



mainroads
WESTERN AUSTRALIA

SPECIFICATION 701

ROADWAY LIGHTING

Copyright MAIN ROADS Western Australia

REVISION REGISTER			
Clause Number	Description of Revision	Authorised By	Issue Date
701.02, 701.03 (1) 701.11 (1), 701.22.06 (1)	Legislative requirements clarified Reference to pit design drawings added	A/MEAM	28/04/2025
701.01 (1), 701.01 (2)	Scope clarification	A/MEAM	01/12/2023
Whole document 701.01 701.14 701.14.05 701.14.13 701.16.01 (3) 701.16.02 (1) 701.16.02 (2) 701.16.02, 701.17.01, 701.17.10, 701.28, 701.29 701.16.03, 701.16.04, 701.16.05, 701.16.08, 701.17.02, 701.17.04, 701.17.05 701.17.03 (2) 701.22.10 701.81 701.82	Various editorial amendments Update AS/NZS 1158.6 to SA/SNZ TS 1158.6, inclusion of AS 60529 and removal of redundant and unreferenced standards Amendment to switchboard light technology Amendment to door lock type and dual key requirement for meter panel only Removal of pilot light requirements Added NEMA socket requirement Added SA/SNZ TS 1158.6 as a luminaire requirement Added IP66 as a luminaire requirement Removal of reference items to HPS technology Removal of HPS related sub clauses Amendment to autotransformer sizing Removal of referenced to Henley compound and jointing and addition of piercing connectors and gel joints Amendment to submit As-Builts to Superintendent within two-weeks of commissioning Amendment to maintenance and reporting requirements during defect liability period	A/MEAM	21/08/2023
701.14 701.05 701.15.12 701.15.13 701.22 701.24	Editorial and amendment to clauses 701.14, 701.22 and 701.24. Clauses 701.05, 701.15.12 and 701.15.13 added.	EE/TSE	21/02/2017
701.15.09	Bolt torque changed from 420 Nm to 410 Nm.	EE	03/03/2015

REVISION REGISTER			
Clause Number	Description of Revision	Authorised By	Issue Date
701.14 701.21	Amendment to single and double door switchboard Bolts and nuts of slip base pole Editorial	EE	24/02/2015
701.21.02	Amendments to bolt torque and lock nut details	EE	30/10/2014
701.12.04 701.28.06 701.28.07	Amendments to clauses to allow for rigid conduit and change holding screws	EE	12/12/2012
701.12, 701.23.01	Clarified and corrected Items 5 and 2 respectively	EE	15/03/2012
701.02, 701.11, 701.14.08, 701.22, 701.23.01	Removed dates on standards, added pit gaskets, RCDs, flush pit installation, pit location, pre-cast surrounds, and amended testing	EE	20/02/2012
701.22.10	Item 6 deleted	TESM	29/03/2010
701.03	Deleted Item 4 to the Clause referring to 'Residual Current Devices'	EE	06/01/2010
701.03	Added Item 4 to the Clause referring to "Residual Current Devices"	EE	20/10/2009
701.14.05	Amendment to Item 4	EE	10/06/2009
701.17	Major amendments have been made to all parts of this clause	EE	08/06/2009
701.22.11 & 701.24.02	Changed Drawing No. reference	A/TESM	08/04/2009
701.02	References - amendments to AS/NZS Standards	EE	25/09/2008

CONTENTS

Clause	Page No
GENERAL	6
701.01 Scope.....	6
701.02 References.....	6
701.03 Electricity Regulations and Authorities	7
701.04 Contractor's Drawings.....	7
701.05 Staged Construction Works.....	8
701.06 – 701.09 NOT USED	8
PRODUCTS AND MATERIALS	8
701.10 General	8
701.11 Cable Pits	8
701.12 Conduits.....	8
701.13 Wiring and Colours.....	9
701.14 Switchboards	9
701.15 Roadway Lighting Poles – Design and Manufacture	13
701.16 Roadway Lighting Luminaires	15
701.17 Control Gear	17
701.18 – 701.20 NOT USED	19
INSTALLATION.....	19
701.21 Poles and Luminaires.....	19
701.22 Electrical Installation	22
701.23 Testing	26
701.24 Impact Absorbent Light Pole	27
701.25 Switchboard Documentation and Switching.....	28
701.26 Removal of Pole Mounted Lighting.....	28
701.27 Pedestrian Shared Path Lighting.....	29
701.28 Installation of Underpass Lighting	30
701.29 Retrofitting of Underpass Lighting	31
701.30 Bridge Mounted Installation	31
701.31 – 701.80 NOT USED	31
AS BUILT AND HANDOVER REQUIREMENTS	31
701.81 As Built Drawings	31
701.82 Maintenance During Defects Liability Period	32
701.83 Maintenance and Handover	32
701.84 – 701.90 NOT USED	32
CONTRACT SPECIFIC REQUIREMENTS	32

701.91 – 701.99 NOT USED 32

ANNEXURE 701A 33

Supply of Electrical Materials..... 33

SPECIFICATION 701

ROADWAY LIGHTING

GENERAL

701.01 SCOPE

1. This specification defines the requirements for the supply, installation, testing and commissioning, and handover of Main Roads lighting infrastructure required as part of the work under the Contract, specifically for:
 - (a) roadway lighting;
 - (b) bridge mounted lighting;
 - (c) underbridge lighting;
 - (d) underpass lighting; and
 - (e) pedestrian shared path lighting.
2. This specification does not include requirements pertaining to the following lighting infrastructure:
 - (a) solar lighting;
 - (b) temporary lighting; and
 - (c) any other lighting not detailed in clause 701.01 (1).

701.02 REFERENCES

1. Australian Standards, MAIN ROADS Western Australia Standards and MAIN ROADS Western Australia Test Methods are referred to in abbreviated form (e.g. AS 1234, MRS 67-08-43 or WA 123). For convenience, the full titles are given below:

Acts and Legislation

Electricity Act 1945 (WA)
Electricity (Licensing) Regulations 1991 (WA)
Electricity Regulations 1947 (WA)
Electricity (Network Safety) Regulations 2015 (WA)
Western Australia Electrical Requirements (WAER)
Western Australian Service and Installation Requirements (WASIR)

Australian Standards

AS 60529 Degrees of Protection Provided by Enclosures
 (IP Code) (Reconfirmed 2018)

Australian/New Zealand Standards

SA/SNZ TS 1158.6	Lighting for roads and public spaces – Luminaries
AS/NZS 1170.2	Structural design actions – Wind actions
AS/NZS 1906.1	Retroreflective materials and devices for road traffic control purposes – Retroreflective sheeting
AS/NZS 2053	Conduits and fittings for electrical installation (Parts 1 to 8 including all amendments)
AS/NZS 3000	Australian/New Zealand Wiring Rules (including Amendments)
AS/NZS 4671	Steel reinforcing materials
AS/NZS 4676	Structural design requirements for utility services poles
AS/NZS 4677	Steel utility services poles
AS/NZS 4680	Hot-dip galvanised (zinc) coatings on fabricated ferrous articles
AS/NZS 60598.1	Luminaires – General requirements and tests

