Engineering Construction Specification

C22 Public Lighting

Print version is uncontrolled. Current version is maintained on Wingecarribee Shire Council Website in searchable PDF format.

This document is a modified version of AUS-SPEC 1197 Street and Public Lighting October 2018 version

Working with you

WSC.NSW.GOV.AU

Wingecarribee
SHIRE COUNCIL

Table of Contents

1 General

1.1 Responsibilities

1.1.1 General

Requirement: Provide street lighting and electrical systems, as documented.

1.1.2 Design and Construct contracts

Requirement: Complete the requirements documented in **PRE-CONSTRUCTION PLANNING** and conform to **MATERIALS**, **EXECUTION** and the **ANNEXURES**.

1.1.3 Construct only contracts

Requirement: Conform to the requirements documented in **MATERIALS**, **EXECUTION** and the non-design requirements of the **ANNEXURES**.

Authority Requirements

General: Liaise with and comply with the requirements of the local network distributor. CROSS REFERENCES

1.1.4 General

Requirement: This worksection is not a self-contained specification. In addition to the requirements of this worksection, conform to the following:

- *C01 General requirements (Construction)*
- *C02 Quality management (Construction)*
- *C03 Control of traffic*
- *C04 Control of erosion and sedimentation (Construction)*
- *C13 Road openings and restoration*
- *C28 Auxiliary concrete works*

1.2 Standards

1.2.1 General

Lighting for roads and public spaces: To the AS/NZS 1158 series.
Design for intersections and crossing: Austroads AGRD04.
Design for roadside environment: Austroads AGRD06B.
Luminaires: To SA/SNZ TS 1158.6 and AS/NZS 60598.2.3.
Electrical installations: AS/NZS 3000.

1.2.2 Minimum energy performance standards (MEPS)

General: To AS/NZS 4782.2, AS/NZS 4783.2 and AS 4934.2.
Self-ballasted lamps: To AS/NZS 4847.2.

1.3 Interpretation

1.3.1 Abbreviations

General: For the purposes of this worksection the following abbreviations:

- CCT: Correlated colour temperature.
- CIE: International Commission on Illumination.
- CRI: Colour rendering index.
- HID: High intensity discharge.

- IES: Illuminating Engineering Society.
- LED: Light-emitting diode.
- PE: Photoelectric.

1.3.2 Definitions

General: For the purposes of this worksection the definitions given in Austroads AP-C087 and the following definitions apply:

- Control system (AUS-SPEC): A lighting control system comprising a combination of some or all of the following:

  Automatic sensing and control components.

  Computer interface for programming.

  Dimming systems.

  Manual overrides.

  Motion detection sensors (occupancy sensors).

  Timers.
- Electricity distributor: Any person or organisation that provides electricity from an electricity distribution system to one or more electrical installations. Includes distributor, supply authority, network operator, local network service provider, electricity retailer or electricity entity, as may be appropriate in the relevant jurisdiction.
- Proprietary luminaires: Luminaires available as a catalogue item.

1.4 Submissions

1.4.1 Authority approval

Design: Submit evidence of electricity distributor approval of the design.

1.4.2 Design documentation

Design and Construct contracts: Submit design documents to **PRE-CONSTRUCTION PLANNING**.

1.4.3 Products and materials

Proprietary equipment: Submit manufacturers' information for luminaires, fittings and accessories.

1.4.4 Records

Evidence of compliance: Submit documentation confirming all works conforms to this worksection and the electricity distributor's requirements.
Audit: Submit results of verification testing and evidence of satisfactory inspection by the electricity distributor on completion of commissioning and testing.

1.4.5 Variations

Columns directly buried in the ground: If the soil is unsuitable for installing columns in the ground, submit details of alternative pole mounting method.

1.4.6 Warranties

Manufacturer's warranty: Submit the manufacturer's published product warranties.

1.5 Inspections

1.5.1 Notice

General: Give notice so that inspection may be made of the following:

- Footings for base mounted columns: Formwork and anchor bolt assembly location.
- Power cables: Completed installation of cabling including trenching if required.
- Audit: Commissioning and verification testing.

2 Pre-construction planning

2.1 Network distribution

Approvals: obtain documented approval of the design from the local network distributor.
The provision of underground electricity to service shall be in accordance with the requirements of the local network provider, obtain documentary evidence from the network provider qualifying that the requirements of the provider have been met.

