type	Screw type
Instantaneous trip current	Type C (Type B can be considered with Council approval)
Rated Current	To suit load and associated cabling
Rated short current	≥ 10kA

Residual current devices

Residual circuit devices (RCDs) must comply with the requirements in Table 30.

Table 30: RCD characteristics

Item	Characteristic
Standard	Without overcurrent protection (RCCBs): *AS/NZS 61008.1* With overcurrent protection (RCBOs): *AS/NZS 61009.1*
Mounting	DIN rail or chassis mount
Residual operating current	30mA
Trip time	≤ 30ms
Terminal type	Screw type
Instantaneous trip current	Type C – RCBO only
Rated Current	To suit load and associated cabling
Rated short current	≥ 10kA

Contactors

Contactors must comply with *AS 60947.4.1* and to suit the specific requirements of the control installation.

Surge protection devices

Surge protection devices must be provisioned for all installations other than at the service entry (i.e., MSB) for Rate 3 installations where the MSB is integral to the lighting pole. Surge protection devices must meet the requirements of *AS/NZS 1768*, *IEC 61643-11* and *IEC 61643-12*, for the following categories and requirements outlined in Table 31.

- Service entry (main switchboard): Category C1.
- Distribution switchboards: Category B.
- Luminaires and specialist equipment: Category A.

Surge protection devices must be protected by a suitably rated circuit breaker or fuse (to manufacturer recommendations).

Table 31: Surge protection device requirements

Criteria (L-N specification)	Service entry	Distribution Switchboard	Luminaires and Specialist Equipment
AS/NZS 1768 Category	Category C1	Category B	Category A
Nominal voltage Un	230/400 VAC	230/400 VAC	230 VAC
Maximum continuous operating voltage Uc	275 VAC	275 VAC	275 VAC
Voltage protection level Up (3kA 8/20µs)	≤ 850 V	≤ 850 V	≤ 850 V
Voltage protection level @ In	≤ 1,500 V	≤ 1,500 V	≤ 1,000 V
Maximum surge current Imax (8/20 µs)	40kA (min)	40kA (min)	10kA (min)
Nominal discharge current In (8/20 µs)	20kA (min)	20kA (min)	5kA (min)
Mounting	DIN Rail Mount, with appropriately rated circuit breaker or HRC fuse		Suit equipment
Visual indicator	Required		Not required for integral SPDs
Auxiliary Alarm Contacts	Voltage free contact for remote indication		Not required for integral SPDs

10. Electrical system components

10.1 Scope

This section of the ELIM outlines requirements for electrical system components, accessories, and cabling. This section also provides guidance on typical distribution arrangements to public lighting infrastructure to fulfill mandatory safety obligations for earthing and protection systems.

Image: In pole equipment and underground joint

10.2 Electrical cabling

Electrical cabling must be provided to suit the specific requirements of the electrical installation and connected load groups. All cabling and cable support systems must be provided in compliance with *AS/NZS 3000*, *AS/NZS 3008* and *AS/NZS 3013*. Table 32 provides general requirements for all cabling.

Table 32: Electrical conductor and cable guidelines

Criteria	Requirement
Conductors	To comply with *AS/NZS 1125*
Conductor material	Multistranded copper
Neutral conductors	Sized according to the corresponding active conductors. The neutral conductor must be sized for maximum harmonic currents.
PVC and XLPE	To comply with A*S/NZS 5000.1*, *AS/NZS 3808*, and *AS/NZS 3560*.
Manufacturer recommendations	Unless otherwise specified, install, terminate, and joint cables in accordance with manufacturer's recommendations.

Criteria	Requirement
Handling cables	Handle cables to avoid damage to insulation, serving or sheathing. Report damage and replace or repair damages as directed by Council.
Minimum bending radius	Install cables with bending radius greater than the manufacturer's minimum and not less than eight times the outside diameter of cable.
Conductor colours	Per *AS/NZS 3000*.
Segregation and clearances	Maintain the required segregation of different cabling system classes and other services (new and existing) along the entire length of the cable. Coordinate with other cabling system and service installers, as required. Separation distances must be in accordance with AS/NZS 3000 and other relevant service standards.
Direct bury cables	Not permitted. All underground cabling must be installed in conduit.
Surface mounted cabling	Only permitted where appropriate mechanical protection to *AS/NZS 3013 WSX2* is provided.

Circuits must be designed to comply with current carrying capacity, short circuit capacity, voltage drop, earth fault loop impedance, automatic disconnection times, and earthing requirements in accordance with AS/NZS 3000. Cables must be appropriately selected to achieve compliance with these requirements.

Cable insulation and sheathing must comply with the minimum requirements established in Table 33. These requirements must apply for all cable size and phasing (single or three-phase). Multicore cables must be used unless project specific factors dictate the use of single core cables.

Table 33: Cable selection guide

Application	Configuration	Insulation	Sheath
Internal switchboard wiring (e.g., event outlets)	Flat	PVC V-90	PVC V-90 (White)
General exterior cabling installed in typical underground pit or conduit system.	Circular	XLPE X-90	PVC V-90 (Orange)
Exterior cabling installed in underground pit or conduit system in continually wet and vermin infested areas.	Circular	XLPE X-90	HDPE (Black)
Separate single core earthing conductor used for EFLI compliance.	Circular	PVC V-90 (Green/Yellow)	N/A

All cabling exiting a switchboard must be provided with labelling equal to Grafoplast labelling system or approved equivalent.

10.3 Cable joints and junctions

General principles

The use of cable joints must be minimised were practical subject to the nature of the installation. Mains and submain cabling must be installed in continuous runs without joints unless otherwise approved by Council. Where required and agreed with Council, cable joints are to comply with the requirements specified in the following subsections.

Underground cable joints

Underground cable joints must comply with the requirements outlined in Table 34.

Table 34: Underground cable joint requirements

Criteria	Requirement
Type	Re-openable "bell-type" joint.
Location	Installed in suitably sized cable pit, accessible for inspection and maintenance.
IP rating	IP68
Approved products	EQL and TMR approved bell joints. Install to manufacturer requirements and instruction.
Mounting	Provide a proprietary fibre glass pit support bar to ensure cable joint is located towards the top of the pit and in the correct orientation. Provide sufficient cable slack to ensure joint can be safely pulled from the pit for inspection and maintenance.
Labelling	Provide permanent labelling to all joints to indicate circuit origin and reference.

Underground cable joints associated with single cables with no junction or branch connection (e.g., connection of a single decorative lighting driver to a sub-circuit) can be installed using an appropriately sized resin cable joint kit (in lieu of a re-openable bell joint). Where resin joints are utilised, they must be located as per the guidance above and cabling provided with sufficient slack to facilitate future replacement of the joint if required.

Above ground cable joints

Above ground cable joints must comply with the requirements outlined in Table 35.

Table 35: Above ground cable joint requirements

Criteria	Requirement
Type	Surface mounted installation: Junction or adaptable box with screw connectors or terminal block. Switchboard and in-pole installation: Terminal block
Location	Installed in suitably sized enclosure, accessible for inspection and maintenance.
IP rating	Appropriate for the location, typically IP56.
Accessories	Provide all required installation accessories including cleaning and cable preparation material, heat-shrink sleeves, terminals, and cable glands.
Mounting	Location appropriate to minimise public exposure.
Labelling	Provide permanent labelling to all joints to indicate circuit origin and reference.

10.4 Outlets, isolators and accessories

Socket outlets must comply with the requirements outlined in Table 36.

Table 36: Socket outlet requirements

Criteria	Requirement
Standards	*AS/NZS 3112* (standard outlets) *AS/NZS 3123* (industrial outlets)
Type	Switched socket outlet (rotating switch type for three-phase outlets).
Material	High impact, UV stabilised HDPE.
IP rating	To suit location requirements.
Current rating	To suit project specifications and requirements.
Pin arrangement	Mount outlets with the earth pins at the 6 o'clock position. Three-phase outlets to be five-pin unless otherwise specified
RCD Protection	Provide RCD protection to all socket outlets unless otherwise specified. RCD protection must (typically) be located in the supply switchboard to prevent unauthorised access from members of the public. Council may allow exemption from this requirement for specific purposes (e.g., installations for major events and the like). For these applications, approval must be sought from Council for the use of local RCDs (located adjacent to the outlet).

Local isolators for permanently connected equipment must comply with the requirements outlined in Table 37.

Table 37: Local Isolator Requirements

Criteria	Description
Type	Weatherproof, surface mount.
Location	Accessible, and adjacent to the connected equipment.
Material	High impact, UV stabilised HDPE.
Current rating	To suit project specifications and requirements.
RCD Protection	Provide RCD protection to all permanently connected equipment (≤ 32A) unless otherwise specified. RCD protection must be located in the switchboard supplying the circuit.

Enclosures for mounting of outlets, isolators or other equipment such as remote luminaire drivers must comply with the requirements outlined in Table 38.

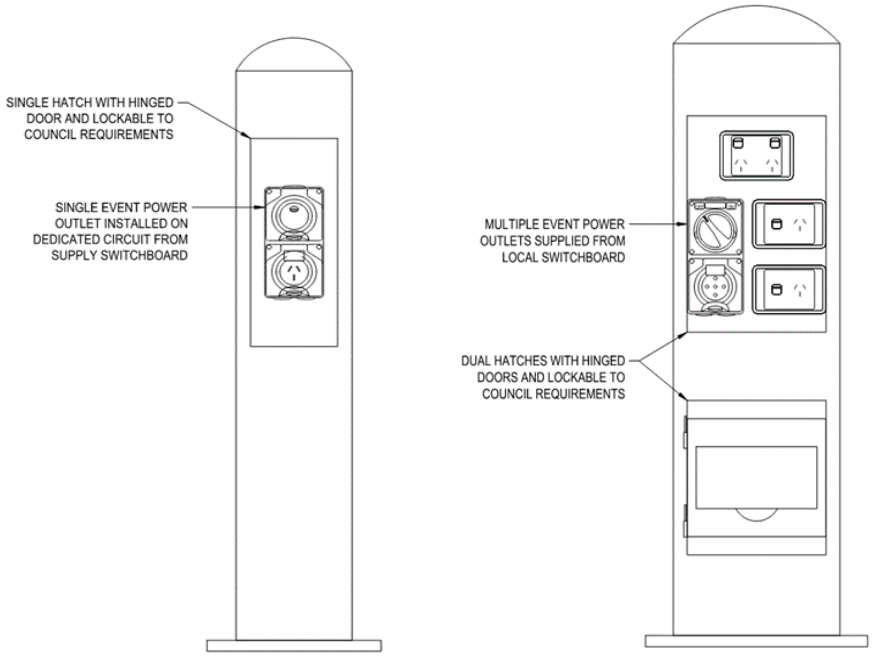
Table 38: Outlet and equipment enclosure requirements

Criteria	Description
Type	To suit the accessory or equipment, with appropriate IP rating.
Size	To suit accessory and equipment, including associated leads, plugs, and connectors.
Location	Accessible for maintenance purposes with a focus on maintaining vandal resistance and aesthetic requirements.
Material	High impact UV stabilised HDPE, or 316 grade stainless steel.

10.5 Event power bollards

Event power bollards are permitted in locations where event power distribution switchboard provisioning would impact broader landscaping objectives. Bollards may represent a more aesthetically pleasing solution.

Figure 25 shows the two typical power bollard configurations permitted for use in Council applications. Alternative configurations may be allowable subject to approval from Council.



Power bollard Type 1 Power bollard Type 2

Figure 25: Event Power Bollard Types

Typical provisioning for these bollard types is summarised in Table 39. Alternative provisioning may be allowable subject to Council approval.

Table 39: Event power bollard typical configuration

Type	Outlet Provisioning	Circuiting Arrangement	Comments
Type 1	2x 10A SSO; or 1x 15A single SSO; or 1x three-phase outlet	Single circuit connection from nearest Council metered switchboard.	Single door bollard for access to outlet/s
Type 2	2x 10A SSO; and 1x 15A single SSO; and 1x 3-phase outlet	Submains connection from nearest Council metered switchboard to internally mounted distribution switchboard.	Two-door bollard for separate access to outlets and switchboard.

Bollards must confirm to the technical requirements outlined in Table 40.