MAIN ROADS Specifications

Specification 901 CONCRETE – GENERAL WORKS

Specification 908 ANTI-GRAFFITI

701.03 ELECTRICITY REGULATIONS AND AUTHORITIES

- | | |
|---|---|
| 1. The Works shall be carried out in accordance with the requirements of the Electricity Act 1945 (WA) and supporting regulations, the Western Australia Electrical Requirements, AS/NZS 3000 Australian/New Zealand Wiring Rules, and the requirements of Western Power, Synergy, Horizon or any other authority having jurisdiction over the installation (Network Operator). | <i>Electricity Act</i> |
| 2. The Contractor shall submit all notices and applications required by the Network Operator and pay any fees required. | <i>Notices</i> |
| 3. The power supply is as detailed on design Drawings. The Contractor shall ensure all equipment is designed to operate at the correct voltages prior to installation. The Contractor shall ensure all equipment installed is suitable for the maximum prospective short circuit current found at the point of installation. | <i>Power Supply
Voltage supply</i> |

701.04 CONTRACTOR'S DRAWINGS

701.04.01 MANUFACTURING DRAWINGS

- | | |
|---|---|
| 1. Pole fabrication Drawings, assembly and erection instructions shall be prepared in accordance with AS/NZS 4677 Clause 2.4 prior to commencing manufacture. | <i>Pole
Fabrication
Drawings</i> |
|---|---|

- | | |
|--|----------------------------------|
| 2. Switchboard Design Drawings showing elevation and section details, equipment layout, materials schedule and label details shall be prepared prior to commencing manufacture. The Switch Boards Design Drawings shall comply with the Main Roads Design Drawing presentation and Typical Standard Drawings for switchboards. | Switch-board
Drawings |
| 3. Drawings shall be prepared on the Principal's Standard Drawing templates for borders and title blocks and shall comply with Main Roads numbering system. | Drawing
Number |

701.05 STAGED CONSTRUCTION WORKS

1. The Contractor shall advise Main Roads if they intend to stage the construction phase where affecting existing lighting asset.

701.06 – 701.09 NOT USED

PRODUCTS AND MATERIALS

701.10 GENERAL

1. A summary of required electrical material requirements is provided at Annexure 701A.

701.11 CABLE PITS

- | | |
|---|------------------------------|
| 1. Cable pits shall be as specified on the design drawings. If the design drawings reference pits specified on Standard Drawing 200231-0063, then the requirements outlined in Clause 701.11 (2), (3), (4), (5), and (6) shall apply. | Pit
Requirements |
| 2. Cable pits shall be plastic and fitted with heavy-duty well-fitting concrete lids with 'MRWA ELECTRICAL CABLE' moulded into the surface in accordance with Drawing No. 200231-0063. | Pit Type |
| 3. To ensure that the lid cannot be easily removed without the aid of tools, only one lifting hole shall be cast into the lid. | Pit Lids |
| 4. An industry-standard plastic plug shall be used to plug the lifting hole when lifting is not required to alleviate most water and sand ingress. | Plastic Plug |
| 5. An industry-standard gasket shall be fitted to the pit lid to alleviate water and sand ingress. | Gasket |
| 6. Concrete surround to cable pits shall comply with the requirements of Standard Drawing No. 200231-0063. The concrete surround may be pre-cast. | Concrete
Surround |

701.12 CONDUITS

- | | |
|---|---------------------|
| 1. All conduits, whether rigid or flexible, shall be in accordance with AS/NZS 2053 series. | AS/NZS 2053 |
| 2. All rigid electrical conduits shall be heavy duty, suitable for underground use and shall be orange in colour. | Conduit Type |

- | | |
|---|----------------------------|
| 3. Only rigid PVC fittings shall be used. All joints shall be cemented. Where a thread is required on a conduit, a suitable adaptor shall be cemented to the conduit. | Jointing |
| 4. Conduits for casting within bridge decks shall be rigid with the use of sweep bends where necessary. Right angled bends are not to be used. | Bridge Decks |
| 5. All necessary precautions shall be taken during construction to protect conduits from damage, ingress of water and dirt or movement from position due to any other work processes. If conduits are found to be damaged, contain water or dirt, they shall be replaced. | Precautions |
| 6. All external conduits and fittings shall have adequate protection against external influences. Their classification should be as per AS/NZS 2053 series. | External Influences |

701.13 WIRING AND COLOURS

- | | |
|---|----------------------|
| 1. All cables shall have copper conductors and double insulated PVC with an insulation rating of 0.6/1 kV. Colour coding shall be: | Colour Coding |
| (a) Active conductors – Red, white, blue as specified on the Drawings | Active |
| (b) Neutral conductors – Black | Neutral |
| (c) Earth conductors – Yellow/Green | Earth |
| (d) The colour of insulation tape shall match the colour of the cable insulation. | Insulation |
| 2. All multi-strand conductors shall be terminated with crimp lugs. Joints with or without connectors shall not be accepted except within cable pits. | Termination |

701.14 SWITCHBOARDS

- | | |
|---|--|
| 1. There are two types of Single or Double Door Switchboards to be installed based on the application and roadway lighting design requirements. | Double and Single Door Switchboards |
| 2. For general arrangement and internal wiring lay out refer to Main Roads Standard Drawings for each type. | |

701.14.01 ACCESSIBILITY

- | | |
|--|----------------------------------|
| 1. The arrangement and layout of all equipment shall provide adequate and safe means of access and working space for installation and maintenance purposes. | Access |
| 2. All equipment shall be installed such that removal, replacement or repair of each and every component may be carried out with standard electrical trade tools. | Standard Tools |
| 3. Particular attention shall be given to the location and clearance of handles, levers, switches, etc. in respect to the safety of personnel operating the equipment. | Location & Clearances |

- | | |
|---|--|
| 4. To allow for ease of maintenance in darkness, an LED light shall be installed in the top front of the single-door switchboard that is automatically operated when the door is opened. The light shall adequately illuminate all internal components of the single-door switchboards. | <i>Lighting for
Maintenance
Single door</i> |
| 5. Two or more LED lights shall be installed in the top front of the double-door switchboard that is automatically operated when the door is opened, in such a manner that provides adequate illumination for all internal components of the double-door switchboard. | <i>Lighting for
Maintenance
Double door</i> |

701.14.02 MATERIAL

- | | |
|--|-----------------------|
| 1. The cubicle and escutcheon shall be fabricated from marine grade aluminium sheet of not less than 2.5 mm thickness. | <i>Cubicle</i> |
|--|-----------------------|