2.2 Lighting design criteria

The design, drawing and construction shall be done by different levels in Accredited Service Providers (ASP) in accordance with part 10 of the NSW Electricity Supply(general) Regulation 2001.
Note: In addition to Accreditation from NSW industry & Investment, ASP must hold authorisation from Integral Energy for work on or near its network.

2.2.1 General

Requirement: Design the street lighting installations to the following:

- Vehicular traffic category V: To AS/NZS 1158.1.1 and AS/NZS 1158.1.2.
- Pedestrian areas Category P: To AS/NZS 1158.3.1.
- Pathways and cycleways: To AS/NZS 1158.3.1.
- Pedestrian crossings: To AS/NZS 1158.4.
- Tunnels and underpasses: To AS/NZS 1158.5.

Lighting design strategy: Make sure the documented installations meet the following principles:

- Safety and comfort: Provides a safe and comfortable visual environment for pedestrians/cyclists/drivers at night.
- Aesthetic quality: Enhances the pedestrian spaces and parks and provides good colour rendition to give people and surrounds a natural appearance.
- Sustainability: Maximises efficiency and minimises greenhouse gas emissions by using LED technology where possible.
- Minimise street clutter: Coordinated with other lighting elements.

2.2.2 Safety and amenity

Requirement: Design the street lighting installations to maintain and enhance the security of the Work area and at least meet the following:

- Provide a sense of safety by allowing pedestrians to see and be seen.
- Minimise glare: Prevent glare, blind spots, light spill and light pollution.
- CCTV: If required, make sure the lighting level provided is sufficient so that clear, high resolution digital images can be captured.
- Vandalism: With luminaire selection and mounting height that does not provide opportunities for vandalism.
- Direction signage and maps: Adequately illuminate to facilitate clear, safe wayfinding and orientation.

- Encourage active transport at night.

2.2.3 Sustainability

Requirement: Design the street lighting installations to meet the following:

- Minimise energy consumption: Through the establishment of appropriate lighting levels and luminaire and equipment selection.
- Asset management and maintenance:

  Material and design of luminaires and support, including brackets, to withstand the environmental conditions of the site.

  Fixings: Concealed and tamperproof.

2.2.4 Park lighting

Requirement: Design park lighting installations as appropriate for the size, location, circulation patterns/access and use of the park. Conform to the following:

- Main pathway: Extend park lighting off the main pathway.
- Glare: Minimise glare sources.
- Additional lighting applications: Integrate tree and furniture lighting to improve the perception of safety and increase park activity.
- Lighting level: Provide sufficient lighting level to the main park pathways and park perimeter to assist navigation and wayfinding.
- Visibility: Maximise the visibility the pedestrian has of the whole park.

2.3 Design documentation

2.3.1 General

Design information: Prepare documentation, including the following:

- Lighting design report: Include details of non-conforming design elements, whole of life cost analysis, and how construction of the project will be managed so that the design is successfully implemented.
- Lighting design drawings: Include details of the following:

  Existing and proposed electrical load of the lighting circuits.

  Cable offsets: Existing cable locations and offsets that are maintained by the electricity distributor.

  Distribution pole attachment details.

  Lighting details: Lighting classification and subcategory, mounting height, tilt, maximum spacing and any non-conforming portions.

  Lighting schedule: With details of lamps, luminaires, brackets, columns, mounting heights, and other equipment.
- Details of the design method used: Include the values of the light technical parameters obtained, for each road element, compared to the limiting values in the AS/NZS 1158 series.
- Computer analysis information: To the AS/NZS 1158 series.
- Luminaire intensity distribution tables: IES or CIE format, as appropriate, and the origin of this photometric data.
- Computer program used: The name and source of the program and a statement with details of conformance to the requirements of AS/NZS 1158.2.
- Details of the road surface reflection characteristics: Assumed in luminance-based design calculations.

- Maintenance: Justification for the maintenance factor used in the calculations and associated schedule of maintenance, e.g. for luminaire cleaning and or lamp replacement intervals.
- Cross-section drawings: Showing proposed column type, setbacks, outreach arm, luminaire offset, luminaire and a plan showing potential light spill if in an existing residential area.

2.3.2 Designer qualifications

Requirement: Use only persons appropriately experienced and qualified to undertake the lighting and electrical design work.

2.3.3 Authority requirements

Requirement: Liaise with and conform to the requirements of the electricity distributor.
Approvals: Obtain documented approval of the design from the electricity distributor.

2.3.4 Standards

Materials: All materials to the Network Distributors standards.
Columns, outreaches, brackets, adaptors, Luminaires, fuse shall be from network distributor standards unless otherwise requested.