Table 40: Event power bollard requirements

Criteria	Requirement
Material	Electrostatically powder-coated, or 316 grade stainless steel
Height	≤ 1,200mm
Diameter	Suitable to meet internal equipment and cabling needs

Criteria	Requirement
Doors	Hinged and lockable type to meet Council requirements
Accessories	316 grade stainless steel hinges and locking accessories
Integrated switchboard (Type 2 bollard)	Provide appropriately sized insulated load centre in lower bollard hatch. Load centre must be mounted to suit spatial limitations and provided with the required neutral and earth bars and terminals. IP rating: IP55 (minimum)
Sample product	Type 1 LEDA Security Titan 200NB Power Bollard, single door. Type 2 LEDA Security Titan 300NB Power Bollard, two door – upper door for outlets, lower for switchboard provisioning. BEGA bollard tube

10.6 Barbecue connections

Connections to barbecue equipment in green spaces must be installed to the barbecue manufacturer's recommendations. Final connection ratings and mounting requirements should be confirmed with the manufacturer or supplier prior to installation.

Refer to Council's *Open Space Landscape Infrastructure Manual* – barbecue embellishment for product details.

Incoming cabling must turn up within the barbecue cabinet to ensure wiring is not publicly accessible.

10.7 Earth electrode

Earth electrodes must be installed at main switchboards and securely clamped to the main earthing conductor. Earth clamps must be finished with cold galvanising treatment following installation.

Earth electrode locations must maintain the following minimum separation requirements:

- Clearance from any other underground service: 500mm.
- Clearance from any EQL earth installation: 5m.

The earth electrode for all switchboard types (including traffic signal installations) must be installed in dedicated earth pits located adjacent to the switchboard on a common concrete plinth.

Where earth electrodes are to be installed in non-standard ground conditions, the following requirements apply:

- Excavate a 600mm diameter hole at the depth of the electrode.
- Fill the hole with ground enhancing material such as bentonite.
- Install the electrode in the centre of the material.
- Carry out and record measurements of the resistance of the earth electrode in accordance with *AS/NZS 3017*. Testing must be performed without the use of watering to provide a fair and reasonable assessment of typical ground conditions.

11. Electrical supply and distribution considerations

11.1 Scope

While the responsibility for compliance with the requirements of *AS/NZS 3000* and the ELIM ultimately lies with the designer and installer, the following sub-sections provide guidance on typical circuit reticulation and earthing strategies that can be applied.

Note that this guidance applies predominately to roadway and pathway lighting installations, particularly where cabling distances require careful consideration of factors such as earth fault loop impedance (EFLI).

11.2 Supply arrangements

The ELIM endorses the following two supply arrangements:

- Mains supply from utility LV network to a standalone switchboard.
- Mains supply from utility LV network direct to a lighting pole.

All supply arrangements must comply with *AS/NZS 3000* and utility authority requirements. Specific considerations for each arrangement are overview in Figure 26 and Figure 27.

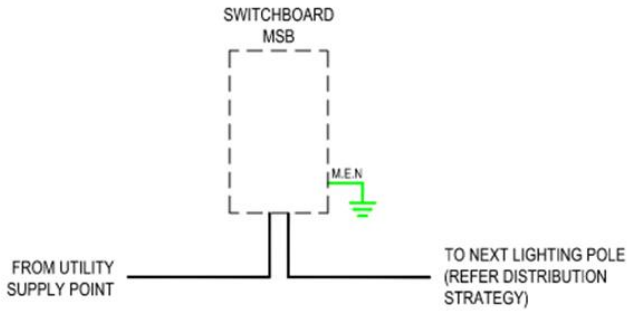
Mains supply from utility LV network to a standalone switchboard	
	
Application	Must be utilised for all metered installations. Can be applied to Rate 3 lighting.
Requirements	Utility connection for metered installations must comply with the requirements of the QECM and QEMM. Utility connection for Rate 3 installation must comply with unmetered connection requirements of the QECM and relevant EQL standards. Refer ELIM Section 9 for switchboard requirements.

Figure 26: Mains supply to switchboard

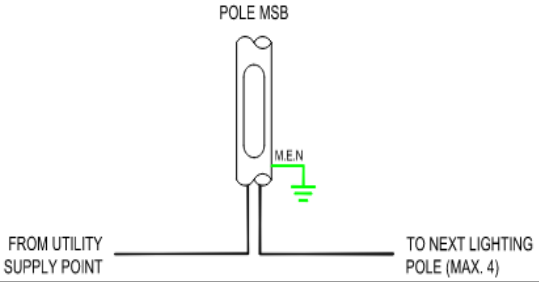
Mains supply from utility LV network direct to light pole	
	
Application	Only applies to Rate 3 lighting installations.
Requirements	In-pole switchgear and cabling must comply with AS/NZS 3000, including: • Main earth, MEN connection and labelling. • Inclusion of appropriately rated main switch. • Labelling to indicate MSB application and main earthing. In addition to the luminaire associated with the pole MSB, a pole MSB can supply up to four additional lighting poles on a single circuit. Where greater quantities of lights are required (or more circuits) a standalone switchboard must be provided.

Figure 27: Mains supply to lighting pole

11.3 Electrical reticulation strategies

Council recognises two electrical reticulation strategies for roadway and pathway lighting installations:

- Loop in / loop out cabling.
- Local in-pit junction with tee-off to light pole.

To minimise the extent of in-pit cable joints, Council has a general preference for loop-in loop-out cabling arrangements. Where broader considerations such as EFLI (and associated cable sizing), or other site constraints prevent the use of loop-in loop-out cabling, in-pit junctions are permitted.

All reticulation arrangements must comply with *AS/NZS 3000* requirements. Specific considerations for each arrangement are overview in Figure 28 and Figure 29.

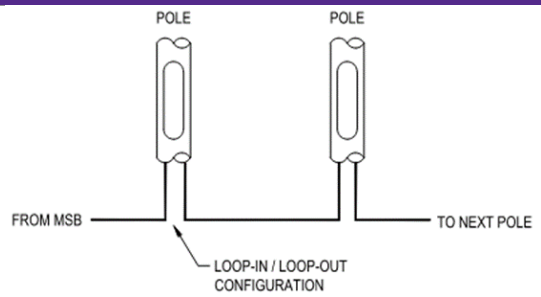
Loop in / loop out reticulation strategy	
	
Application	Preferred where possible to minimise in-pit cable joints.
Requirements	Looped cabling must be terminated onto in-pole terminal blocks or lugged connections. If utilising a remote MEN strategy at each light pole, the looping PEN conductor must be terminated in the pole via a bolted connection (or similar) that does not rely on screw terminals (in accordance with *AS/NZS 3000* Clause 5.5.3.

Figure 28: Loop in / loop out reticulation arrangement

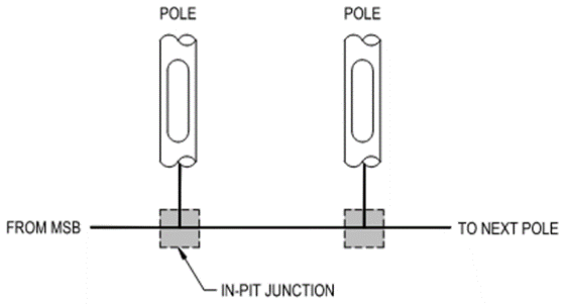
In-pit junction with tee reticulation strategy	
	
Application	Where loop-in / loop-out cabling is not able to be utilised due to cabling sizing or other installation factors.
Requirements	In-pit junctions must be installed in a pit located directly adjacent to each light pole. Provisioning of in-pit junctions must comply with ELIM section 10.3. Change in cable gauge is permitted on the tee cable from the joint to the pole (if required) and need not be provided with dedicated circuit protection unless: • The lower gauge tee cable is no longer suitably protected from overload by the upstream protection device. • The earthing strategy dictates the use of a 5s disconnect protection device at the MSB (a 0.4s disconnect is required for cabling entering the pole).

Figure 29: In-pit junction with tee reticulation arrangement

11.4 Earthing systems and strategy

General

Earthing compliance is fundamental to ensure the safety of the electrical installation. The following sub-sections are provided as guidance for appropriate earthing strategies that can be implemented to achieve earthing compliance. Responsibility for ensuring earthing system compliance lies with the designer and installation contractor. This section must be read in conjunction with the position statement on the use of RCDs for public lighting circuits.

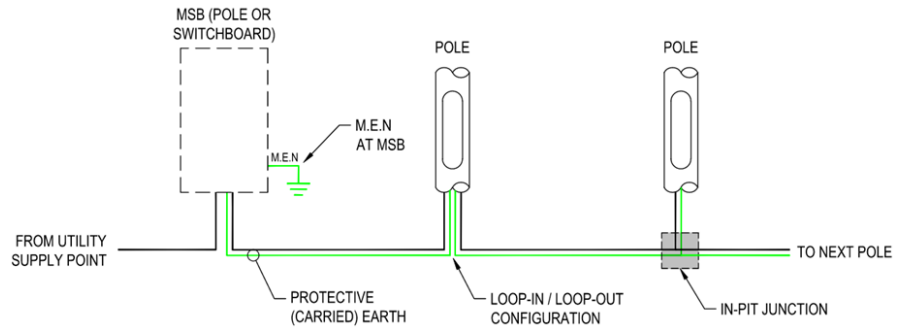
Earthing configurations

Council recognises two earthing system configuration strategies for roadway and pathway lighting installations:

- Carried protective earth conductor.
- Protective Earth Neutral (PEN) arrangement with remote MEN.

All earthing arrangements must comply with *AS/NZS 3000* requirements. Specific considerations for each configuration are overview in Figure 30 and Figure 31.

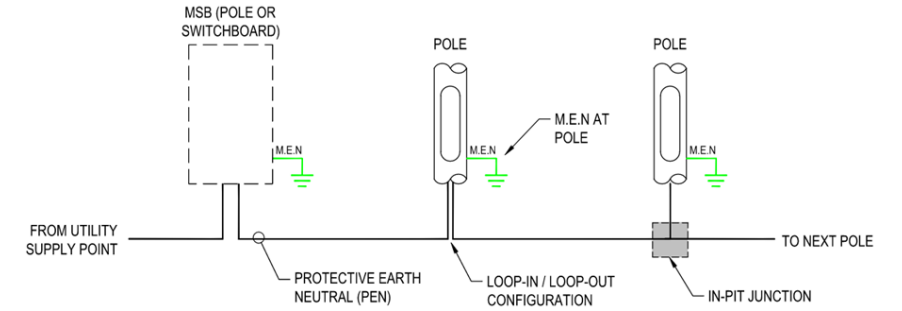
Carried protective earth conductor



Application	Preferred wherever RCD's are required on circuits (to avoid RCD's being located in light poles); or otherwise where EFLI requirements can be met with reasonably sized protective earthing conductors.
Requirements	Provided in accordance with *AS/NZS 3000* clause 5.5.2.

Figure 30: Carried protective earth conductor configuration

PEN arrangement with remote MEN – "Outbuilding"



PEN arrangement with remote MEN – "Outbuilding"	
Application	To be considered where cabling distance and associated EFLI requirements prevents the use of reasonably sized protective earthing conductors; and where RCD protection does not provide the primary means of disconnection of supply during earth fault conditions. Note that "outbuilding" configuration with remote MEN is not viable for poles in locations where local ground conditions prevent contact with the greater mass of earth (e.g., bridges, boardwalks, large culverts etc). In such instances a carried earth strategy shall be utilised.
Requirements	Provided in accordance with *AS/NZS 3000* clause 5.5.3.1.

Figure 31: PEN arrangement with remote MEN

Image: Earth stake and in-pole M.E.N

Earth fault loop impedance requirements

In addition to the earthing strategies described above, the earthing system must comply with the recommendations outlined in *AS/NZS 3000* Clause 5.7.2 (a) and *Appendix B4.3* with regards to disconnection times. A disconnection time of 0.4s must be used for all protection devices supplying circuits to equipment that may be subject to a dangerous touch potential (for example a conductive light pole).

To comply with this disconnection time requirement, Council recognises two configuration strategies for roadway and pathway lighting installations:

- Provision of an appropriately rated protection device with 0.4s disconnection time at the supply switchboard.
- Provision of a 5s disconnection device (fuse-switch) at the supply switchboard, with an additional 0.4s disconnection device provided at the in-pit tee (as described in ELIM section 11.3).