701.14.03 FABRICATION AND WELDING

- | | |
|--|--------------------------|
| 1. The cubicle dimensions shall be as shown on the design Drawings. | <i>Dimensions</i> |
| 2. All joints shall be full length welded and ground to a smooth square finish. The exterior of the cabinet shall present a smooth surface without any bolt heads or the like projecting outside the cubicle. | <i>Joints</i> |
| 3. Doors and escutcheon panels shall be fitted with suitable internal stiffeners. Horizontal escutcheon edges shall be folded through a right angle to offer rigidity. | <i>Stiffeners</i> |
| 4. Escutcheon fixing bolts shall be made captive to the escutcheon and shall be 8 mm plated steel with nylon washers. In addition, four fixed guide pins per escutcheon shall be fitted to the cubicle to locate the escutcheon. | <i>Fixings</i> |
| 5. A pocket for keeping drawings or other documents shall be fitted to each switchboard door. The document pocket shall be of minimum size 250 mm wide x 300 mm high x 20 mm capacity. | <i>Pocket</i> |

701.14.04 WEATHER-PROOFING

- | | |
|--|------------------------------|
| 1. Neoprene door seals shall be fitted to ensure that water, moisture and dust cannot enter the interior of the cubicle giving IP65 degree of protection. The seals shall be such that new seals can be fitted at a later date without the necessity of removing any equipment other than the old seals. | <i>Neoprene Seals</i> |
|--|------------------------------|

701.14.05 DOOR LOCKS AND HINGES

- | | |
|--|--------------------------|
| 1. Each of the doors shall be fitted with two flush mounted Lockwood Series 303 single cylinder deadlocks. All locks on all doors shall be operated by the Main Roads key number 247E. | <i>Lock</i> |
| 2. All locks on doors containing a meter, must be dual keyed capable of being opened by both the Network Operator's nominated metering key and Main Roads key number 247E. | <i>Dual Keyed</i> |
| 3. Any keys held by the Contractor as a result of purchasing the deadlocks shall be provided to the Superintendent. | <i>Keys</i> |

4. A locking arm shall be fitted to each of the doors to hold it firmly in the 100° (or more) open position.	Locking Arm
5. Each of the doors shall be fitted with two deadlocks, one fitted near the top and another near the bottom of the opening side of the door to provide five adequate fixing points (with the three hinges) for the door. The doors shall only be capable of being lifted off the hinges when in the open position.	Door
6. The doors shall close positively against the gasket with no slack movement.	
701.14.06 CUT-OUTS	
1. Particular care shall be taken to provide stress-free panels where cut-outs are required so that no distortion of the cut-outs will occur. Rough edges shall be removed and all cut-outs shall be accurate to 0.5 mm.	Stress-Free Panels
701.14.07 EARTHING	
1. A drilled copper bar providing a separate hole for each connected earth conductor shall be fitted near the bottom of the cubicle. Each hole shall have two (2) fixing screws.	Earthing Bar
701.14.08 RESIDUAL CURRENT DEVICE	
1. A 10 ms-delayed type residual-current device (RCD) shall be installed with the appropriate over-current protection. These shall be Clipsal 4RC440G30 or similar and shall comply with AS/NZS 3000.	RCD
701.14.09 WIRING	
1. All insulated wiring within the cubicle shall be run in horizontal and vertical lines. Each group of wiring shall be strapped at short intervals with black nylon cable ties.	Wiring Runs
2. Each wire shall be terminated by crimp type terminal lugs fitted by the lug manufacturer's recommended crimping tool.	Terminations
3. All conductors shall be standard sizes with PVC insulation, minimum voltage rating 0.6/1 kV and temperature rating V75.	Conductors
4. Internal conductor sizes shall be of adequate cross-section. The minimum size permissible shall match the full current rating capacity of the connected equipment.	Conductor Sizes
5. Where more than one item is connected to a common feed, such as fuses or circuit breakers, the minimum conductor size of the common feed shall match the arithmetic sum of the connecting equipment full current rating capacities. In any case, the smallest conductor shall be not less than 1 mm ² .	Common Feed
701.14.10 NAME PLATES AND LABELS	
1. All equipment labels shall be manufactured from white-black-white "Traffolite" with engraved black letters on a white background or red-white-red with white letters on a red background.	Letters

2. As far as practicable all labels shall be of the same overall dimensions with identical mounting holes. The minimum size of letters shall be 3.5 mm upper case.	Sizes
3. All final sub-circuit circuit breakers/fuses shall be labelled with Industrial Products Australia (IPA) coloured and numbered markers.	Labelling
4. The switchboard number shall be clearly shown on the outside of the door of each cabinet. The switchboard number shall be made up of 50 mm black characters on a 50 mm x 60 mm background of adhesive class 2 yellow retro-reflective material as per AS/NZS 1906 Part 1. A further label of the same material consisting of 2 lines of 35 mm black characters shall be placed 30 mm below the switchboard number. Line 1 shall read; "138 138" and line 2; "MAIN ROADS WA".	Numbers
5. Manufacturer's name plates shall not be affixed to the switchboard's housings.	Manufacturer's Name Plates
701.14.11 FINISH	
1. All internal and external panel surfaces shall have an orbital sanded finish with a clear anti-graffiti coating applied in accordance with Specification 908 ANTI-GRAFFITI.	Orbital Sanded Finish
701.14.12 MOUNTING	
1. Metering shall be as per the design Drawing and in accordance with Network Operator's requirements.	Meter Height
2. The plinth/cable pit shall be as shown on the Drawings. Mounting bolts shall not be accessible from outside the switchboard.	Plinth Mounting
3. The finished top surface of the concrete plinth shall be graded away from the switchboard to prevent water accumulating on the plinth.	Plinth
701.14.13 CONTROL EQUIPMENT	
1. Each switchboard shall have a selector switch to enable selection of the type of control to be used to operate the lights.	Selector Switch
2. Each switchboard shall have a selectable HPMPE 170/10 or similar light sensing relay for the control of lighting fixed to an external panel using a minimum of four concealed bolts. The sensing unit shall be fixed with suitable non-ferrous screws to the south side of the panel (where possible) using nutserts and sealed with RTV silicon sealant.	Control Switch
3. Each switchboard shall have a selectable digital electronic timer for control of lighting.	Digital Timer
4. All equipment shall be hard fixed to the enclosure via screws or other mechanical fixings.	