3 Materials

3.1 General

3.1.1 Standards

Materials: To the electricity distributor standards.

3.2 Proprietary luminaires

3.2.1 General

Requirement: Provide proprietary luminaires complete with lamps, luminaire control equipment, lighting control equipment, and accessories, as documented.
Lamp manufacturer: Provide lamps of the same type from the same brand and country of manufacture.
Self-ballasted lamps: To AS/NZS 60968 and AS/NZS 60969.

3.2.2 Luminaire body

Form and construction of the luminaire: To SA/SNZ TS 1158.6 Section 2.

3.3 Fluorescent lamps

3.3.1 Standards

General: To SA/SNZ TS 1158.6.
Fluorescent lamps: To AS/NZS 4782.1 and AS/NZS 4782.2.
Compact fluorescent lamps: To AS/NZS 4847.1 and AS/NZS 4847.2.

3.3.2 General

CCT: 4000 K or as documented.
Linear lamp type: T8 (26 mm diameter) or T5 (16 mm diameter), linear lamps, triphosphor, TL84, as documented.
Compact fluorescent lamps types: Four-pin, non-integrated type.

3.4 Fluorescent lamp ballasts

3.4.1 Linear lamp types

Requirement: Electronic fluorescent lamp ballasts for fluorescent lamp lighting systems selected for compatibility with the lamp and control method.
Electronic fluorescent lamp ballasts: Conform to the following:

- To AS/NZS 60929 and AS/NZS 61347.2.3.
- Current total harmonic distortion: < 15%.
- Soft start.
- Number of ballasts: Provide separate ballasts for each lamp or integral dual ballasts as an alternative for dual lamp fittings.
- Ballast performance measurement – fluorescent lamps: To AS/NZS 4783.1.

Reactive fluorescent lamp ballasts: Conform to the following:

- To AS/NZS 60921 and AS/NZS 61347.2.8.
- Connections: Quick-connect terminals or wiring, suitable for the operating temperature close to the ballast.
- Number of ballasts: Provide separate ballasts for each lamp.
- Ballast type: Low loss ballasts.
- Starters: Multi-pulse soft start voltage pulse type as follows:

  Starters (electronic type) other than glow starters: To AS/NZS 61347.2.1.

  Glow type Starters: To AS 4111 and AS/NZS 60155.

3.4.2 CFL lamp types

Requirement: Electronic fluorescent lamp ballasts for CFL lighting systems selected for compatibility with the lamp and control method.

- Electronic fluorescent lamp ballasts: To AS/NZS 61347.2.3 and AS/NZS 60929.
- Current total harmonic distortion: < 15%.
- Number of ballasts: Provide separate ballasts for each lamp or integral dual ballasts as an alternative for dual lamp fittings.

Ballast performance measurement – fluorescent lamps: To AS/NZS 4783.1.
Reactive fluorescent lamp ballasts: Conform to the following:

- To AS/NZS 60921 and AS/NZS 61347.2.8.
- Connections: Quick-connect terminals and wiring, suitable for the operating temperature close to the ballast.
- Ballast type: Low loss ballasts.
- Starters: Multi-pulse soft start voltage pulse type as follows:

  Starters (electronic type) other than glow starters: To AS/NZS 61347.2.1.

  Glow type Starters: To AS 4111 and AS/NZS 60155.

3.4.3 Fluorescent lamp power factor correction

Power factor correction on all luminaires: To minimum power factor of 0.9 lagging.

3.4.4 Power factor correction capacitors

Requirement: To SA/SNZ TS 1158.6 Section 4, AS/NZS 61048 and AS/NZS 61049.

3.4.5 Surge protection devices (SPD)

Requirement: Provide surge protection, as documented, metal oxide varistors fitted and installed as recommended by the electronic control gear manufacturer.
Minimum MOV value: 320 joules.

3.5 Discharge lamps (HID)

3.5.1 Standards

High pressure mercury vapour: To IEC 60188.
High pressure sodium vapour: To IEC 60662.
Low pressure sodium vapour: To IEC 60192.
Metal halide lamps: To IEC 61167.
Lamp controlgear for HID lamps: To AS/NZS CISPR 15, AS/NZS 60923, AS/NZS 61347.1 and the AS/NZS 61347.2 series.