Council's preferred approach is for configuration option 1. Option 2 should only be utilised where Option 1 is not possible due to cabling distances. The options are presented diagrammatically in Figure 32 and Figure 33.

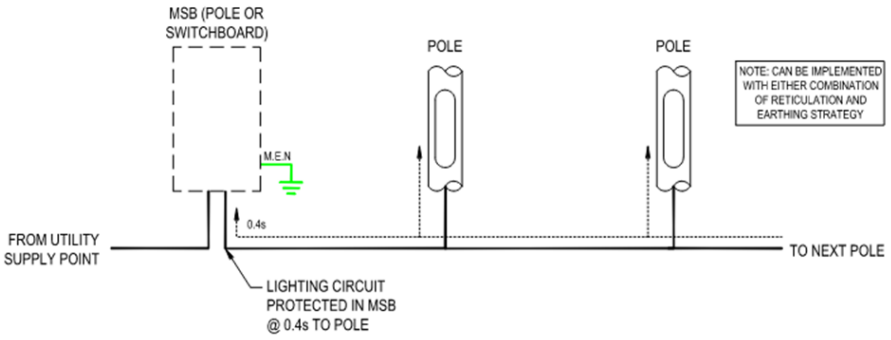


Figure 32: Earth fault protection with 0.4s disconnect at switchboard

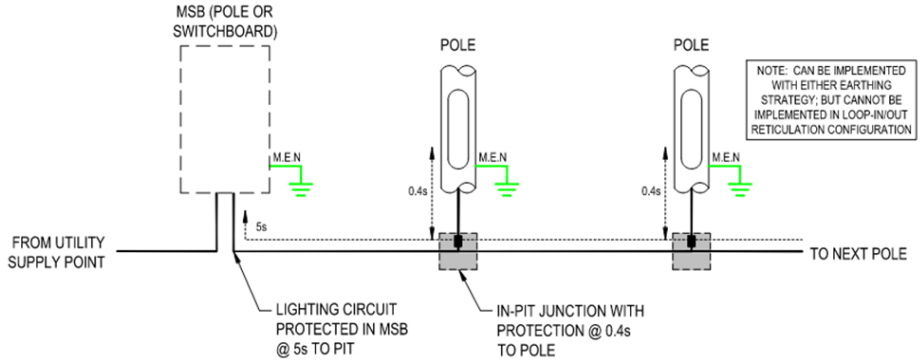


Figure 33: Earth fault protection with 0.4s disconnect at in-pit junction

11.5 Residual Current Devices (RCD)

General

AS/NZS 3000 requires automatic disconnection of the supply in the event of a fault between a live part and exposed conductive parts or a protective earthing conductor to limit the prospective touch voltage arising between simultaneously accessible conductive parts. Disconnection of the fault is achieved by providing suitable circuit protective devices in conjunction with an earthing and bonding system.

To fulfill this obligation, all circuits must be designed to comply with current carrying capacity, short circuit capacity, voltage drop, earth fault loop impedance, automatic disconnection times, and earthing and bonding requirements outlined in *AS/NZS 3000*. Equipment must be designed with the standard basic protection including "finger-proofing" of live parts.

RCDs are required to provide additional protection as nominated in *AS/NZS 3000*, unless otherwise exempted by Council. RCDs must be installed in convenient locations where they are grouped together to enable maintenance and periodic verification to be carried out at a minimum number of locations (typically in the switchboard at the origin of the sub-circuit).

RCD exemptions for public lighting installations

RCDs must be provided for all final sub-circuits unless the disconnection of the circuit by the RCD could cause a safety risk greater than the risk of electrical shock associated with earth leakage.

Council have deemed that RCD protection may be omitted in the following installations:

- Final subcircuits supplying traffic signal installations (all areas).
- Final subcircuits supplying category V road lighting.
- Final subcircuits supplying category P road lighting.
- Final subcircuits supplying category PX pedestrian crossing lighting.
- Final subcircuits supplying category P lighting in a public open space (provided in accordance with *AS/NZS 1158.3.1*).

The omission of RCD protection is in accordance with *AS/NZS 3000* Clause 2.6.3.2.3.3 Exception 2.

Where this exemption is used, the following additional risk control measures must be implemented to ensure the risk of electric shock due to the omission of the RCD protection is minimised:

- The electrical installation must be fully compliant with all other requirements of *AS/NZS 3000*, including *AS/NZS 3000* Clause 5.7.2 (a) and Appendix B4.3 with regards to disconnection times. A disconnection time of 0.4s must be used for all protection devices supplying final sub-circuits to equipment that may be subject to a dangerous touch potential (e.g., a light pole).
- All live equipment and terminations must only be accessible by qualified, licenced personnel who are trained to perform the operation or maintenance activity required. Operation and maintenance activities must be carried out in accordance with relevant safe work method statements or procedures.
- All equipment must be labelled to indicate the omission of RCD protection.

RCD bypass facilities for event power provisions

There are instances where the specific nature of specialised equipment connected to a Council provided power outlet could cause an RCD to trip through its normal (safe) operation, thus preventing that connected equipment from performing its intended function. Such examples include:

- Large events (e.g., music festivals, markets etc) whereby a Council provided power outlet is used to supply third party provided sub-distribution equipment (e.g., temporary distribution switchboards).
- Specialised equipment (e.g., carnival equipment such as Ferris wheels).

In accordance with the position statement provided at Appendix E, to ensure major event operators have access to a safe, reliable power supply for the performance of their intended function, Council has deemed that a key-operated RCD bypass facility may be provided to allow temporary bypass of outlets intended for controlled access for specialised use. These would typically be limited to three-phase outlets rated ≥ 20A. Bypass facilities must not be provided for any other connection/outlet type.

The omission of RCD protection (through the use of a keyed bypass facility) is in accordance with *AS/NZS 3000* Clause 2.3.3.2.3.3 Exception 3.

Where an RCD bypass facility is installed or operated, the following risk control measures must be implemented to ensure the risk of electric shock due to the omission of the RCD protection is minimised:

- The electrical installation must be fully compliant with all other requirements of *AS/NZS 3000*, including *AS/NZS 3000* Clause 5.7.2 (a) and Appendix B4.3 with regards to disconnection times. A disconnection time of 0.4s must be utilised for all protection devices supplying final sub-circuits to equipment that may be subject to a dangerous touch potential.

- The RCD bypass facility must be key operated, with keying to Council requirements and access controlled by Council operating procedures.
- The RCD bypass facility must be appropriately labelled (with permanent labelling) to nominate that the bypass should only be operated in accordance with nominated requirements (refer Appendix E).
- The outlet associated with the bypass must be appropriately labelled (with permanent labelling) to nominate that the outlet is not RCD protected when the bypass facility is in use.

11.6 Equipotential bonding

Equipotential bonding must be provided to all relevant conductive elements in accordance with AS/NZS 3000; including conductive piping, conductive cable supports, structural metal work and conductive building materials. Minimum size of equipotential bonding conductor must be 4mm^2.

12. Pit and conduit systems

12.1 Scope

This part of the ELIM covers aspects associated with the supply, installation and testing requirements for electrical pits, conduits, and associated system components. This section should be read in conjunction with the Smart Infrastructure Manual (SIM) which outlines requirements for telecommunications pit and conduit infrastructure.

Image: Electrical pit with concrete collar

12.2 Pit and conduit alignment

Road reserves

Pit and conduit infrastructure installed in the road reserve must be installed on standard alignments as governed by the following requirements:

- *IPWEA Standard Drawing RS-100* - Typical service corridors and alignments.
- *IPWEA Standard Drawing RS-101* - Typical service conduit sections.
- *EQL Underground Distribution Construction Manual* (UDCM) Section C2 Excavation and Reinstatement.

Road crossings are to be made perpendicular to the carriageway.

For Rate 3 installations conduit, alignment must be offset and installed within the 850 - 900mm alignment from the property boundary per the requirements of the EQL UDCM.

Where standard alignments cannot be achieved due to the presence of other services or geometry of the road reserve, a non-standard alignment is to be identified, discussed, and agreed upon with Council before proceeding.

Public open spaces

Pit and conduit infrastructure installed in public open spaces must be provisioned using the following principles:

- Coordinated with landscape features such as pathway alignments.

- Coordinated with other service elements, utilising typical service trenching where possible. Minimum clearances from other services must be maintained.
- Coordinated with existing vegetation and tree protection zones. Impact on tree protection zones must be avoided where possible. Where unavoidable, under-boring or vacuum excavation is to be undertaken to minimise disturbance. Advice must be sought from Council's Arborist before commencing these activities.

12.3 Cable pits

Selection and application

Cable pits are provided for the purposes of cable hauling, facilitating significant change in cable direction, jointing of cables or as otherwise required to suit the installation. Electrical pits and conduits must be separated from telecommunications pits and conduits. Electrical pit spacing depends upon design requirements however, the distance between each pit is to be no greater than 50m.

Image: Circular Electrical pit with cable junction

Generally, Type P1 and P2 pits are not to be used. Other (larger) pit types may be allowable to suit specific project needs on an as required basis subject to approval from Council.

Table 41 provides a summary of acceptable pit types for use in Council applications.

Table 41: Event power bollard requirements

Type	Dimensions (mm)				Application
	Length	Width	Depth	Clearance	
P3	575	350	520	440 x 250	Minor electrical cabling only, no in-pit joints/equipment.
P4	700	400	810	595 x 295	Standard electrical reticulation, including pits associated with lighting poles. Switchboard pits for small installations.
Circular	680		1000	600	Electrical reticulation at intersections where conduits entering from multiple directions (TMR Type 60).
450 x 450	560	560	505	450 x 450	Electrical reticulation within public open space at junction points with conduits entering from multiple directions.

Type	Dimensions (mm)				Application
	Length	Width	Depth	Clearance	
600 x 600	700	700	655	600 x 600	Electrical reticulation within public open space at significant junction points with conduits entering from multiple directions. Switchboard pits for large installations.
1000 x 1000	1120	1120	840	1000 x 1000	Switchboard pits for major installations, with conduit quantities exceeding maximum recommended for smaller pits.
Earth pit	220	220	150	175 x 175	Dedicated to earth stake, installed adjacent to switchboard.

Maximum conduit quantities entering a pit should be in accordance with manufacturer recommendations. To avoid compromising pit integrity, do not exceed manufacturer recommendations. Table 42 provides guidance on the recommended maximum number of conduits installed against pit type. Conduit quantities are indicative only, and installation requirements must be per the appropriate standards or pit manufacturer's recommendation.

Table 42: Guide for Conduit Arrangements in Pits

Pit Type	Side	Conduit Diameter (mm)				
		25	32	50	80	100
Type P3	Long	5	4	3	3	2
	Short	2	2	1	1	1
Type P4	Long	7	6	5	4	3
	Short	3	3	2	1	1
450mm x 450mm	All	4	4	3	2	2
600mm x 600mm	All	6	5	4	3	2
1,000mm x 1,000mm	All	11	10	8	6	5

Pit technical requirements

Pits installed for Council purposes must meet the technical requirements in Table 43.

Table 43: Technical requirements for pits

Criteria	Requirement
Pit Material	HDPE or reinforced concrete (precast or in situ).
Load rating	Selected in accordance with *AS 3996* to suit installed location. The following should be considered minimum requirements for typical conditions: • Class A: Installed in garden bed or other location not subject to vehicle traffic. • Class B: Installed in grass, subject to potential lightweight vehicle traffic such as mowers. • Class C: – Installed in driveway or access way subject to moderate vehicle traffic. – Installed in road reserve or verge for Rate 3 lighting. • Special applications: All other areas to suit likely vehicle movement.