701.15 ROADWAY LIGHTING POLES – DESIGN AND MANUFACTURE

701.15.01 SHAPE OF POLE

- | | |
|---|--------------|
| 1. The pole with outreach arm shall conform to the shape shown in the Standard Drawing Nos. 0530-1456 and 0530-1457 with a vertical, continuously tapered pole with or without a continuously tapered outreach arm. Poles shall be fitted with pole caps and bird guards. | Shape |
|---|--------------|

701.15.02 CROSS SECTION OF POLE

- | | |
|---|----------------------|
| 1. Tubular cross section of the pole and outreach arm shall be octagonal shape in cross section with equal sides in accordance with Main Roads Standard Drawing Nos. 0530-1456 and 0530-1457. | Cross Section |
|---|----------------------|

701.15.03 STRUCTURAL DESIGN OF POLES

- | | |
|---|---------------------------------|
| 1. The structural design of the poles shall be in accordance with AS/NZS 4676. | AS/NZS 4676 |
| 2. Under the design wind speed loading, the horizontal displacement of the luminaire resulting from any combination of flexural and torsional deflection shall not be greater than 5% of the mounting height. | Horizontal Displacement |
| 3. The vertical pole and outreach structure shall be constructed and pre-cambered in such a manner as to ensure that in the erected position with the luminaire installed the outreach spigot is at an angle above the horizontal of 3.0 ± 0.5 degrees and such that the outreach is at right angles to the true road delineation ± 1 degree. | Angle of Outreach Spigot |

701.15.04 FABRICATION

- | | |
|---|-------------------------|
| 1. Poles shall be fabricated in accordance with AS/NZS 4677. Fabrication of slip base pole shall include slip base fixing system. | AS/NZS 4677 |
| 2. The column shall be sufficiently sealed to ensure that moisture running down the side of the column or vermin cannot enter the column. | Sealing |
| 3. The column of the pole shall be fabricated in no more than three (3) lengths. The outreach arm section of the pole shall be fabricated in a single length. | Number of Pieces |
| 4. The vertical section shall be structurally and mechanically capable of accepting any outreach arm of sizes 1.5 m, 2.5 m, 3.0 m, 3.5 m and 4.5 m. Any outreach arm must fit onto the top of the vertical section of the pole. | Outreach Size |
| 5. Any two column sections shall telescope together with a lap length not less than 1.5 times the column section dimension as measured at the lap joint. The minimum and maximum overlap required for the lap joint shall be painted or otherwise clearly marked on the pole prior to assembly. | Lap Length |

701.15.05 GALVANISING

- | | |
|--|--|
| 1. Steel poles and outreach arms shall be hot dip galvanised in accordance with AS/NZS 4680. | Steel Poles & Outreach Arms |
|--|--|

2. The complete holding down bolt and slip base assembly but excluding the mesh cage shall be galvanised. Galvanising is to be carried out after all fabrication welding and cleaning have been completed.

701.15.06 OUTREACH ARM

- | | |
|---|----------------------------|
| <ol style="list-style-type: none"> 1. The outreach arm shall be continuously tapered and fitted with a 60.3 OD x 3.6 CHS tube spigot. The spigot shall be 300 mm long and have a luminaire lock welded to the end as shown in the Standard Drawing numbers 0530-1456 and 0530-1457. | <i>Tapered Arms</i> |
| <ol style="list-style-type: none"> 2. The outreach arms may be fixed to the vertical pole by bolts as shown in the Drawings. The outreach arm shall have an uplift of 3 degrees. | <i>Uplift Angle</i> |
| <ol style="list-style-type: none"> 3. The outreach arms may be bolted or welded to a short upper section of vertical pole which is fixed to the vertical section using the functional fit due to taper. If this method is used, the requirements specified under Clause 701.15.04 apply. | <i>Fixing</i> |
| <ol style="list-style-type: none"> 4. If the outreach arm is made from a material of a thickness different to the vertical section of the pole, the vertical section shall be reinforced. | <i>Reinforcing</i> |
| <ol style="list-style-type: none"> 5. The opening between the outreach arm and the vertical section of the pole shall be such that if any restriction exists, the restriction will not impede the installation of a cable from the luminaire end of the outreach arm. All sharp edges shall be removed to prevent damage to the cable. | <i>Restrictions</i> |

701.15.07 DOOR

- | | |
|---|-----------------------------|
| <ol style="list-style-type: none"> 1. The pole access door opening shall be a minimum size of 630 mm by 150 mm with one captive door fastening bolt located at the top of the door. | <i>Dimensions</i> |
| <ol style="list-style-type: none"> 2. Doors shall be interchangeable and in accordance with Standard Drawing No. 0530-1457. Above the door and external to the pole, a weather strip shall be welded to reduce the possibility of water entering the pole at the door. | <i>Weather Strip</i> |

701.15.08 GENERAL FINISH AND APPEARANCE

- | | |
|--|--------------------------------|
| <ol style="list-style-type: none"> 1. All holes and surfaces shall be free of burrs and sharp edges to allow the installation of electrical cables into the pole without damage. All sections shall be smooth and free of kinks, ripples and galvanising defects. | <i>Surface Surfaces</i> |
| <ol style="list-style-type: none"> 2. When the pole is installed, vertical sections of the pole shall not deviate from the straight by more than 6 mm in any 3 m length. | <i>Verticality</i> |

701.15.09 SLIP BASE

- | | |
|--|--|
| <ol style="list-style-type: none"> 1. A slip base complete with slip joint washer, bolts, nuts and washers as per the Drawings shall be considered as part of the pole. | <i>Slip base Components</i> |
| <ol style="list-style-type: none"> 2. The slip joint washer, flat washers and the load bearing faces of the bolt head and nut shall be flat and even. Any excessive warping or uneven galvanising shall be rectified at no cost to the Principal. | <i>Flat & Even Surfaces</i> |

- | | |
|--|---------------------------|
| 3. Prior to delivery on site the pole shall be attached to the slip base with M36 slip base bolts tightened to a torque of 410 Nm. | <i>Bolt Torque</i> |
|--|---------------------------|

701.15.10 FIXING BOLTS

- | | |
|---|-------------------------------|
| 1. Apart from the footing holding down bolts and slip base bolts, all fixings and bolts shall be stainless steel grade M316 in accordance with AS 2837. | <i>Stainless Steel</i> |
|---|-------------------------------|

701.15.11 HOLDING DOWN BOLT ASSEMBLY

- | | |
|---|---|
| 1. The holding down bolt assembly shall include the mesh cage and shall be complete with eight (8) nuts and eight (8) washers per assembly as per Standard Drawing No. 0530-1457. | <i>Mesh Cage and Bolt Assembly</i> |
| 2. All bolts shall be the same length with respect to the vertical axis of the assembly. | <i>Bolt Length</i> |
| 3. The bolt arrangement shall be such that the pole may be mounted with the access door in any of four positions which are 90° apart. | <i>Bolt Arrangement</i> |
| 4. The bolts shall be 30 mm threaded rod and have a minimum $F_y = 300\text{MPa}$. | <i>Bolt Grade</i> |
| 5. All fittings shall be of a material which does not promote electrolytic corrosion. | <i>Electrolytic Corrosion</i> |