3.5.2 Discharge lamp ballasts

Requirement: Ballasts for lighting systems selected for compatibility with the lamp and control method.
High-pressure mercury vapour, low-pressure sodium vapour, high-pressure sodium vapour and metal halide type: To AS/NZS 60923 and the AS/NZS 61347 series.
Metal halide type:

- ≤ 150 W: Reactors or electronic controlgear.
- > 150 W outdoor: To the lamp manufacturer's recommendation.

Igniters: If required, provide igniters which cut out when lamp ignites and after pre-determined time period if lamp fails to ignite.
Instant restrike igniters: If required, provide instant restrike igniters for instant restart of suitable HID lamps to the manufacturer's requirements.

3.5.3 HID power factor correction

Power factor correction on all luminaires: To minimum power factor of 0.9 lagging.

3.5.4 Capacitors

Standard: To AS/NZS 61048 and AS/NZS 61049.

3.5.5 Integral fuses

Requirement: Integral fuses for reactive high intensity discharge (HID) lamp ballasts.

3.6 Light-emitting diodes (LEDS) luminaires

3.6.1 General

Requirement: Provide light emitting diode (LED) luminaires, as documented, including integral LEDs, reflectors, lenses, heatsinks and drivers.

3.6.2 Light-emitting diode luminaires

Performance: LED luminous efficacy of the LED luminaire at normal operating temperature in its normal position and enclosure of > 60 lumens per watt.
Life of the LED in the complete luminaire: L70 to IES LM-80-2008 or as documented.
Colour: CRI > 80.
CCT: 3000K or as documented.

3.6.3 Light-emitting diode lamp replacement modules

Reflector lamps replacement modules luminous efficacy: At operating temperature in normal position and enclosure more than 40 lumens per watt where the quoted beam angle is the angle between the points of 50% of maximum luminous intensity.
Linear fluorescent lamps replacement modules luminous efficacy: > 80 lumens per watt.

3.7 Control gear enclosure

3.7.1 General

Standards: To SA/SNZ TS 1158.6 Section 3.
Requirement: Provide controlgear support enclosure within the body of the luminaire, except where remotely mounted controlgear is documented or required by the manufacturer.
Enclosures and controlgear mounting assemblies: Heat dissipation facilities to dissipate heat from the luminaire.
Controlgear enclosure: Form a barrier against direct contact with live parts of the controlgear and the area of the luminaire containing the lamp and lamp support holders.
Fixing: Screw fixed.

3.8 Lighting control

3.8.1 General

Automatic control systems: By use of photo-electric (PE) cells controlling groups of street lighting fittings.
PE cells: To the electricity distributor's requirements.

3.8.2 Manual controls

Requirement: Provide manual control of luminaires into groups, zones and to individual devices, as documented.
Control wiring: To the control system manufacturers' recommendation, with distinctive sheath colour.
Controllers and contactors: Rated for the characteristics of the controlled load and to AS/NZS IEC 60947.4.3.

3.9 Wiring systems

3.9.1 Selection

Cable selection: To AS/NZS 3008.1.1.
Wiring and cable reticulation systems: Provide systems appropriate to the installation conditions and the function of the load. Include the following:

- Underground services.
- Above-ground services.

Type: Re-wireable system.
Circuit arrangements: For long street lighting circuits, distribute the lighting load over three phases to the local network distributor requirements.
Neutral conductors: The same size as the corresponding active conductors. Rate the neutral conductor size for the maximum harmonic currents.
Cable support system: To AS/NZS 3000.

3.10 Power cables

3.10.1 Underground cable systems

Polymeric insulated cables: To AS/NZS 5000.1.

3.10.2 Cable

Requirement: Select multi-stranded copper cables.
Default insulation: V-75.
Default sheathing: 4V-75.
Minimum size of power sub-circuits: 2.5 mm^2.
Voltage drop: Select final sub-circuit cables within the voltage drop parameters dictated by the route length and load.
Fault loop impedance: Final sub-circuit cables to satisfy the requirements for automatic disconnection under short circuit and earth fault/touch voltage conditions.

3.10.3 Colours

Fixed wiring cables: Coloured conductor insulation or at least 150 mm of close fitting coloured sleeving at the termination points of each conductor.
Active conductors in single phase circuits: Red.
Active conductors in polyphase circuits:

- A phase: Red.
- B phase: White.
- C phase: Blue.
- Sheath: White.

3.10.4 Above-ground cable systems

Aerial cables: To AS 1746.
Requirements: To the electricity distributor's requirements.