Criteria	Requirement
Lid material	Must meet load rating requirements and take into consideration the following: • Locations near parks, gardens or playgrounds: Concrete or composite. Steel lids are not permitted for use in these areas unless required to suit specific load rating requirements. Refer coating requirements below. • Standard concrete pathways: Concrete. • Decorative pathways and pavements: Urban in-fill to match surrounding pavement type. • All other areas: Galvanised steel, concrete, or composite. Where galvanised steel lids are used in areas subject to foot traffic, including verges in residential developments, lid shall be coated with EPIREZ Safe Step 100 heavy pedestrian grade anti-slip coating, or Council approved equivalent of "Light Grey" colour.
Concrete collar	To protect against mower damage and prevent crushing or slipping in expansive or erosive soils, pits installed in turfed areas must be provided with a 150mm thick x 100mm wide N25/20 concrete surround complete with N12 lapped bar spaced centrally.
Accessories	Pit accessories such as riser brackets must be proprietary and provided by the pit supplier to suit the installed pit system. Custom risers and other accessories are not permitted unless approved by Council. All accessories must be installed to manufacturer requirements and recommendations.
Conduit entry	Conduit entries to pits must comply with the following: • Conduit entry via base of pit is not permitted. • Pit bushes are to be provided for all conduits to eliminate any sharp or rough conduit ends and prevent damage to drawn cables. • All conduit entries are to be sealed into pit wall using a flexible sealant. • All conduits must enter the pit at right angles to the pit wall. Changes in direction are to be achieved by large radius sweep bends.
Cable markers	Provide directional cable markers set into concrete collar indicating direction of outgoing conduits. Where a concrete collar is not provided, provide a concrete block adjacent to the pit, finished flush with the ground level with a directional marker affixed.

Installation of pits

Electrical pits must be installed by (or installed under the direct supervision of) a licenced electrical contractor.

Pits must be positioned in convenient locations where they do not cause a hazardous situation. Pits must not be installed on roads, subjected to heavy vehicles, or on batters greater than 1:3.

Excavation and installation of pits must comply with the following:

- Carried out in a manner to cause minimal disruption to the surrounds and with minimal removal of material.
- Installed on 100mm of bedding sand compacted to a density index not less than 60.
- Backfilling for pits must consist of a minimum 150mm thick layer of stabilised sand or clean fill around each wall. Backfill must be compacted in maximum 300mm layers to minimise movement and distortion.
- The top surface of the pit, lid and surround must be flush with the finished surface level of the surrounds.
- Provide drainage to all pits. Drainage should be direct to the stormwater network if achievable, otherwise provide a rubble drain with suitable aggregate and geotextile fabric to adequately disburse water from the pit.

Multi-service (shared) pits

Shared pits are only permitted under the following circumstances:

- At intersections with Council owned joint use lighting and traffic signals infrastructure. The following conditions apply to these shared installations:
  - Lighting and traffic signals cabling must still be run through separate conduits.
  - Communications cabling for ITS or smart cities equipment must be reticulated via separate communications pit and conduit infrastructure (i.e., cannot be reticulated through a shared electrical pit).
- For decorative lighting installations requiring the use of ELV, network or other telecommunications cabling (e.g., DMX-512) for the sole purpose of lighting control. The following conditions apply to these shared installations:
  - This must only be undertaken where agreed with Council.
  - No other telecommunications provisions can be reticulated through the electrical pit system (only cabling dedicated to lighting control purposes).
  - The control cabling must be sub-ducted through the electrical pit using flexible conduit. Conduit must be appropriately fixed to the pit wall to ensure that suitable segregation is provided from electrical cabling.
  - The cabling must still be run through separate conduit infrastructure dedicated to telecommunications services.

Note that while DALI cabling is classified as an ELV service, the DALI standard only requires basic protection between DALI cabling and LV cabling. As such, DALI cabling does not need to be segregated from LV cabling and can therefore be reticulated through the electrical pit and conduit system.

12.4 Underground conduits

Selection and application

Underground conduits of sufficient quantity and size must be provided to facilitate the required cabling installation, factoring in capacity for future expansion and modification of the installation.

Table 44 is provided as a guide for the minimum recommended conduit size and quantity for typical applications. These recommendations can be modified if required to suit specific project design conditions or requirements.

Table 44: Conduit selection and application guidelines

Area / Category	Typical Application	Conduit Location	Requirement (Qty | Size-mm)
Category V (Major Road)	Rate 3 lighting. Telecom carrier corridor.	POS to switchboard	1 x 50
		Switchboard to switchboard pit	1 x 80
		Pit to pit	1 x 80; 1 x 50
		Pit to pit - road crossing	2 x 80
		Pit to pole	1 x 50
		Pole to pole - loop-in, loop-out	1 x 50
Category P (Minor Road)	Rate 3 lighting.	POS to switchboard	1 x 50
		Switchboard to switchboard pit	1 x 50
		Pit to pit	1 x 50

Area / Category	Typical Application	Conduit Location	Requirement (Qty | Size-mm)
		Pit to pit - road crossing	2 x 50
		Pit to pole	1 x 50
		Pole to pole - loop-in, loop-out	1 x 50
		Pillar to pole - direct connect	1 x 50
Streetscape or Town centre	Metered lighting (street and decorative), with event power and smart cities provisions.	POS to switchboard or cabinet	1 x 80
		Switchboard to switchboard pit	2 x 100
		Pit to pit Note 1	2 x 80; 2 x 50
		Pit to pole	1 x 50
		Pit to decorative lighting Note 2	1 x 25
		Pit to event power bollard	1 x 63
Public Open Spaces Note 3	Metered lighting (pathway, shelter and decorative), with event power, barbecue connections and smart cities provisions.	POS to switchboard or cabinet	1 x 80
		Switchboard to switchboard pit	2 x 80
		Pit to pit Note 2	1 x 80; 1 x 50
		Pit to pole	1 x 50
		Pole to pole - loop-in, loop-out	1 x 50
		Pit to shelter (lighting)	1 x 25
		Pit to BBQ enclosure	1 x 50
		Pit to event power bollard	1 x 63

Notes:

1. Where project requirements dictate the need for a sub-distribution board (DB), an additional 80mm (nom.) electrical conduit must be provided between the MSB and DB (through the corresponding pit network) for reticulation of submains cabling.
2. Telecommunications pit and conduits for decorative lighting elements should be provided where the lighting control strategy dictates the use of ELV or telecommunications cabling (e.g., DMX 512 cabling).
3. Alternative conduit arrangements must be coordinated with Council.

Conduit technical requirements

Underground conduits must comply with the technical requirements set out in Table 45.

Table 45: Conduit technical requirements

Criteria	Description
Standards	*AS/NZS 3000, AS/NZS 2053, AS/NZS 61386, AS/CA S009*
Type	Rigid, heavy-duty uPVC or high-density polyethylene. Smooth inner bore and no corrugated outer surface.
Bends	Must be a manufactured large sweep bend to suit required change in direction.

Criteria	Description
Joins	Conduits must be joined together using methods suitable for the conduit type to achieve a continuous burr and snag-free tube free of debris ingress.
Colour	Electrical: Orange
Draw Wires	All conduits must be provided with a nylon draw wire.
Marker Tape	Must be installed for the full length of the conduit run and provided in accordance with *AS/NZS 2648*.1 and the following: General: Detectable with integrated stainless-steel wire Electrical: to comply with *AS/NZS 3000*

General installation requirements

Electrical conduits must be installed by (or installed under the direct supervision of) a licenced electrical contractor. Electrical conduit installations must be fully compliant with *AS/NZS 3000*, with minimum depth of cover of 600mm for public areas. For areas intended to be utilised for major markets or events, conduit depth and requirements should be in accordance with *AS/NZS 3002*.

Prior to excavation, the installation contractor must:

- Accurately locate and identify all existing services (in-ground or otherwise) in the vicinity of the works area.
- Liaise with all relevant service authorities as required.

Ensure all electrical conduits maintain required clearance from other services in accordance with AS/NZS 3000 and utility standards as applicable.

Depth of cover

Minimum depth of cover should be as described in Table 46.

Table 46: Conduit Minimum Depth of Cover Requirements

Location	Minimum Depth of Cover (mm)
Road Reserve – Grass verge	600
Road Reserve – Under concrete footpath	600
Road Reserve – Minor road crossing	750
Road Reserve – Major road crossing	1,000
Open Space – General turfed or Garden area	600
Open Space – Under concrete footpath	600
Open Space – Major market or Event space	1,000
Extra Low Voltage cabling for lighting circuits	250 Note 1

Note 1: ELV depth is provided as a guide only. Where an ELV installation has been deemed necessary, installation depth must be chosen to suit local conditions. All ELV cabling for lighting purposes must be installed in HD conduit (or better) irrespective of depth of cover.

Conduit depth must be coordinated with pit type to ensure conduit entry to pits is through the pit side or end (base entry is not permitted). Provide pit risers or conduit sweep bends to coordinate appropriate conduit entries.

Where localised conditions prevent installation at the minimum stated depth, cover can be reduced in accordance with the recommendations in *AS/NZS 3000* (including additional mechanical protection). Where the standard depth of cover or protection requirements of *AS/NZS 3000* cannot be achieved, an alternative engineered solution may be proposed for review and acceptance by Council. The proposed solution must nominate the reduced depth and fully detail all additional protection required to demonstrate compliance with the performance objectives of *AS/NZS 3000*. Where Council accepts an engineered solution for reduced cover, the following must also be provided as part of the solution:

- Surface cable markers (installed at suitable intervals) stating the presence of the reduced depth conduits, together with arrows indicting direction.
- As-constructed records showing the location and extent of the reduced depth installation.
- Photographic evidence of the installation prior to backfilling / concrete pours.

Excavation requirements

Excavation works must comply with the following requirements:

- Prior to commencing excavation works, confirm all conduit routes onsite using dimensioned set-outs coordinated with other services, civil and landscape elements.
- Comply with relevant tree protection requirements. Tree protection requirements within the works area must be confirmed with landscape documentation or with Council's Arborist. Utilise under-boring or vacuum excavation when excavating in and around root zones.
- Excavate trenches so that:
  - Trench width is minimised, allowing minimum 25mm horizontally between conduits (of the same service) and minimum 50mm between conduits and side walls of the trench.
  - Trench depth is minimised, allowing 75mm bedding sand on the bottom of the trench, 50mm vertically between conduits (of the same service), and minimum depth of cover to top of conduit in accordance with nominated requirements.
- Where trenches are left open during construction works ensure that they are protected by barricades or in such a manner as to prevent them creating a hazard.

Following excavation and installation of conduits, backfill and make-good must comply with the following:

- Backfill trenches only after Council has provided acceptance the laid conduits.
- Backfilling methods must ensure that the conduits and pits do not move, are not damaged, distorted or put under stress. Recommended backfill methods to suit installation location are as follows:
  - Roadways or other areas possibly subject to high loading: Lean mix (1:20) low slump concrete.
  - Other areas not expected to be subject to high loading: Compacted bedding sand to a minimum depth 75mm above the highest conduit.
- Marker tape must be provided during backfill in accordance with *AS/NZS 3000* and *AS/CA S009*.
- Make good existing paving, kerbing, and landscaping to match surrounding surface finish. Works must comply with project specifications or to the approval of Council. Remove all excess excavated spoil.
- Provide 316 stainless steel kerb markers on each side of the road for conduit road crossings. Kerb markers should be 40mm diameter with 25x5mm anchor, labelled "E" for electrical and "C" for communications.

After installation and backfilling, conduits must be proved by drawing a mandrel (size - minimum 95% of the conduit diameter) through the conduit. Once proven, a continuous length of draw rope without knots, complete with a 1m tail at each end tied to a small section of PVC conduit (or equal) must be left in the full length of conduit prior to the conduit ends being capped to prevent the ingress of foreign material.

Shared trenching

The use of shared trenching is desirable wherever possible to minimise ground disturbance. Shared trenching is permitted under the following circumstances:

- Council owned assets: maintain required service clearances in accordance with *AS/NZS 3000*, *AS/CA S009* and other relevant service standards as applicable.
- Council assets with third party or utility assets: Subject to agreement with third party provider. Maintain required clearances in accordance with third party guidelines.

While shared trenching is permissible, conduits and cables must not pass through shared pits. Sharing of pits between services and third-party providers is not permitted without written approval from Council and the relevant third-party provider.

Vacuum and hand excavation methods

Vacuum excavation or hand excavation methods should be utilised where conduits are required to be installed in close proximity to existing services or where tree protection requirements prevent the use of standard mechanical excavation. Coordinate all tree protection requirements with Council's Arborist prior to excavation and ensure all other minimum installation requirements are adhered to.