701.15.12 IMPACT ABSORBANT LIGHT POLE AND FOOTING

- | | |
|--|---|
| 1. An impact absorbent light pole and its footing shall be designed and installed as per clause 701.15 and standard typical Drawing 0348-3122. | <i>Impact absorbent light pole</i> |
| 2. The design of impact absorbent light pole shall be reviewed and approved by the Superintendent prior to fabrication and procurement. | <i>HOLD POINT</i> |
| 3. The detail of footing for impact absorbent light pole to be reviewed and approved by the Superintendent prior to issue of drawings for construction (IFC). | <i>HOLD POINT</i> |

701.15.13 LOCALISED WIDENING

- | | |
|--|----------------------------------|
| 1. Main Roads typical Standard Drawings 200231-0063 and 201331-0008 provide guidance for localised widening. | <i>Localised widening</i> |
|--|----------------------------------|

701.16 ROADWAY LIGHTING LUMINAIRES

701.16.01 GENERAL

- | | |
|---|---------------------------------|
| 1. Luminaire details (make and model) shall be as shown on the design Drawings. | <i>Luminaire Details</i> |
|---|---------------------------------|

- | | |
|--|----------------------------------|
| <p>2. Alternative luminaires other than those specified on design Drawings may be used subject to the Superintendent's prior approval. The granting of this approval is at the absolute discretion of the Superintendent. The Contractor shall, at its cost, submit revised design Drawings as per the Roadway Lighting Design guidelines. The Contractor shall provide complete revised photometric data, manufacturer's detail Drawings and sample luminaire to the Superintendent for evaluation. The new design shall conform to the requirements of Main Roads Roadway Lighting Design Guidelines.</p> | <p><i>HOLD POINT</i></p> |
| <p>3. Luminaires and their associated drivers supplied for Main Roads lighting schemes shall be equipped with a 7-pin NEMA socket, as specified in SA/SNZ TS 1158.6.</p> | <p><i>NEMA Socket</i></p> |

701.16.02 CONSTRUCTION AND FINISH

- | | |
|--|----------------------------------|
| <p>1. The luminaire shall be type tested and demonstrated to comply with:</p> <p>(a) AS/NZS 60598.1:2003</p> <p>(b) SA/SNZ TS 1158.6</p> <p>(c) AS/NZS 4051</p> | <p><i>Type Tests</i></p> |
| <p>2. The luminaire shall provide an IP66 degree of protection, in accordance with the requirements of AS 60529.</p> | <p><i>IP Rating</i></p> |
| <p>3. Access to the terminals shall be by a hinged one piece cast aluminium door. Any hinged parts shall be secured such that they will withstand high velocity wind in the open position.</p> | <p><i>Door</i></p> |
| <p>4. All catches, cotter pins, clamps, adjustment screws and accessories shall be made of corrosion resistant metals equal to stainless steel grade M316.</p> | <p><i>Accessories</i></p> |
| <p>5. All other external metal parts shall be protected with a baked enamel finish.</p> | <p><i>Finish</i></p> |
| <p>6. The luminaire shall have provision to be adjusted between five (5) degrees up and three (3) degrees down from the horizontal plane.</p> | <p><i>Adjustment</i></p> |

701.16.03 NOT USED

701.16.04 NOT USED

701.16.05 NOT USED

701.16.06 WEIGHT AND SAIL AREA

- | | |
|---|----------------------------------|
| <p>1. The weight of the luminaire complete with lamp shall not exceed 25 kg. The sail area shall not exceed 0.20 m².</p> | <p><i>Sail Limits</i></p> |
|---|----------------------------------|

701.16.07 BIRD GUARD

- | | |
|---|---------------------------------|
| <p>1. A bird guard shall be provided with each luminaire to prevent birds entering the housing when the luminaire is installed on the outreach arm.</p> | <p><i>Bird Guard</i></p> |
|---|---------------------------------|

701.16.08 NOT USED

701.17 CONTROL GEAR

701.17.01 GENERAL

1. All control gear components shall be suitable for operation on either 415V (phase to phase) or 240 V (phase to neutral) 50 Hz as applicable and conform to the requirements of AS/NZS 61347.
2. The control gear shall be quiet in operation and suitable in every aspect for mounting in the base of the pole. The control gear shall be mounted on a base plate.
3. For Roadway Column Mounted Luminaires the dimensions and form shall be suitable for mounting on the gear tray as detailed on Drawing 0448-3002.

***Operating
Voltage***

Mounting

701.17.02 NOT USED

701.17.03 AUTOTRANSFORMER

1. Autotransformers are used where a two phase supply with no neutral is provided as the electrical connection to the luminaire. Design and construction shall generally comply with AS/NZS 3108 as far as is applicable. Autotransformers shall have the following minimum specification:
 - (a) Primary Voltage 415 V 50 Hz
 - (b) Secondary Voltage 240 V
 - (c) Shock Protection Class 1
 - (d) Regulation (max) 5%
 - (e) Insulation Class H
 - (f) Terminals 32 A 16 mm²
 - (g) Total Losses (hot) 2%
2. Autotransformers shall be rated for a minimum 1.5 times the design luminaires power rating. The autotransformer is to be sized to the nearest higher industry standard rating autotransformer available.
3. Windings shall be weather proof so as to inhibit the effects of moisture and humidity.

***Minimum
Specification***

701.17.04 NOT USED

701.17.05 NOT USED

701.17.06 FUSE HOLDER AND FUSE

1. Fuses of correct rating shall be fitted for protection and isolation purposes. Generally the fuses are complete with Red Spot type fuse holders fitted to the gear tray except where street light cut-outs are used, details for which are given in clause 701.17.07.

Fuses and fuse holders shall comply with the requirements of AS/NZS 60269.

Features required:

- (a) Voltage rating 250 V 50 Hz
- (b) Type NIT fuse class gG
- (c) Black flame retardant thermoplastic fuse holder
- (d) Fuse holder rating 20 A
- (e) Insulating terminal shrouds
- (f) Terminal capacity 10 mm²

701.17.07 STREET LIGHT CUT-OUT

1. Where column mounted luminaires are fitted with integral control gear a street light cut-out shall be mounted in the column base as detailed on Drawing No. 0448-3008. Where the luminaires is fused the cut-out shall be fitted with a copper link otherwise a fuse of the correct rating shall be fitted.

Fuses shall comply with the requirements of AS/NZS 60269.

Features required:

- (a) Voltage rating 250 V 50 Hz
- (b) Current rating 25 A
- (c) Type LST fuse class gG
- (d) Moulded GRP body with detachable fuse holder and terminal cover
- (e) Insulating terminal shrouds
- (f) Tin plated brass tunnel with 16 mm² conductor capacity. Separate loop in / out terminals.