3.11 Street lighting support Columns

3.11.1 General

Columns: For fabricated columns higher than 2400 mm, designed to support street lighting accessories, conform to the following:

- Public lighting poles: AS 1798.
- Concrete utility service poles: To AS/NZS 4065.
- Steel utility service poles: To AS/NZS 4677.
- Hot-dipped galvanized (zinc) coatings on ferrous articles: To AS/NZS 4680.

3.11.2 Design

Requirement: Tapped hot-dipped galvanized steel, aluminium or concrete columns, designed, manufactured and tested by a specialist manufacturer.
Mounting: Conform to the following:

- Steel and aluminium columns: Base plate mounting, suitable for mounting on rag bolt assemblies.
- Concrete columns: Direct mounting in the ground.

Footings and rag bolt assemblies: Designed by a professional engineer and independently certified.
Site specifics: Consider the design wind category and the soil conditions.

Dimensions: To AS 1798.
Rag bolt assemblies: Galvanized threaded steel of cross-sectional area designed to support each column taking into account the wind loads expected to act on the column and the luminaires mounted on the column. Set the rag bolt assemblies in the concrete footings. Cut holding bolts within 3 threads above top of base plate top lock nuts.
Base sealing: Seal space under pole base plate with grout.
Maintenance access: Provide pole stirrups secured to either side of the column for access to accessories. Locate the first stirrup greater than or equal to 3 m above ground level.
Electrical connections: For hollow metal or concrete poles, provide a recess fitted with a flush mounted lockable or screw fixed cover at the base of the column for access to cable connections and equipment.
Cable support: For connections higher than 3 m, provide a catenary wire cable support system unless cable and anchor methods at the ends of the cable suspension are designed for unsupported cable suspension.
At column base: Provide the following:

- Adequate drainage.
- Street lighting controlgear panel.

3.12 Power poles

3.12.1 Hardwood poles

Requirement: Conform to the requirements of AS/NZS 3000, the local network distributor's standards and the local Service and Installation Rules.
Selection: Dressed, natural, round poles with all sapwood removed.
Capping: Galvanized steel, domed cap extending 25 mm down the sides. Fix with galvanized steel nails.
Termite and fungus treatment: To 600 mm above ground level.

3.12.2 Hardwood cross arms

Material: 75 x 75 x 1500 mm minimum hardwood.
Fixing: Securely fix to pole with M20 galvanized bolts, nuts and washers.
Bracing: Two 5 x 40 x 690 mm galvanized steel fixed at 45° to the pole below the cross arm with M12 x 75 mm galvanized coach screws in the pole and M12 galvanized bolts, nuts and washers in the cross arms.

3.12.3 Steel poles

General: Hot-dipped galvanized round steel poles conforming to the requirements of AS/NZS 3000, the local network distributor's standards and the local Service and Installation Rules.
Capping: Galvanized steel, domed cap extending 25 mm down the sides. Fix with galvanized steel screws.
Drainage: Provide adequate drainage at the column base.
Bases: Provide columns with mounting bases for fixing to reinforced concrete footings via rag bolt assemblies.

3.13 Custom designed poles/columns

3.13.1 General

Columns: Designed, manufactured and tested by a specialist manufacturer.
Standards: To the electricity distributor's standards and to the local Service and Installation Rules.

3.13.2 Construction

Requirement: Hot-dip galvanized steel columns and fittings after fabrication. Powder coat or anodise aluminium columns and fittings after fabrication.
Drainage: Provide adequate drainage at the column base.

3.13.3 Bases and footings for custom designed columns

Bases: Provide mounting bases for rag bolt assembly fixing to reinforced concrete footings.
Bases to custom designed columns: As documented.
Footings and rag bolt assemblies: Designed by a professional engineer and independently certified.
Site specifics: Design for the site wind category and the soil conditions.
Dimensions: To AS 1798.
Rag bolt assembly: Cut holding bolts within 3 threads above top of base plate top lock nuts.
Base fixing: Galvanized holding down nut with galvanized lock nut above.
Design of footing and rag bolt assemblies: Undertake design by a professional engineer and provide independent certification.
Base sealing: Seal space under pole base plate with grout.
Finish: Paint to the documented colour.