Trenchless installation methods

The use of trenchless techniques for installation of conduits is permitted where the use of open trenching is otherwise prohibited. This may include the following:

- Service conflicts where an alternative route is not possible to avoid the conflict.
- In locations where removal and re-instatement of existing finished surfaces is not desirable due to technical, financial or political reasons. This may include driveway crossings, decorative streetscape pavements, or similar installations.
- Where tree protection requirements prevent the use of open trenching.

Trenchless installations must be carried out by an appropriately qualified civil contractor with experience in the nominated installation technique. Conduits must be chosen by the contractor to suit the installation methodology, bore diameter and service quantities. All required installation accessories must be provided in accordance with industry standard practice. This may include (but is not limited to):

- Bore spacers: To hold conduits together whilst maintaining required separation.
- Adapters: To ensure a smooth transition between Polyethylene (PE) pipe to a PVC conduit at each end of a bore.
- Bore Lining: Where localised conditions require additional ground support.

As the installation of cable protection covers by trenchless techniques is not possible, the following requirements must apply to the minimum depth of cover:

- Conduit run predominantly by trenchless techniques: 1,000mm (to the bore casing).
- Conduit run predominantly by conventional open trenching techniques, with small section of trenchless installation: Depth of cover of the under-bored section must be consistent with the depth of cover of the associated open trenches.

Multi-service (shared) conduits

Conduits must only carry those service types for which they are intended. ELV and telecommunications cabling must not be reticulated through electrical conduits and vice-versa. Sub-ducting of telecommunications cabling through electrical conduits is not permitted unless otherwise approved by Council.

Environmental management considerations

All excavation works must be undertaken in accordance with Council's environmental protection and management requirements as established in:

- Planning Scheme Policy.
- Landscape Infrastructure Manual - Environmental management of fauna and flora.
- Landscape Infrastructure Manual - Site Set up (including tree protection).
- Landscape Infrastructure Manual - Tree sensitive design (existing and new trees).
- Project-specific landscape or Arborist conditions (as applicable).

Council has a target of no-net-loss of vegetation and is committed to avoiding or mitigating impacts to natural assets as far as practical. Where impacts cannot be avoided or mitigated, they are to be appropriately offset. In the first instance, offsets must provide environmental or landscape values and benefits as similar as possible to those being lost.

Where onsite mitigation is not practical, offsite offsets must achieve an environmental outcome that is greater than the impacted (or lost) natural asset prior to the action. Offsets are determined based on the mapped value of impacted vegetation and calculated by multiplying the offset ratio and base figure per square meter or per stem impacted.

All vegetation impacts are required to be approved by Council and financial obligations met prior to works.

Surface mounted conduit

Surface mounted conduit should be avoided unless necessary to achieve installation requirements. If required, surface mounted conduit must comply with Table 47.

Table 47: Surface mounted conduit requirements

Criteria	Requirements
Type	MDuPVC – grey type per the requirements of *AS/NZS 2053*. Where exposed, paint conduit to match surrounding surface finish.
Alignment	Coordinate reticulation with the structure to which it is mounted to minimise visibility and the risk of tampering.
Fixings	Fix to structural elements without compromising the integrity of those elements. Installed with 316 grade stainless steel fixings at appropriate intervals (nominally ≤ 500mm) to provide adequate support.
Additional protection	Provide aluminium hat section where conduit is exposed or accessible to the public. Hat section should be powder coated to match surrounding features.

13. Telecommunications

13.1 Introduction

Continued development of digital infrastructure for analogue and digital uses requires underground and above ground assets to be future ready and adapt to changing requirements as Council manages its public spaces.

Inclusion of telecommunications infrastructure at the time of upgrades or streetscapes provides the physical and wireless connections for future embellishments to be added quickly and more cost effectively.

Council is committed to working with telecommunication carriers to ensure they comply with the desired standards, codes, processes, and practices.

Image: Example of an urban centre with a variety of smart technology solutions (for guidance only).

13.2 Council telecommunications carrier licence

Council has developed a telecommunications access network (conduits and pits) that can be shared by multiple carriers to provide improved services to residents and businesses.

Council secured its own telecommunications licence to:

- Support the international submarine cable and maintain the beach landing.
- Provide a multi-carrier access network and standardised conduit system across the region to:
  - Ensure there is more space in the road reserve.
  - Minimise the need to dig up gardens, pathways, under bore, trench or bury new ducting or fibres.
- Reduce the number of telecommunications conduit or pits in the public realm.
- Deliver a small amount of revenue to maintain the network.

13.3 Smart Infrastructure Manual

The Smart Infrastructure Manual (SIM) provides a detailed guide for the location and distribution of approved smart technologies in:

- Urban centres.
- Open spaces.
- Buildings and venues.
- Private developments.

For further guidance refer to the following SIM attachments:

- Key locations and smart technologies: provides examples of centres, corridors, parks, gardens, environmental reserves, community and sport facilities, events, Brisbane 2032 Olympic and Paralympic venues, and private developments identified for the inclusion of selected smart technologies.
- Digital infrastructure: Provides guidance on implementation of digital infrastructure elements including:
  - Multi-function poles.
  - Integrated switchboard.
  - Digital kiosks.
  - Digital screens.
  - Other infrastructure.
- Telecommunications and connectivity: Provide guidance on implementation of telecommunications infrastructure elements including:
  - Telecommunications conduits and pits.
  - Passive optic fibre.
  - Active network infrastructure.
  - In-building telecommunications room.
  - Internet of Things (IoT) gateway network.
  - WiFi access points.
  - 5G micro cell sites.

14. Appendices

14.1 Appendix A: Acronyms, Abbreviations and References

Acronyms and Abbreviations

Abbreviation	Description
1Φ	Single Phase
3Φ	Three Phase
A	Ampere
AC	Alternating current
ACMA	Australian Communications and Media Authority
ADAC	Asset Designed as Constructed
AEMO	Australian Energy Market Operator
AGM	Absorbent Glass Mat
AS	Australian Standard
BoQ	Bill of Quantities
CA	Communications Alliance
CAD	Computer Aided Design
CCA	Copper Chrome Arsenate
CCT	Corelated Colour Temperature
CCTV	Closed Circuit Television
CMA	Combination Mast Arm
CMS	Central Management System
CPTED	Crime Prevention Through Environmental Design
CT	Current Transformer
(D)	Depth (dimension)
D4i	DALI for the IoT (DALI-2 extension)
DALI	Digital Addressable Lighting Interface
DALI-2	Latest version of DALI protocol
DB	Distribution Switchboard
DC	Direct Current
DMX-512	Digital Multiplexing
TMR	Department of Transport and Main Roads (Queensland)
.DWG	AutoCAD drawing file format
EFLI	Earth Fault Loop Impedance
EMC	Electromagnetic Compatibility
EQL	Energy Queensland
H	Height (dimension)
HD	Heavy Duty

Abbreviation	Description
HDPE	High Density Polyethylene
HDG	Hot-Dip Galvanised
IEC	International Electrotechnical Commission
IK	Impact Protection (mechanical)
IP	Ingress Protection
IPWEA	Institute of Public Works Engineering Australasia
ITS	Intelligent Transport System
JUP	Joint Use Pole
LDD	Lamp Dirt Depreciation
(L)	Length (measurement)
LED	Light Emitting Diode
LIM	Landscape Infrastructure Manual
LLD	Lamp Lumen Depreciation
LPC	Light Point Controller
M12	Metric dimension 12.
m	Metre
mA	Milliampere
MCB	Miniature Circuit Breaker
MCCB	Moulded Case Circuit Breaker
MD	Medium Duty
MEN	Multiple Earth Neutral
mm	Millimetre
MPPT	Maximum Power Point Tracking
ms	Milliseconds
MSB	Main Switchboard
N/A	Not Applicable
NBN	National Broadband Network
NEM	National Electricity Market
NEMA	National Electrical Manufacturers Association
NER	National Electricity Rules
RATE	Network Public Lighting
RU	Rack Unit
PDF	Portable Document Format
PE	Photoelectric
PPE	Personal Protective Equipment
PV	Photovoltaic
PVC	Polyvinyl Chloride

Abbreviation	Description
QECM	Queensland Electricity Connection Manual
QEMM	Queensland Electricity Metering Manual
QTP	Qualified Technical Person
RCBO	Residual Current Circuit Breaker with Overcurrent Protection
RCD	Residual Current Device
RGB/W	Red, Green, Blue and White
RPEQ	Registered Professional Engineer of Queensland
SAA	Standards Association of Australia
SD	Standard Drawing (from the TMR drawing set)
SL72	Square 7 bar diameter; 200 square
SPD	Surge Protection Device
SSO	Switched Socket Outlet
UDCM	Underground Distribution Construction Manual
ULMP	Urban Lighting Master Plan
uPVC	Un-plasticised Poly Vinyl Chloride
UV	Ultraviolet
VAC	Voltage AC
(W)	Width (measurement)
W	Watt
WAP	Wireless Access Point
XLPE	Cross Linked Polyethylene
Zhaga Book18	Standard for smart interfaces between luminaires and ancillary devices

References

Reference	Title
ANSI C136	Standards for Roadway and Area Lighting Equipment
AS 1170	Structural design actions
AS 1231	Aluminium and aluminium alloys - Anodic oxidation coatings
AS 1554	Structural steel welding
AS 1604.1	Specification for Preservative Treatment Part 1: Sawn and Round Timber
AS 1768	Lightning protection
AS 1798	Lighting poles and bracket arms - Recommended dimensions
AS 1874	Aluminium and aluminium alloys - Ingots and castings
AS 2159	Piling - Design and installation
AS 2312	Guide to the protection of structural steel against atmospheric corrosion by the use of protective coatings
AS 3600	Concrete structures

Reference	Title
AS 3715	Metal finishing - Thermoset powder coatings for architectural applications of aluminium and aluminium alloys
AS 3818.11	Timber - Heavy structural products - Visually graded Utility poles
AS 3996	Access covers and grates
AS 4100	Steel structures
AS 4312	Atmospheric corrosivity zones in Australia
AS 4506	Metal finishing - Thermoset powder coatings
AS 60947 (suite)	Low voltage switchgear and control gear
AS 61386	Conduit systems for cable management
AS/CA S009	Installation requirements for customer cabling (Wiring Rules)
AS/NZS (SAI) 2053	Conduits and fittings for electrical installations
AS/NZS 1100	Technical drawing
AS/NZS 1125	Conductors in insulated electric cables and flexible cords
AS/NZS 1158 (suite)	Lighting for roads and public spaces
AS/NZS 1170	Structural Design Actions
AS/NZS 1554.1	Structural Steel Welding
AS/NZS 1594	Hot-rolled steel flat products
AS/NZS 1664	Aluminium structures
AS/NZS 1665	Welding of aluminium structures
AS/NZS 1734	Aluminium and aluminium alloys - Flat sheet, coiled sheet, and plate
AS/NZS 1768	Lightning protection
AS/NZS 2648	Underground marking tape
AS/NZS 3000	Electrical installations (known as the Australian/New Zealand Wiring Rules)
AS/NZS 3002	Electrical installations - Shows, carnivals, and events
AS/NZS 3008.1.1	Electrical installations – Selection of cables Part 1.1: Cables for alternating voltages up to and including 0.6/1kV – Typical Australian installation conditions
AS/NZS 3013	Electrical installations - Classification of the fire and mechanical performance of wiring system elements
AS/NZS 3017	Electrical installation – Verification guidelines
AS/NZS 3112	Approval and test specification - Plugs and socket-outlets
AS/NZS 3123	Approval and test specification - Plugs, socket-outlets, and couplers for general industrial application
AS/NZS 3560	Electric cables - Cross-linked polyethylene insulated - Aerial bundled - For working voltages up to and including 0.6/1 (1.2) kV
AS/NZS 3750.13	Paints for steel structures Epoxy primer (two-pack)
AS/NZS 3808	Insulating and sheathing materials for electric cables
AS/NZS 4282	Control of the obtrusive effects of outdoor lighting