701.17.08 TEMPERATURE

1. The control gear shall operate satisfactorily between the ambient temperatures of -10°C and +50°C when installed in the base of the pole with relative humidity up to 100%.

***Ambient
Temperature***

701.17.09 TERMINALS

1. Terminals shall be provided for the incoming conductors and the lamp socket connections. The terminals shall be of adequate size for wire sizes up to 4 mm² and must be of the type which does not provide connection directly between the terminal screw and the conductor.

Terminal Type

Features required:

- (a) Voltage rating 600 V 50 Hz
- (b) Current rating 30 A
- (c) Temperature rating 100°C
- (d) Captive chromate plated steel screws acting on shielding plate to protect conductor.
- (e) Tin-plated brass tunnel with 4 mm² conductor capacity.
- (f) “Dead front” construction with both screws and tunnel contacts recessed in the housing.

701.17.10 CONTROL GEAR MOUNTING

1. All control gear shall be mounted on purpose made 3 mm thick mild steel plate as detailed on drawing 0448-3002. Gear plate to be zinc plated (chrome passivation) after fabrication.

701.17.11 CABLE CLAMP

1. A suitable cable clamp shall be provided as part of the control gear mounting plate to securely clamp the 4 mm² incoming cables to ensure that terminal connection are not duly stressed.

Cable Clamp

701.17.12 CIRCUIT DIAGRAM

1. A schematic circuit diagram shall be firmly attached to each set of control gear and each item of equipment shall be clearly labelled as to its function.
2. The circuit diagram and labelling shall be such that they do not deteriorate with age.

Circuit Diagram

***Long term
Durability***

701.18 – 701.20 NOT USED

INSTALLATION

701.21 POLES AND LUMINAIRES

701.21.01 POLE BASE FOOTING

1. The light pole footing shall be located as shown on the design Drawings. Where the pole footing is to be located at embankments, pole setback and location to be as per Design Drawings and AS/NZS 1158 series and drawings 200231-0063 and 201331-0008.

Location

- | | |
|--|----------------------|
| 2. The pole footing size shall be in accordance with the dimensions shown on Drawing Nos. 0530-1456, 0530-1457 and 0438-3122 for terrain category 2 and winds in region A to AS/NZS 1170.2. Where other conditions exist alternative designs shall be produced by the designer for the approval of the Superintendent. | Size |
| 3. Each pole base shall be within ± 100 mm of its location and ± 10 mm of its final level as shown on the design Drawings. The slip joint washer shall be 75 ± 10 mm above the finished ground level. The ground level would depend on the pole location and pole setback as identified on the design Drawings. | Tolerance |
| 4. A circular hole, 600 mm in diameter and 1640 mm deep for single outreach or 1890 mm in depth for double outreach shall be excavated to accommodate the pole base footing. | Depth |
| 5. Prior to the installation of the pole base footing the excavated hole shall be presented to the Superintendent for approval to proceed. | HOLD POINT |
| 6. The holding down bolt assembly shall be orientated so that when erected the outreach arm is at right angles to the kerb or edge of seal. | Orientation |
| 7. Concrete shall be Class N32 and meet all requirements of Specification 901 CONCRETE – GENERAL WORKS, including in relation to its placement. | Concrete |
| 8. Footing reinforcement shall be SL81 mesh in accordance with AS/NZS 4671. | Reinforcement |
| 9. Should the water table be such that the concrete cannot be placed in a dry hole, it shall be placed by tremie. Water shall not be allowed to flow through the space in which the concrete is to be cast. Should the walls of the hole be likely to collapse before pouring the concrete, a simple sheet metal, Spirolock or plastic sleeve shall be inserted to prevent the collapse. The tremie shall consist of a sheet metal hopper with a metal pipe leading out of the bottom that has a simple outlet valve at its lower end. It shall be water tight with a minimum diameter of 100 mm. The tremie shall be kept filled with concrete at all times during placing. Should the concrete charge be lost, the tremie shall be withdrawn and refilled. The tremie shall be operated in such a manner as to discharge below the surface of the fresh concrete and to maintain as nearly as practicable uniform flow. Concrete shall not be dropped through water. No agitation or vibration of the concrete shall be permitted during placing. Compaction shall take place after concrete pouring has been completed and the water displaced. | Tremie |
| 10. Prior to the drilling of any bridge or other structural element the Contractor shall accurately identify to the Superintendent all locations, sizes and depths of the penetrations and of any reinforcement likely to be affected by the drilling operations, for approval by the Superintendent to proceed. | HOLD POINT |

701.21.02 POLE ASSEMBLY

- | | |
|--|--------------------|
| 1. The access door shall face away from the carriageway for slip base mounted poles and shall face the carriageway for bridge mounted poles. | Access Door |
|--|--------------------|

- | | |
|--|--|
| <p>2. The slip base shall be removed from the pole and firmly bolted to the footing, then levelled using a spirit level with a minimum of two levels taken at right angles to each other. All electrical connections for the cable between the cable pit and the Anderson Connectors shall be made prior to installing the pole on the slip base. The placement of the slip base assembly shall be as shown on the Standard Drawing Nos. 0530-1456 and 0530-1457 to achieve correct orientation of the pole on the upper slip base flange.</p> | <p><i>Slip Base</i></p> |
| <p>3. After the installation of the slip base and prior to the erection of the pole the Contractor shall present the slip base plate, slip base washer and pole base plate to the Superintendent for inspection to ensure that they are clean, flat and free from deformation and for approval to proceed with the pole erection.</p> | <p><i>HOLD POINT</i></p> |
| <p>4. Poles shall be erected in accordance with the manufacturer's published procedures. Poles shall be lifted using a sling or chain formed into a noose at approximately two thirds column height from the base. To prevent poles from falling and/or the dislodgement of pole segments, lift poles into position using a temporary attachment between the poles' lifting lug (located at the pole's base) and noose preventing the noose from slipping up the pole while also transferring the lifting force via the lifting lug back to the pole base. Care must be taken when handling the poles so that the galvanising is not damaged. Metal Slings, if used, shall have adequate protection so that metal to metal contact does not occur.</p> | <p><i>Pole Erection Procedure</i></p> |
| <p>5. The bolts used to attach the pole to the slip base shall be fitted with the nuts uppermost.</p> | <p><i>Bolt Torque</i></p> |
| <p>6. Each slip base bolt shall initially be tensioned to 410 Nm upon installation of the pole, to remove any minor deformation in the slip joint base washer with the full sized nut. One nut at a time shall be removed and a thin nut shall be installed and tensioned to 50 Nm. The full sized nut shall be installed on top of the thin nut and tensioned to 170 Nm whilst the thin nut is held in place with an open ended spanner.</p> | |
| <p>7. Bolts shall be tensioned with a calibrated torque wrench in the presence of the Superintendent.</p> | <p><i>HOLD POINT</i></p> |
| <p>8. Each slip pole shall be bolted truly vertical on its footing.</p> | <p><i>Verticality</i></p> |
| <p>9. The luminaire lamp holders shall be adjusted to the nominated distribution.</p> | <p><i>Luminaire</i></p> |
| <p>10. The luminaire spigot clamp shall be set to the correct angle.</p> | <p><i>Spigot Clamp</i></p> |
| <p>11. The lamp bases shall be date coded.</p> | <p><i>Date Coding</i></p> |
| <p>701.21.03 GROUTING OF THE SLIP BASE POLE</p> | |
| <p>1. The holding down nuts and bolts shall be covered with bituminous paint.</p> | <p><i>Bituminous Paint Drain</i></p> |
| <p>2. A drain shall be installed at the base of the slip base as shown on Drawing No. 0530-1456.</p> | |
| <p>3. A 3:1 mortar dry pack mix shall be forced under the slip base.</p> | <p><i>Mortar Pack</i></p> |