3.13.4 Cable support at point of supply

Underground cable facilities: Provide access and cable support for conduit and cable systems connecting the street lighting fixtures to the underground cable duct system.
Accessory mountings: Adjustable mountings to suit accessories. Include provision for rigidly clamping each item in position, once adjusted correctly.
Maintenance access: Provide pole stirrups, as documented, secured to either side of the column for access to accessories. Locate the first stirrup minimum 3 m above the ground level.
Electrical connections for hollow metal or concrete poles: If a continuous conduit system is not utilised, provide a recess fitted with a lockable or screw fixed flush mounted cover at the base of the column for access to cable connections and equipment.
Cable support: If cable and anchor methods at the ends of the cable suspension are not designed for unsupported cable suspension, provide a catenary wire cable support system for connections higher than 3 m.
Service connection: Pole mounted equipment including weatherproof box and service fuses at the service connection point as required by the electricity distributor.
Street lighting controlgear panel: Provide controlgear panel at base of column.

3.14 Solar street lighting

3.14.1 General

Requirement: Proprietary solar street lighting assemblies complete with solar panels, lamps, luminaires lighting control equipment, batteries and accessories, as documented.
Solar panels: Monocrystalline, high efficiency type, sized to meet the lamp size and battery storage requirements.
Panel efficiency: ≥ 21%
Storage battery: Maintenance free, deep cycle gel type, sized to meet the run time and lamp wattage requirements.
Lamp type: High performance LED, sized to meet the lighting level requirement.
Lamp control: Local PE cell mounted within the unit.

3.15 Footings

3.15.1 Concrete

Concrete, reinforcement and formwork: To the *C28 Auxiliary concrete works* worksection and the requirements of the street lighting column manufacturer.
Compressive strength of concrete: 25 MPa.
The type of foundation shall be as per drawings

3.15.2 Anchor bolts

Welding: To AS/NZS 1554.1 Category GP.
Anchor bolt assemblies: Hot-dip galvanize after fabrication to AS/NZS 4680 with minimum 100 µm thickness and a bright finished appearance free from all galvanizing defects.
Treatment before galvanizing: To AS 1627.1 and AS 1627.4 (class 2.5 Blast).
Galvanized bolts, nuts and washers: To AS/NZS 1214.

4 Execution

4.1 Establishment

4.1.1 Protection of services and utilities

Existing services: Locate and protect existing services and utilities before starting excavation work.
Damage: Rectify any damage to existing services and utilities.

4.2 Luminaires

Luminaires and fuses shall be provided to network distributor standards unless otherwise requested**.**

4.2.1 Installation

Mounting: Mount luminaires on proprietary supports.
Luminaires shall be mounted on brackets and outreach arms from the network distributor standard or from their standard lists. After installation it must be ensured that the whole structure is with in 2o degrees tolerance from vertical position, and the column is balanced with all connections tightened securely.

4.2.2 Completion

Replacement of lamps: At the date of completion, verify the operation of all luminaires. Replace lamps which have been in service for more than 50% of the lamp life as published by the lamp manufacturer.

4.3 Lighting supports

4.3.1 General

Free standing luminaires: Provide columns and mounting for free standing road lighting luminaires, as documented.
Luminaires on network power poles: Mount luminaires with proprietary hardware on network power poles conforming to the electricity distributor’s standards.

4.3.2 Column installation

Installation of columns: As documented.
Columns set in the ground: Set columns in the ground to AS 1798 and to the manufacturers' requirements.

Soil suitability: If the soil is unsuitable, use alternative pole types and mount in concrete or on rag bolt assemblies set in concrete footings.

4.3.3 Footings for base mounted columns

Location: Construct concrete footings at the locations for street lighting columns, as documented.
Excavation: Excavate footings neatly from solid material. Compact to 90% maximum dry density.
Dimensions: Construct footings to the dimensions and embedment details, as documented.
Anchor bolt assembly: Locate accurately and firmly support the anchor bolt assembly.
Concrete supply and placement: To the *C28 Auxiliary concrete works* worksection.
Electrical conduits: Make sure all conduits have large radius bends through the footing. No

- Elbow bends: Not permitted.

Placing: Do not place concrete until the formwork and anchor bolt assembly location have been approved.

4.3.4 Columns directly buried in the ground

Requirement: To AS 1798 and the manufacturers' recommendations.
Soil suitability: If the soil is unsuitable, use alternative pole and support method, such as mounting in concrete or on rag bolt assemblies set in concrete footings.

4.3.5 Hardwood poles

Requirement: Set poles directly in the ground.
Planting depth: 1600 mm minimum or as required by AS/NZS 3000, the electricity distributor's standards and the Service and Installation Rules.
Verification: Verify soil suitability to support poles.
Painting of Column and accessories.
Columns and outreaches are powder coated and coloured Hawthorn Green or as per the conditions on each street lighting project or as per drawings. Replacement of painted columns, the cost of painting may be at the public lighting customer's cost.