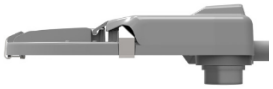
Reference	Title
AS/NZS 4680	Hot-dip galvanized (zinc) coatings on fabricated ferrous articles
AS/NZS 5000.1	Electric cables - Polymeric insulated For working voltages up to and including 0.6/1 (1.2) kV
AS/NZS 5131	Structural steelwork - Fabrication and erection
AS/NZS 60898	Electrical accessories - Circuit-breakers for overcurrent protection for household and similar installations
AS/NZS 61008	Residual current operated circuit breakers without integral overcurrent protection for household and similar uses (RCCBs)
AS/NZS 61009	Residual current operated circuit breakers with integral overcurrent protection for household and similar uses (RCBOs)
AS/NZS 61439	Low voltage switchgear and control gear assemblies
AS/NZS IEC 60947.3	Low-voltage switchgear and controlgear Switches, disconnectors, switch-disconnectors and fuse-combination units
CA C524	External Telecommunication Cable Networks
IEC 60269	Low-voltage fuses
IEC 61643	Low-voltage surge protective devices
MRTS78	Main Roads (TMR) Technical Specification Fabrication of Structural Steelwork
MRTS97	Main Roads (TMR) Technical Specification Mounting Structures for Roadside Equipment
RS-100	IPWEA Standard Drawing - Typical service corridors and alignments
RS-101	IPWEA Standard Drawing - Typical service conduit sections
SD 1380	TMR Standard Drawing Road Lighting - Slip Base Pole and Footing Installation Details for No Crossfall
SD 1381	TMR Standard Drawing Road Lighting - Slip Base Pole and Footing Installation Details for Crossfalls Up to and Including 1:6
SD 1382	TMR Standard Drawing Road Lighting - Slip Base Pole and Footing Installation Details for Crossfalls Greater than 1:6 Up to and Including 1:3
SD 1392	TMR Standard Drawing Road Lighting - Base Plate Mounted Pole and Footing Installation Details for Crossfalls Up to and Including 1:2
SD 1393	TMR Standard Drawing Road Lighting - Base Plate Mounted Pole and Footing Installation Details for Crossfalls Greater than 1:2
SD 1429	TMR Standard Drawing Road Lighting - Slip Base Pole and Footing Installation Details for Crossfalls Greater than 1:6 Up to and Including 1:3 Using Concrete Step Tread
UDCM	EQL Underground Distribution Construction Manual
WCS 37	EQL Work Category Specification Public Lighting Installations
WCS 47.3	EQL Work Category Specification Public Lighting Rate 2 Design
N/A	Electrical Safety Act 2002
N/A	Electrical Safety Regulation 2013
N/A	Professional Engineer Act 2022
N/A	Professional Engineers Act 2002

Reference	Title
N/A	Sunshine Coast Planning Scheme 2014
N/A	Council Urban Lighting Master Plan 2016
N/A	Council Open Space Landscape Infrastructure Manual (LIM)
N/A	Council Electrical Infrastructure within Road Reserves
N/A	EQL QLD Public Lighting Construction Manual
N/A	International Dark Sky Places (IDSP) – Certification Program
N/A	Council Guidelines for Creation and Submission of ADAC
N/A	Council Periodic Testing and Verification Specification
N/A	AEMO National Electricity Market Load Tables for Unmetered Connection Points
N/A	EQL Works Plans Standards
N/A	Energex Public Lighting Manual - Standard Conditions for Public Lighting Services
N/A	Council Drafting and Design Presentation Standards
N/A	Work Health and Safety Regulation 2011
N/A	Work Health and Safety Act 2011
N/A	ACMA Telecommunications Cabling Provider Rules 2014

14.2 Appendix B: Pre-Approved Luminaire List

Note: this list is provided for general reference purposes only. Final luminaire selections (including the use of alternatives that do not appear on this list) must be agreed with Council as part of the design process.

Reference Image	Name/ Reference	Typical Applications						Approvals			
		Cat-V (Major Road)	Cat-P (Minor Road)	Streetscape or Town Centres	Pathway	Carpark	Public Activity Area	ADSA Approved	ADSA Prized	ADSA Prized Wildlife	AEMO (Rate 3)
	EWO F-System	✓	✓	✓	✓	✓	✓	✓	✓		✓
	EWO IR-Series		✓	✓	✓	✓	✓		✓	✓	✓
	AEC Italo	✓	✓	✓	✓	✓					✓
	AEC Mod 2.0 Urban		✓	✓	✓	✓	✓		✓		✓

Reference Image	Name/ Reference	Typical Applications						Approvals			
		Cat-V (Major Road)	Cat-P (Minor Road)	Streetscape or Town Centres	Pathway	Carpark	Public Activity Area	ADSA Approved	ADSA Prized	ADSA Prized Wildlife	AEMO (Rate 3)
	We-ef PFL-540	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	We-ef VFL-530 / VFL-540	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	LRL NXT Series C/S/M	✓	✓		✓	✓					✓
	Sylvania RoadLED	✓				✓					✓
	Sylvania StreetLED MkIII		✓			✓					✓

Reference Image	Name/ Reference	Typical Applications						Approvals			
		Cat-V (Major Road)	Cat-P (Minor Road)	Streetscape or Town Centres	Pathway	Carpark	Public Activity Area	ADSA Approved	ADSA Prized	ADSA Prized Wildlife	AEMO (Rate 3)
	Philips RoadFlair	✓	✓			✓					✓
	We-ef ASP530		✓	✓	✓		✓				✓
	Sylvania Avenue MkII		✓	✓	✓		✓				✓
	AEC Arya TP			✓			✓		✓		✓

14.3 Appendix C: *AS/NZS 61439.1* user information template

The following table has been extracted from *AS/NZS 61439.1* and can be used (in conjunction with the standard and project specific design documentation) as a basis for the Council user requirements under the standard.

Characteristics	Default arrangement	Council requirement
Electrical System		
Earthing system	Selected to suit local requirements	M.E.N. (TN-C-S)
Nominal voltage (V)	To local installation conditions	230V / 400V
Transient over-voltages	Determined by the electrical system	Category III
Temporary overvoltage's	Nominal system voltage + 1,200V	4kV
Rated frequency fn Hz	To local installation conditions	50 Hz
Additional on-site testing requirements – wiring, operational performance & function	Suit application	Refer Section 12
Short-circuit withstand capability		
Prospective short-circuit current at supply terminals Icp (kA)	Determined by the electrical system	Suit design conditions (min. 10kA)
Prospective short-circuit current in the neutral	Max. 60% of phase values	Max. 60% of phase values
Prospective short-circuit current in the protective circuit	Max. 60% of phase values	Max. 60% of phase values
SCPD in the incoming functional unit requirement	SCPD Required	SCPD Required
Co-ordination of short-circuit protective devices including external short-circuit protective device details	According to local installation conditions	To be coordinated with upstream protection
Data associated with loads likely to contribute to the short circuit current	Suit application	Typically, no loads likely to have a significant impact
Protection of persons against electric shock in accordance with IEC 60364-4-41:		
Type of protection against electric shock – basic protection (protection against direct contact)	Basic protection	Basic protection – combination of insulation and barrier / enclosure
Type of protection against electric shock – fault protection (protection against indirect contact)	According to local installation conditions	Combination of: Automatic disconnection of supply Electrical separation Component insulation
Installation environment		

Characteristics	Default arrangement	Council requirement
Location type	Suit application	External environment, subject to coastal influence
Protection against ingress of solid foreign bodies and ingress of water	Indoor (enclosed): IP2X Outdoor (min): IP23	Cabinet: IP56 (min) Internal components: IP2X (min) 5o (min) sloping roof
External mechanical impact	None	IK10
Resistance to UV radiation (applies for outdoor assembles only unless specified otherwise)	Indoor: not applicable Outdoor: Temperate climate	Temperate climate
Resistance to corrosion	Normal indoor/outdoor arrangement	Suitable for outdoor environments with coastal influence
Ambient air temperature – Lower limit	Indoor: -5oC Outdoor: -25oC	-10oC
Ambient air temperature – Upper limit	40oC	50oC
Ambient air temperature – Daily average maximum	35oC	35oC
Maximum relative humidity	Indoor: 50% @ 40oC Outdoor: 100% @ 25oC	100% @ 25oC
Pollution degree (of the installation environment)	Industrial: 3	Pollution Degree 3
Altitude	≤ 2,000m	≤ 2,000m
EMC environment (A or B)	A/B	Environment B
Special service conditions (e.g., vibration, exceptional condensation, heavy pollution, corrosive environment, strong electric or magnetic fields, fungus, small creatures, explosion hazards, heavy vibration and shocks, earthquakes)	No special service conditions	Areas within 1km of shoreline subject to coastal influence. Provide insect proofing over ventilation openings.
Installation method		
Type	Manufacturer's standard	Pole / plinth (refer Section 8)
Stationary / movable	Stationary	Stationary
Maximum overall dimensions and weight	Suit application	Suit application
External conductor type/s	Manufacturer's standard	Cable
Direction/s of external conductors	Manufacturer's standard	Bottom entry / exit
External conductor material	Copper	Copper
External phase conductor, cross sections, and terminations	As defined within the standard	As defined within the standard
External PE, N, PEN conductors' cross sections and terminations	As defined within the standard	As defined within the standard
Special terminal identification requirements	Manufacturer's standard	Manufacturer's standard

Characteristics	Default arrangement	Council requirement
Storage and handling		
Maximum dimensions and weight of transport units	Manufacturer's standard	Manufacturer's standard (including consideration of industry standard WHS and safety-in-design obligations)
Methods of transport (e.g., forklift, crane)	Manufacturer's standard	
Environmental conditions different from service conditions	As per service conditions	As per service conditions
Packing details	Manufacturer's standard	Manufacturer's standard
Operating arrangements		
Access to manually operated devices	None	Switchgear: Authorised persons. Control devices: Ordinary persons.
Location of manually operated devices	Easily accessible	Easily accessible. Manually operated devices segregated from live terminals/ components by fixed barriers.
Isolation of load installation equipment items	Manufacturer's standard	Manufacturer's standard
Maintenance and upgrade capabilities		
Requirements related to accessibility in service by ordinary persons; requirement to operate devices or change components while the assembly is energised	Basic protection	Basic protection. Ordinary persons able to operate designated control devices only. No access to live components when energised.
Requirements related to accessibility for inspection and similar operations	No requirements for accessibility	Inspection by authorised/ qualified persons only.
Requirements related to accessibility for maintenance in service by authorised persons	No requirements for accessibility	Maintenance by authorised/ qualified persons only.
Requirements related to accessibility for extension in service by authorised persons	No requirements for accessibility	Upgrades by authorised/ qualified persons only.
Method of functional units' connection	Manufacturer's standard	Manufacturer's standard
Protection against direct contact with hazardous live internal parts during maintenance or upgrade (e.g., functional units, main busbars, distribution busbars)	No requirements for protection during maintenance or upgrade	Maintenance/upgrades by authorised/qualified persons only. No maintenance/ upgrade works carried out on live equipment.
Current carrying capability		
Rated current of the assembly InA (A)	Suit application	Suit application (refer project documentation)
Rated current of circuits Inc (A)	Suit application	Suit application (refer project documentation)
Rated diversity factor	As defined within the standard	RDF for whole assembly

Characteristics	Default arrangement	Council requirement
Ratio of cross section of the neutral conductor to phase conductors: phase conductors up to and including 16mm2	100%	100%
Ratio of cross section of the neutral conductor to phase conductors: phase conductors above 16mm2	50%	100%

14.4 Appendix D: Position Statement - Use of Residual Current Device (RCD) Protection in Public Area Lighting Installations

Organisational Position Statement

Use of Residual Current Device (RCD) protection in public area lighting installations

Scope and Application

This position statement provides guidance on the application and potential omission of Residual Current Device (RCD) protection for Sunshine Coast Council (SCC) controlled electrical, lighting and ITS infrastructure installed in the public realm in accordance with the current legal regulatory framework. SCC manages electrical risks to ensure that its electrical safety obligation is properly discharged. Note that this position statement does not apply to sports fields and holiday park infrastructure.

Fundamental Principles

As an organisation conducting a business or undertaking (PCBU) under the current legal regulatory framework (including Electrical Safety Act (2002), the Electrical Safety Regulation (2013), Work Health and Safety Act (2011), WHS Act and associated standards) has a primary duty of care and is responsible for the safety during the whole of asset life cycle - planning, design, construction, operation, maintenance, and disposal of a variety of electrically operated equipment in the public space.