- | | |
|---|---------------------|
| 4. A 1:3:6, concrete mix shall be poured around the holding down bolt assembly as shown on Drawing No. 0530-1456. | Concrete Mix |
|---|---------------------|

701.21.04 FOCUSING OF LUMINAIRES

- | | |
|--|---------------------------|
| 1. After the poles have been plumbed each luminaire shall be focused using a digital spirit level to the correct angle in accordance with the requirements of the Pole Schedule. | Focusing Luminaire |
| 2. The top of the luminaire shall be horizontal. | Horizontality |

701.21.05 POLE NUMBERS

- | | |
|---|---------------------|
| 1. Numbers as per the design Drawings shall be attached to each pole. The numbers shall be made up of 50 mm black characters on a 50 mm x 60 mm background of adhesive class 2 yellow retro-reflective, material as per AS/NZS 1906 Part 1. | Pole Numbers |
| 2. The numbers shall be fixed vertically to the pole, be read from top to bottom and be at a height of approximately 3 m from the ground. The numbers shall be placed in such a position that they can be readily seen from a vehicle travelling along the carriageway. | Fixing |

701.22 ELECTRICAL INSTALLATION

701.22.01 SWITCHBOARD INSTALLATION

- | | |
|--|-----------------|
| 1. The switchboard shall be installed on a concrete base as detailed on Drawing No. 200231-0062 such that the doors open away from the roadway and that adequate and safe access is provided for removal, replacement and repair. The switchboard base shall be located so that the Photoelectric cell is on the south facing side of the switchboard. | Location |
| 2. Concrete for the base shall be Class N32 and meet all requirements of Specification 901 CONCRETE – GENERAL WORKS. | Concrete |

701.22.02 CONDUITS

- | | |
|---|------------------------------------|
| 1. All conduits shall be installed at a depth not less than 0.6 m below finished surface level at the locations shown in the Drawings. | Installation & Location |
| 2. Conduits shall be run to enable cables to be 'drawn-in' after installation, with sufficient accessible cable pits to be used for this purpose. | Draw in Cables |
| 3. The conduits shall be installed such that water which may enter the conduits always drains into the cable pits. | Drainage |
| 4. Conduits with foreign material inside shall be deemed to be non-conforming and conduits shall be thoroughly cleaned or removed and replaced with new conduit. | Non-Conforming |
| 5. A 3-core polyethylene or polypropylene cable haul rope, with 6.0 mm nominal diameter and blue/yellow/blue in colour, shall be installed in each conduit and suitably anchored at each end. | Draw rope |

701.22.03 CONFLICT WITH DRAINAGE PIPES AND OTHER SERVICES

1. In the areas where drainage pipes and other services are in close proximity to conduit and pole foundations, manual excavation shall be undertaken.

**Manual
Excavation**

701.22.04 EXISTING CONDUITS

1. Care must be taken not to damage existing conduits that are to remain in service. Where necessary manual excavation shall be carried out to avoid damage.

Damage

701.22.05 ROAD CROSSINGS

1. Road crossings shall terminate in a cable pit at each end of the conduit on either side of the roadway. The cable pits shall be installed a minimum of 1m measured from the rear face of the kerb or from the edge of the seal on un-kerbed roads such that their lids are flush with the surrounding finished surface level.
2. Where a crossing is under the road pavement, the crossing shall be installed by directional drilling. Under no circumstances shall the pavement or surfacing be cut to install the crossing.
3. The road crossing conduits shall be installed as per the design Drawings. The crossings shall comprise either a single 80 mm diameter PVC conduit run between respective cable pits, or a single 300 mm diameter RCP or 150 mm diameter PVC pipe. One or more 63 mm diameter conduits shall be installed in the 150 mm and 300 mm diameter crossings as detailed in the design Drawings.

**Road Crossing
Details**

**Directional
Drilled
Crossings**

**Conduits for
Crossings
By Trenching**

701.22.06 CABLE PITS

1. Each cable pit shall be installed as detailed on the design drawings. If the design drawings do not reference any instructions, the requirements outlined in Clause 701.22.06 (2), (3), (4), (5), (6), (7), (8), (9), (10) shall apply.
2. Each cable pit shall be located behind the light pole as shown in "Pole/Cable Pit Orientation" on Standard Drawing No. 200231-0063.
3. The cable pits shall be installed such that their lids are flush with the surrounding finished surface level.
4. Where the conduits enter the cable pits a neat hole shall be cut in the pit using a hole cutter or similar tool. Pits with holes knocked in with a hammer or similar tool will be rejected.
5. All cable pits shall have a preformed or drilled hole of minimum 12 mm diameter in the bottom to facilitate drainage.
6. The conduit shall be sealed at the point of entry through the cable pit wall with appropriate silicone sealant. Only one hole for each conduit entering the cable pit shall be cut. A bell-mouth shall be fitted to the end of each conduit within the cable pit except the conduit to the pole.