4.4 Power supply

4.4.1 Connection

Local network system: Provide power supply and connection to each luminaire from the electricity distributor's low voltage system to conform to the electricity distributor's standards.
Earthing: Provide earthing to meet the requirements of the electricity distributor.

4.4.2 Cable installation

Classifications: To AS/NZS 3013 and as documented.
Handling cables: Report damage to cable insulation, serving or sheathing.
Stress: Do not use installation methods that exceed the cable's pulling tension. Use cable rollers for cable installed on tray/ladders or in underground enclosures.
Straight-through joints: Unless unavoidable due to length or difficult installation conditions, run cables without intermediate straight-through joints.
Cable joints: Locate in accessible positions in lighting column bases, junction boxes and/or in pits.

4.5 Testing

4.5.1 Audit

Requirement: Audit the installation for conformance to the documents.

5 Annexures

5.1 Annexure – Summary of hold and witness points

Reference No:	Clause and description	Type*	Submission/Inspection details	Submission/Notice times	Process held
C22-HP01	SUBMISSIONS, Lighting Design Brief	H	Submit lighting design brief to Council for approval	Prior to commencing design	Commencement
C22-HP02	SUBMISSIONS, Design Documentation Design and Construct contracts	H	For Design and Construct contracts, design documentation.	2 weeks before commencement	Commencement
C22-WP03	SUBMISSIONS, Authority approval Design	W	Evidence of electricity distributor design approval.	5 days before commencement	Commencement
C22-HP04	SUBMISSIONS Lighting Design	H	Lighting design and notification of change of charges by electricity energy provider for acceptance by Council	Prior to commencement of works	Prior to Subdivision Certificate/Occupation Certificate
C22-WP05	SUBMISSIONS, Products and materials Proprietary equipment	W	Manufacturer's information for luminaires, fittings and accessories.	5 days before commencement	Material ordering
C22-WP06	INSPECTIONS, Notice Footings for base mounted columns	W	Formwork and anchor bolt assembly location approved by electricity energy provider.	1 day before installation	Column installation
C22-HP07	SUBMISSIONS, Variations Columns directly buried in the ground	H	Alternative pole mounting method approved by electricity energy provider if soil is unsuitable.	3 days before installation	Column installation
C22-WP08	INSPECTIONS, Notice Power cables	W	Completed cable installation approved by electricity energy provider	1 day before inspection	-
C22-WP09	INSPECTIONS,	W	Commissioning and	1 day before	-

Reference No:	Clause and description	Type*	Submission/Inspection details	Submission/Notice times	Process held
	Notice Audit		verification testing approved by electricity energy provider	inspection	
C22-HP10	SUBMISSIONS, Work as Executed details	H	Submit details showing GPS locations of new lighting and light type.	2 weeks after completion of works	Prior to Subdivision Certificate/Occupation Certificate
	*H = Hold Point W = Witness Point				

5.2 Annexure - Referenced documents

The following documents are incorporated into this worksection by reference:

AS/NZS CISPR 15	2011	Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment (CISPR 15:2009, MOD)
AS/NZS 1158		Lighting for roads and public spaces
AS/NZS 1158.1.1	2005	Vehicular traffic (Category V) lighting - Performance and design requirements
AS/NZS 1158.1.2	2010	Vehicular traffic (Category V) lighting - Guide to design, installation, operation and maintenance
AS/NZS 1158.2	2005	Computer procedures for the calculation of light technical parameters for Category V and Category P lighting
AS/NZS 1158.3.1	2005	Pedestrian area (Category P) lighting - Performance and design requirements
AS/NZS 1158.4	2015	Lighting of pedestrian crossings
AS/NZS 1158.5	2014	Tunnels and underpasses
SA/SNZ TS 1158.6	2015	Luminaires - Performance
AS/NZS 1214	2016	Hot-dip galvanized coatings on threaded fasteners (ISO metric coarse thread series)
AS/NZS 1554		Structural steel welding
AS/NZS 1554.1	2014	Welding of steel structures
AS 1627		Metal finishing - Preparation and pretreatment of surfaces
AS 1627.1	2003	Removal of oil, grease and related contamination
AS 1627.4	2005	Abrasive blast cleaning of steel
AS 1746	1991	Conductors - Bare overhead - Hard-drawn copper
AS 1798	2014	Lighting poles and bracket arms - Recommended dimensions
AS/NZS 2053	2001	Conduits and fittings for electrical installations
AS/NZS 2700S	2011	Colour standards for General Purposes
AS/NZS 3000	2018	Electrical installations (known as the Australian/New Zealand Wiring Rules)
AS/NZS 3008		Electrical installations - Selection of cables
AS/NZS 3008.1.1	2017	Cables for alternating voltages up to and including 0.6/1 kV - Typical Australian installation conditions
AS/NZS 3013	2005	Electrical installations - Classification of the fire and mechanical performance of wiring system elements
AS4282	1997	Control of Obtrusive Effects of Outdoor Lighting