All electrical installations provided by, or on behalf of SCC must comply with the fundamental requirements as established in the current legal regulatory framework as stated above. Compliance with these fundamental principles is critical to ensure the safety of SCC electrical installations. Nothing in this position statement requires or authorises a Councillor, employee of Council or a third party acting on behalf of Council to act in any way that is contrary to these fundamental principles.

Background

AS/NZS 3000 (also known as the "Wiring Rules") sets out the minimum mandatory requirements for low voltage electrical installations (as mandated through relevant QLD legislation). AS/NZS 3000 requires protection against dangers that may arise from contact with exposed conductive parts that may become live under fault conditions.

The Wiring Rules are mainly divided into two parts:

- **Part 1** provides uniform essential elements that constitute the minimum regulatory requirements for a safe electrical installation, design, and installation.
- **Part 2** provides installation practices that achieve certainty of compliance with the essential safety requirements of Part 1.

Under part 1, for new design and construction, wiring rules prescribes four different fault protection methods under **Clause 1.5.5.2** as below:

(a) *Automatically disconnect the supply on the occurrence of a fault likely to cause a current flow through a body in contact with exposed conductive parts, where the value of the current is equal to or greater than the shock current, in accordance with Clause 1.5.5.3*

(b) *Prevent a fault current from passing though a body by the use of class ii equipment or equivalent insulation, in accordance with Clause 1.5.5.4*

(c) *Prevent a fault current from passing though a body by electrical separation of the system, in accordance with Clause 1.5.5.5.*

(d) *Limit the fault current that can pass through the body to a value lower than the shock current.*

Residual Current Devices (RCD's) are required under AS/NZS 3000 to provide additional protection *in areas where excessive earth leakage current in the event of a failure of other measures of protection or carelessness by users could present a significant risk of electric shock (AS/NZS 3000:2018 Clause 2.6.1).*

AS/NZS 1158 (Lighting for roads and public spaces) sets out requirements for provisioning of public lighting to provide an illuminated environment conducive to the safe and comfortable movement of vehicular and pedestrian traffic at night, and for the discouragement of illegal acts.

There are instances where the disconnection of the circuit due to earth leakage could create safety or operational risks greater than that posed by the presence of the leakage current. The use of RCD's in public lighting installations can potentially create safety hazards resulting from disconnection of lighting circuit/s during normal operation of the lighting. RCD tripping under normal operating conditions is referred to as "nuisance tripping". To mitigate this issue, AS/NZS 3000 allows an exception to the RCD installation requirement in *situations where the disconnection of a circuit by an RCD could cause a danger greater than earth leakage current (AS/NZS 3000:2018 Clause 2.3.3.2.3.3 Exception 2).*

Risk Assessment

SCC electrical installations in the public realm support a number of applications from public amenity through to critical traffic management and road safety functions. Critical applications include Traffic signals, road lighting and pathway lighting (where provided for safety in accordance with AS/NZS 1158.3). Risks associated with these installations have been assessed using Council's standard WHS risk assessment template.

Sunshine Coast COUNCIL

WH&S RISK CALCULATOR

Likelihood \ Consequences	Insignificant None or very minimal injuries	Minor First aid treatment only	Moderate Medical treatment required	Major - Major medical treatment required	Catastrophic Life threatening injuries or death
Almost Certain: Expected to occur at most times (eg, 3 per year)	M-28	M-40	H-60	E-88	E-100
Likely: Will probably occur at most times (eg, 1 per year)	L-16	M-36	H - 56	E-84	E-96
Possible: Might occur at some time (eg, 1 per 5 years)	L-12	M-32	M-52	H-72	E-92
Unlikely: Could occur at some time (eg, 1 per 5 to 15 years)	L-8	L-24	M-48	H-68	H-80
Rare: May occur in rare conditions (eg, unlikely during next 15 years)	L-4	L-20	M-44	H-64	H-76

Disconnection of electrical circuits to critical installation (resulting from nuisance tripping of an RCD) can have the potential to create the following safety risks.

Risk Description	Likelihood	Consequence	Risk Rating
Inoperability of traffic signals at intersection resulting in major vehicle / pedestrian accident.	Likely	Major	E-84
Absence of adequate lighting on Category V roadway resulting in major vehicle accident	Likely	Major	E-84
Absence of adequate lighting on Category P roadway resulting in major vehicle accident	Likely	Major	E-84
Absence of adequate lighting at pedestrian crossing resulting in vehicle-pedestrian impact.	Possible	Catastrophic	E-92
Absence of adequate lighting within public open space (eg. pathway, carpark, etc) resulting in injury due to illegal activities (eg. violent crime).	Possible	Major	H-72
Absence of adequate lighting within public open space (eg. pathway, carpark, etc) resulting in injury from slips, trips or falls.	Possible	Minor	M-32

The risk of electric shock resulting from inadvertent contact with exposed conductive parts of a traffic signals or public lighting installation has been assessed for different installations as described in the table below.

Risk Description	Likelihood	Consequence	Risk Rating
Injury from electric shock resulting from contact with live, conductive parts of a traffic signals installation.	Unlikely	Minor	L-24
Injury from electric shock resulting from contact with live, conductive parts of a lighting installation on a Category V roadway.	Unlikely	Minor	L-24
Injury from electric shock resulting from contact with live, conductive parts of a lighting installation on a Category P roadway.	Unlikely	Minor	L-24
Injury from electric shock resulting from contact with live, conductive parts of a lighting installation at a formalised pedestrian crossing.	Unlikely	Minor	L-24
Injury from electric shock resulting from contact with live, conductive parts of a lighting installation in a public open space (eg. pathway, carpark, etc).	Unlikely	Minor	L-24

Position Statement

Based on the above risk assessment, SCC are adopting the following position on the omission of RCD's for electrical installations in the public realm.

Due to the criticality of the infrastructure and increased danger represented through inadvertent disconnection of that infrastructure, SCC have deemed that RCD protection may be omitted in the following installations:

- Final subcircuits supplying traffic signal installations (all areas).
- Final subcircuits supplying category V road lighting.
- Final subcircuits supplying category P road lighting.
- Final subcircuits supplying category PX pedestrian crossing lighting.
- Final subcircuits supplying category P lighting in a public open space (provided in accordance with AS/NZS 1158.3.1).

The omission of RCD protection is in accordance with AS/NZS 3000:2018 Clause 2.3.3.2.3.3 Exception 2.

Additional Risk Control Obligations

Where the RCD exemption is utilised, the following additional risk control measures will be implemented to ensure the risk of electric shock due to the omission of the RCD protection is minimised:

- The electrical installation shall be fully compliant with all other requirements of AS/NZS 3000, including AS/NZS 3000:2018 Clause 5.7.2 (a) and Appendix B4.3 with regards to disconnection times. A disconnection time of 0.4s shall be utilised for all protection devices supplying final sub-circuits to equipment that may be subject to a dangerous touch potential (eg. a light pole in a road reserve).
- All live equipment and terminations shall only be accessible by qualified, licenced personnel who are trained to perform the operational / maintenance activity required. Operation and maintenance activities shall be carried out in accordance with relevant safe work method statement/s or procedures.
- All equipment shall be labelled to indicate the omission of RCD protection.

For installations subject to high pedestrian interaction, one (or more) of the following additional control measures must be utilised:

- The use of composite (non-conductive) pole types.
- All in-pole cabling to be double insulated, with terminals shrouded.
- The use of Class 2 luminaires.

SCC are also committed to maintaining safe, compliant electrical installations and as such will undertake appropriate asset management and associated maintenance activities to minimise electrical safety risks associated with the degradation of infrastructure.

14.5 Appendix E: Position Statement - Use of Residual Current Device (RCD) Bypass Facilities for Event Power

Organisational Position Statement

Use of RCD Bypass Facilities for Event Power

Scope and Application

This position statement provides guidance on the application and usage of RCD bypass facilities for Sunshine Coast Council (SCC) provided event power provisions. This Position Statement is applicable for designers, installers and users of relevant infrastructure as nominated in this document.

SCC provides a variety of general power provisions throughout the Sunshine Coast region. These provisions can be either publicly accessible for general use, or controlled access by venue hirers for pre-approved events such as markets, concerts, street fairs and the like. Event usage is subject to approval from Council under *Community Land Permits -Temporary Event Application* process.

SCC is committed to providing facilities that enhance the usability of a public space while also maintaining a strong focus on public safety. The purpose of this Position Statement is to qualify the use of RCD bypass facilities under strict conditions whilst adhering to the fundamental safety principles as established by electrical standards.

Fundamental Principles

The SCC is responsible for the planning, design, construction, operation, maintenance and disposal of a variety of electrical installations in the public realm. All electrical installations provided by, or on behalf of SCC must comply with the fundamental requirements as established in the Electrical Safety Act (2002), Electrical Safety Regulation (2013), Work Health and Safety Act (2011) and associated standards. Compliance with these fundamental principles is critical to ensure the safety of SCC electrical installations. Nothing in this position statement requires or authorises a Councillor, employee of Council or a third party acting on behalf of Council to act in any way that is contrary to these fundamental principles.

Background

AS/NZS 3000 (also known as the “Wiring Rules”) sets out the minimum mandatory requirements for low voltage electrical installations (as mandated through relevant QLD legislation). AS/NZS 3000 requires automatic disconnection of the supply in the event of a fault between a live part and exposed conductive parts or a protective earthing conductor, to limit the prospective touch voltage arising between simultaneously accessible conductive parts. Disconnection of the supply is achieved by providing suitable circuit protective devices and the provision of a compliant earthing and bonding system.

RCD's are required under AS/NZS 3000 to provide additional protection *in areas where excessive earth leakage current in the event of a failure of other measures of protection or carelessness by users could present a significant risk of electric shock (AS/NZS 3000:2018 Clause 2.6.1)*. Currently, RCD protection is required/recommended for most final subcircuits with a rating of ≤32A. This represents the vast majority of SCC provided electrical circuits in the public realm.

There are instances where the specific nature of specialised equipment connected to an SCC provided power outlet could cause an RCD to trip through its normal (safe) operation, thus preventing that connected equipment from performing its intended function. Such examples include:

- Large events (eg. music festivals, markets etc) whereby an SCC provided power outlet is used to supply third party provided sub-distribution equipment (eg. temporary distribution switchboard/s etc).
- Specialised equipment (eg. carnival equipment such as Ferris wheels etc).

To mitigate the loss of supply through normal operation of such equipment, AS/NZS 3000 allows an exception to the RCD installation requirement for *Final subcircuits installed for the connection of specific items of equipment, provided that the connected equipment is designed, constructed, and installed in such a manner that is not likely to present a significant risk of electric shock and:*

- *Is required by the owner or operator to perform a function that is essential to the performance of the installation and that function would be adversely affected by a loss of supply caused by the RCD operation; or*
- *May cause spurious nuisance tripping through high leakage current being generated in the normal operation of the equipment.*

(AS/NZS 3000:2018 Clause 2.3.3.2.3.3 Exception 3).

Position Statement

To address the potential loss of supply resulting from spurious RCD tripping, and ensure major event operators have access to a safe, reliable power supply for the performance of their intended function, SCC have adopted the following position on the omission of RCD protection on certain power outlet provisions.

RCD protection **must** be provided to **all** power outlets provided for public use (controlled or uncontrolled access).

A key-operated RCD bypass facility **may** be provided to allow temporary bypass of outlets intended for controlled access for specialised use. These would typically be limited to 3-phase outlets rated ≥ 20A. Bypass facilities **shall not** be provided for any other connection/outlet type.

The omission of RCD protection (through the use of a keyed bypass facility) is in accordance with AS/NZS 3000:2018 Clause 2.3.3.2.3.3 Exception 3.