AS/NZS 4065	2010	Concrete utility services poles
AS 4111	1993	Starters for fluorescent lamps - Performance requirements
AS/NZS 4677	2010	Steel utility services poles
AS/NZS 4680	2006	Hot-dip galvanized (zinc) coatings on fabricated ferrous articles
AS/NZS 4782		Double-capped fluorescent lamps - Performance specifications
AS/NZS 4782.1	2004	General (IEC 60081:2000, MOD)
AS/NZS 4782.2	2004	Minimum Energy Performance Standard (MEPS)
AS/NZS 4783		Performance of electrical lighting equipment - Ballasts for fluorescent lamps
AS/NZS 4783.1	2001	Method of measurement to determine energy consumption and performance of ballasts lamp circuits
AS/NZS 4783.2	2002	Energy labelling and minimum energy performance standards requirements
AS/NZS 4847		Self-ballasted lamps for general lighting services
AS/NZS 4847.1	2010	Test methods - Energy performance
AS/NZS 4847.2	2010	Minimum Energy Performance Standards (MEPS) requirements
AS 4934		Incandescent lamps for general lighting service - Test methods
AS 4934.2	2011	Minimum energy performance standards (MEPS) requirements
AS/NZS 5000		Electric cables - Polymeric insulated
AS/NZS 5000.1	2005	For working voltages up to and including 0.6/1 kV (1.2) kV
AS/NZS 60155	2018	Glow-starters for fluorescent lamps
AS/NZS 60598		Luminaires
AS/NZS 60598.2.3	2015	Luminaires for road and street lighting (IEC 60598-2-3, Ed. 3.1 (2011) MOD)
AS/NZS 60921	2002	Ballasts for tubular fluorescent lamps - Performance requirements (IEC 60921:1988, MOD)
AS/NZS 60923	1998	Auxiliaries for lamps - Ballasts for discharge lamps (excluding tubular fluorescent lamps) - Performance requirements
AS/NZS 60929	2005	A.C. supplied electronic ballasts for tubular fluorescent lamps - Performance requirements
AS/NZS IEC 60947		Low voltage switchgear and controlgear
AS/NZS IEC 60947.4.3	2015	Contactors and motor-starters - A.C. semiconductor controllers and contactors for non-motor loads
AS/NZS 60968	2001	Self ballasted lamps for general lighting services - Safety requirements (IEC 60968:1988, MOD)
AS/NZS 60969	2001	Self ballasted lamps for general lighting services - Performance requirements
AS/NZS 61048	2002	Auxiliaries for lamps - Capacitators for use in tubular fluorescent and other discharge lamp circuits - General safety requirements
AS/NZS 61049	2002	Auxiliaries for lamps - Capacitators for use in tubular fluorescent and other discharge lamp circuits - Performance requirements
AS/NZS 61347		Lamp controlgear
AS/NZS 61347.1	2016	General and safety requirements (IEC 61347-1:2000, MOD)

AS/NZS 61347.2.1	2002	Particular requirements for starting devices (other than glow starters)
AS/NZS 61347.2.3	2016	Particular requirements for a.c. supplied electronic ballasts for fluorescent lamps
AS/NZS 61347.2.8	2003	Particular requirements for ballasts for fluorescent lamps
Austroads AGRD		Guide to road design
Austroads AGRD04	2017	Intersections and crossings - General
Austroads AGRD06B	2015	Roadside environment
Austroads AP-C087	2015	Austroads glossary of terms. 2015 edition
IEC 60188	2001	High-pressure mercury vapour lamps - performance specifications
IEC 60192	2001	Low-Pressure sodium vapour lamps - performance specifications
IEC 60662	2011	High-pressure sodium vapour lamps - Performance specifications
IEC 61167	2015	Metal halide lamps - Performance specification