Additional Risk Control Obligations

Where an RCD bypass facility is installed or operated, the following risk control measures shall be implemented to ensure the risk of electric shock due to the omission of the RCD protection is minimised:

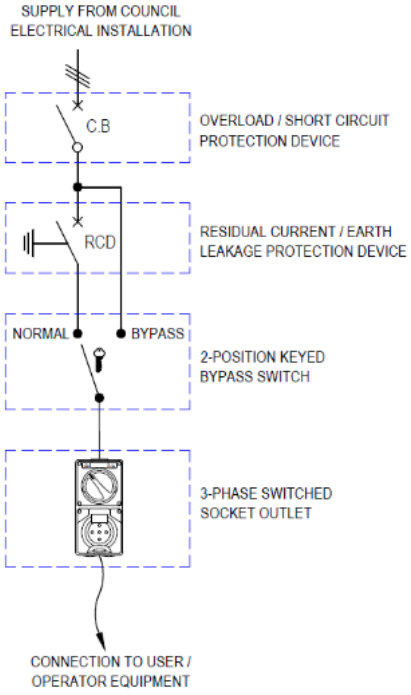
- The electrical designer / installer (acting on behalf of SCC) shall ensure:
  - The electrical installation is fully compliant with all other requirements of AS/NZS 3000, including AS/NZS 3000:2018 Clause 5.7.2 (a) and Appendix B4.3 with regards to disconnection times. A disconnection time of 0.4s shall be utilised for all protection devices supplying final sub-circuits to equipment that may be subject to a dangerous touch potential.
  - The RCD bypass facility is key operated, with keying to SCC requirements.
  - The RCD bypass facility is appropriately labelled (with permanent labelling) to nominate that the bypass shall only be operated in accordance with the requirements of this Position Statement.
  - The outlet associated with the bypass is appropriately labelled (with permanent labelling) to nominate that the outlet is not RCD protected when the bypass facility is in use.
- The user / operator of the RCD bypass facility shall ensure:
  - They have approval from SCC for the event/application and have requested the associated requirement to utilise the bypass facility. As part of the request, the user / operator should provide:
    - Justification for the use of the RCD bypass.
    - Confirmation that their temporary installation will comply with relevant standards (eg. AS/NZS 3000, AS/NZS 3001, AS/NZS 3002).
    - Confirmation that any of their portable equipment and/or circuit protection (ie. sub-distribution RCD's) have been tested/tagged in accordance with the requirements of AS/NZS 3017, AS/NZS 3019, and AS/NZS 3760

    Keys will be provided by SCC as part of this approval process.
  - The bypass facility is operated by a qualified/licenced electrician only.
  - Any equipment or wiring that is connected to the SCC provided outlet is fully compliant with AS/NZS 3000 and/or AS/NZS 3002 (as applicable), with relevant sub-circuits in a sub-distribution scenario provided with appropriate RCD protection in accordance with relevant standards.
  - Appropriate mechanical protection is provided to the cabling between the non-RCD protected SCC outlet and the connected equipment to prevent inadvertent contact or tampering from members of the public (refer AS/NZS 3002 for specific guidance).

SCC are also committed to maintaining safe, compliant electrical installations and as such will undertake appropriate asset management and associated maintenance activities to minimise electrical safety risks associated with the degradation of infrastructure.

Sample RCD Bypass Schematic

The following diagram is provided as an example of an RCD bypass circuit (for reference purposes only).



14.6 Appendix F: Turtle lighting design principle

Turtle safe lighting - (light management for marine turtles)

Note: This section should be read in conjunction with:

- *LIM Environmental of fauna and flora*

Marine turtle nesting occurs on **ALL** Sunshine Coast beaches from November to March. Marine turtles and their nests are protected under Commonwealth and State legislation.

Not all beaches are suitable incubators or safe nesting sites. To nest successfully, marine turtles require sandy beaches with access to the ocean. When sexually mature, breeding female turtles migrate back to the general area (within approximately 100 km) of the beach where they were hatched, to nest.

Lighting is a significant threat to marine turtles. The disturbance caused by brightly illuminated coastal communities can force marine turtles to move to a darker beach to lay their eggs.

Artificial light impacts nesting beaches from as far away as 20km. Any projects within this area should consider the lighting principles discussed below.

High priority nesting beaches include Buddina, Shelly, Yaroomba and North Bribie beaches, but all beaches are a priority for light mitigation.

Hatchlings emerge from their nest between January and March each year. This emergence is most commonly at night and on naturally dark beaches. They crawl seaward, towards the lowest and brightest horizon illuminated by moon and star light. At marine turtle nesting beaches close to urban or industrial locations, the brightest horizon is landward originating from artificial lights on man-made structures and street lights. This artificial light can disrupt a turtle hatchling's capacity to see the natural seaward horizon. The impact of the light causes disorientation (confusion) and misorientation (misdirection) when they crawl toward artificial light sources and reduces their chance of survival. In addition, hatchlings that reach the sea can be enticed back to land by strong artificial lights.

The long-term survival of a breeding population may be jeopardised if too few hatchlings from a nesting area survive to maturity.

Darkness is the best lighting management option at turtle nesting beaches.

- All industrial and urban light types, including tungsten, fluorescent, mercury vapour, high pressure sodium, low pressure sodium and amber LED can be disruptive to sea turtle ocean finding behaviour if not managed correctly.

  High intensity bright white lights rich in short wavelength blue light are typically the most disruptive to marine turtles. Any uncontrolled light may be scattered by sea spray and reflected from clouds, causing sky glow over large areas of the sky above nesting beaches.
- In Australia, amber LEDs are the most available and preferred light types for coastal areas adjacent to turtle nesting beaches.

See the following for further guidance:

- *Recovery Plan for Marine Turtles in Australia - Australian Government in conjunction with the Queensland Government*
- *National Light Pollution Guidelines for Wildlife Including Marine Turtles, Seabirds and Migratory Shorebirds, Commonwealth of Australia 2020*

It is recommended that all developed areas along the coastline of the Sunshine Coast comply with the advice given under the UNEP SSAP *(United Nations Environment Program Single Species Action Plan)*:

Objective	Actions
Manage coastal lighting at significant loggerhead turtle nesting beaches to create a dark coastline	Ensure there is no direct light source visible to the nesting beaches. Reduce reflected light illuminating the sky/ salt spray above and behind nesting beaches.

Turtle biologists have predicted that over the next 50-100 years, loggerhead turtles may undertake a southward shift in nesting in response to climate change, specifically identifying the Sunshine Coast as a potential major rookery for the species. Therefore, the protection of coastal habitat and management of light impacts associated with development adjacent to potential nesting beaches on the Sunshine Coast is of national and international importance to the loggerhead turtle.

Design to protect turtle nesting

Lighting and other infrastructure must be installed to ensure there is no interference with known nesting sites.

Marine turtles are a threatened species, protected under State and Federal legislation and International agreements and action plans.

The *Commonwealth Recovery Plan for Marine Turtles* and *UNEP Single Species Action Plan* for the loggerhead turtle (South Pacific Genetic Stock) advocate the following **-All designs within 100 metres of a nesting beach must follow the four guiding principles to minimise light impacts on turtles:**

- **Keep it off**
  - Consider motion activated light sensors, or timers on lights. Timers may be adjusted during critical nesting times to minimise disruption.
  - Consider turning lights off for short periods. At particularly sensitive sites, turning lights off manually during hatching periods, would minimise the disruption caused by artificial lights. Extra volunteers would be required to help direct pedestrians.
  - The *Single Species Action Plan for Loggerhead Turtles in the South Pacific Ocean* recommends that an '8pm lights off' initiative is a realistic and consistent goal to ask of local residences, businesses and visitors that are located near nesting beaches (within 2.0 km).
- **Keep it shielded**
  - Position lights to face away from the beach.
  - Direct lights downwards.
  - Design facilities to avoid light spill onto the beach and sea surface.
  - Shield light bulbs to control excess light spill into the atmosphere and to prevent sky glow.
  - Use natural topography, plant vegetation buffers / screens to shield the beach from light.
  - Design surfaces on structures and ground coverings to avoid reflection, so light is not reflected towards beaches or upwards (to reduce sky glow).
- **Keep it low**
  - Reduce heights of car park and pathway lights where possible. Consider a shorter pole height of 3.5m for car park lighting to reduce travelling glow (typical car park pole height 4.5m).
  - Use 3,000 Kor lower colour temperature light fixtures. Pathway lighting should use PP4 (pedestrian and cyclist paths) and PR3 or PR4 (local roads) Category lighting.
  - Minimise the wattage and the number of light fixtures.
  - Use reflective materials to delineate pathways and embed lighting where possible.
  - Design lighting to avoid 'over the horizon glow' above significant nesting areas.
  - Design light fixtures that are mounted low, shielded and aligned to direct light onto the target area only. Examples include:
    - embedded LED stud lights (not pointed into sky)
    - recessed lighting.
- **Keep it long**
  - Use light fixtures that emit long wavelength (e.g. 550 - 700 nanometres) yellow, orange and red light and is less intense (so less visible to turtles), then a white, blue or green light at the same wattage.
  - Consider using amber LED lighting. This type of lighting minimises disturbance to the surrounding environment and are the best choice for nesting turtles.

See *Figure A: Guiding principles for turtle friendly design (within 100m of turtle nesting beaches)* for further guidance.

Additional strategies

Additional strategies and elements that should also be considered to minimise the effects of artificial lighting on turtle nesting beaches while maintaining safety standards include:

LED lights provide good 'cut off' lighting, meaning there is no excess light throw outside the light beam. This allows better control of light in unwanted areas.

- Generally, council does not provide lighting to beach accesses.
- Consider use of window tinting to reduce emission of internal lights.

  Avoid white halogen, metal halide or fluorescent lights where possible and only use white lights in contained areas where colour rendition is required.
- Plan construction and maintenance activities for daylight hours only or avoid turtle nesting season where possible.
- Design for the minimum number, height and intensity of lights necessary
- Signage or lighting should be accompanied by substantial vertical shielding to reduce sky glow
- Signage designed to be read at all hours of the day, including after dark (e.g., turtle awareness, educational content) should contain reflective surfaces to reduce the need for artificial lighting.
- Using bollard lighting as the only light source for pathways, does not meet Australian Standards because they do not provide enough light to identify pedestrian faces. They are also prone to damage by mowers and vandalism.

Site risk assessment and budget

Each individual site located near a nesting beach must be assessed for risk, such as impact from existing, and future uses relating to lighting and site function. In most cases, potential conflicts and elements that may disrupt and disorientate turtles, can be designed out of a proposed development.

Budget should be allocated to allow for the potential additional costs to achieve turtle friendly outcomes. All final designs must be assessed and approved by a Council's TurtleCare Coordinator prior to finalisation. The designer must ensure the turtle friendly elements agreed upon are carried through to construction.

- Once infrastructure is built, undertake an audit of the lights visible from nesting beaches and where possible, the project related sky glow overhead.
- Where lights illuminate nesting beaches or the sea:
  - Screen the affected habitat from the light source.
  - During the nesting season, arrangements should be made to turn off lights that are impacting upon the nesting site.

For further information contact Department of Environment and Science.

See the following LIM categories for further guidance:

- *LIM Beach Infrastructure* (for turtle friendly fence designs)
- *LIM Environmental management of fauna and flora* (Preliminaries).

Turtle safe lighting (light management for marine turtles)

Legend

1 Shelter lighting
- light recessed within shelter.
- timer lights, off after 8pm OR
- lighting not installed. Limit the use to daylight hours only. Case by case basis.

2 Pedestrian pathway lighting
- position lights so that they face away from nesting beaches; see *Figure 2* for guidance
- reduce reflected light illuminating the sky / salt spray, above and behind nesting beaches
- consider shorter light poles, timers, monochromatic (orange) LED shielded lighting
- use reflective materials to delineate pathways and use embedded lighting where possible, however be careful to not create results where lights are pointing directly up into the sky.

3 Car parks and lighting
- new car parks should be positioned a minimum 100m from nesting beaches
- car parks that provide lighting, consider shorter light poles, timers, and monochromatic (orange) LED lighting shielded lighting.

4 Amenity lighting
- lights shielded and set back inside architectural features.

5 Signage
- use reflective signage where possible to reduce lighting needs
- commonly designed for day use.

6 Beach accesses
- lights must not be directly visible from the beach
- lights should be shielded behind buildings or a vegetation screen.

7 Natural vegetation and planting
- use natural topography, plant vegetation buffers or use structures to shield the beach from light.

8 Turtle friendly fencing
- allows turtle access into protected dunal areas and known nesting locations
- see *LIM Beach Infrastructure* for further guidance to identify suitable fence types.

Figure A: Guiding principles for turtle friendly design (within 100m of turtle nesting beaches)
(not to scale – for guidance only – site specific design required)

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