**Installation
Requirements**

Location

**Flush
installation**

Conduit Entry

Drainage

Sealing

- | | |
|--|--------------------------|
| 7. A 150 mm wide x 150 mm deep concrete surround with a reinforcement bar, as per Standard Drawing 200231-0063 shall be cast and trowelled to a neat finish around each cable pit. Alternatively, a pre-cast surround may be used. | Concrete Surround |
| 8. All cables in the pit, whether joined or not, shall be taken over the conduit, wedged into and across the top of the pit, and securely fixed with a nylon cable tie to the conduit as detailed in Drawing No. 200231-0063. | Cable Ties |
| 9. All foreign material shall be removed and sand and dirt vacuumed from the pit after all electrical connections have been made. | Cleaning |
| 10. The pit gasket shall be installed directly under the lid and rest on the pit lip. | Gasket |

701.22.07 CABLE ROUTE MARKERS AND ORANGE DANGER TAPE

- | | |
|--|----------------------------|
| 1. The location of all underground cables shall be indicated by means of cable route markers set securely in the concrete surround to the cable pits. The markers shall be set flush in the concrete surround of the cable pits. | Cable Route Markers |
| 2. The 100 mm diameter aluminium cable markers (with the words “Electric Cable MRWA” embossed into the disk and 2 x 30 mm long hooks for casting into concrete) shall be cast into the concrete surround using the embossed arrow to identify the direction of all conduit runs in accordance with Standard Drawing No. 200231-0063. | Dimensions |
| 3. The Contractor shall install 150 mm wide orange danger tape in accordance with AS/NZS 2648.1 300 mm above all installed cables and conduits. | Orange Danger Tape |

701.22.08 POLE CONDUITS

- One 32 mm heavy duty corrugated flexible PVC conduit shall be run between the pole base and the cable pit. The conduit shall finish a minimum of 50 mm above final ground level.

701.22.09 POLE CONNECTIONS

- | | |
|--|--------------------|
| 1. Single core 4 mm ² stranded copper/PVC insulated/ PVC sheathed 0.6/1 kV cables in the appropriate colours shall be run between the control gear in the base of the pole and the cable pit. | Cables |
| 2. In the base of the pole the cables shall be cut and fitted with Anderson Power pole modular connectors. The correct crimping tool as specified by the manufacturer shall be used for the Anderson connectors. | Connectors |
| 3. Between the main cables and the connectors the earth cable shall be at least one metre longer than the supply cables which shall be cut to equal lengths. Between the connectors and the control equipment base (gear) plate the earth cable shall be at least as long as the incoming supply cables. | Earth Cable |

4. The incoming supply cables shall be securely clamped to the control equipment base (gear) plate and the earth firmly attached to earth studs on the plate and the support bar in the pole. The incoming supply cables shall be securely fixed to the support bar in the slip base with nylon cable ties or similar so that in the event the pole is hit by a vehicle the Anderson connectors disconnect leaving the incoming supply cables and the bottom connectors below the top of the slip base.

***Incoming
Supply Cables***

5. The excess earth cable shall be loosely coiled up. The Anderson connectors for the supply cables shall be assembled together with a dummy connector separating the two supply connectors. The earth connector shall be left free.

***Cables &
Connectors***

6. It is essential for the safe operation of the slip base in a crash that the pole connections shall be carried out strictly in accordance with Drawing Nos. 0530-1456 and 0530-1457, including installing the correct length of the cables in accordance with Drawing No. 200231-0063 and the design Drawings.

***Safety
Considerations***

701.22.10 ROADWAY LIGHTING TEE CONNECTIONS IN PITS

1. Tee connections must either be waterproof piercing connectors or waterproof gel joints. Formal written approval for the use of other connection methods or systems must be sought from the Superintendent.

Tee Connection

701.22.11 INTERNAL POLE WIRING

1. Generally a three (3) core, 1.5 mm² stranded copper/PVC insulated /PVC sheathed 0.6/1 kV (TPS) cable shall be provided from the base of the pole to the luminaire. However, cable selection shall suit the temperature rating required by the luminaire terminal temperature. At the top of the pole a loop shall be formed in the cable using a nylon cable tie as shown on Drawing No. 0530-1456. The cable shall then be attached to the pole cap using this loop.

Cable

2. The control gear plate complete with all necessary equipment shall be installed at the base of the pole. The cables from the pole base shall be connected to the terminal strip and firmly clamped to the plate.

***Control Gear
Plate***

3. Earth studs shall be fitted to the slip base, the control gear plate and on one of the mounting straps for bonding the plate, the pole and slip base support bar to earth. The luminaire shall also have an earth stud and be earthed.

Earth Studs

701.22.12 CABLE RUNS

1. Although it is desirable for the main cables to be continuous, this is not always practical. When joints are necessary, they shall be made adjacent to a Tee off joint using the appropriate crimp link. The joint shall then be insulated and supported at the top of the cable pit. Under no circumstances shall cable joints in conduits be permitted.

Joints

2. When pulling cables through the conduits, extreme care must be exercised to ensure that the cable is not damaged by the bell-mouth at the ends of the conduits. Where there is evidence of excessive wear on the bell-mouth caused by the pulling of the cables into the conduit, the cables shall be removed, made available for inspection by the Superintendent, and replaced with new cable if the insulation is damaged, or otherwise replaced.

Cable Damage

701.22.13 CABLE IDENTIFICATION

1. All cables shall be clearly identified with permanent water resistant cable markers showing each outgoing cable in the switchboards, in each cable pit and in the base of each pole. The markers shall identify each circuit, for example L1, L2, etc. In the cable pits one marker for each circuit is acceptable providing the circuit cables are firmly tied together where the marker is attached.

Cable Markers

701.22.14 EARTHING

1. The installation shall be earthed in accordance with Section 5 of AS/NZS 3000 and the requirements of the Network Operator and any regulatory requirements.

Earthing

701.22.15 RESIDUAL CURRENT DEVICES

1. Residual Current Devices (RCDs) shall be installed in accordance with AS/NZS 3000.

RCDs

701.22.16 POINT OF ATTACHMENT OF SUPPLY AUTHORITY MAINS

1. Underground power is the preferred method of mains supply from the Network Operator to the switchboard(s).
2. Where used, the point of attachment pole shall be hot dip galvanised in accordance with AS/NZS 4680 after all fabrication, drilling and welding has been completed. All cables shall be run inside the pole. Exterior conduits shall not be permitted.

Underground Power

Overhead Mains

701.23 TESTING

701.23.01 ELECTRICAL INSTALLATION

1. After cables have been installed and connected, the Contractor shall carry out an insulation test of all cables using a 1000 V insulation tester. The test voltage shall be applied for a minimum of 10 seconds. Prior to carrying out the tests all fuses shall be removed, circuit breakers opened and neutrals disconnected.

Insulation test

2. In accordance with AS/NZS 3000 Section 8, the following tests shall be made:

**AS/NZS 3000
Mandated Tests**

- (a) Continuity of the earthing system (earth resistance)
- (b) Insulation resistance between all live conductors and earth
- (c) Polarity
- (d) Correct circuit connections
- (e) Verification of earth fault-loop impedance
- (f) Correct operation of RCDs

3. All control circuits and devices shall be functionally checked to verify correct operation.

**Function
Checks**

4. **Prior to and as a prerequisite to obtaining Practical Completion all new or modified installations shall be inspected and tested in accordance with section 8 of AS/NZS 3000 and a copy of the test results shall be submitted to the Superintendent demonstrating that the installations meet the relevant requirements.**

HOLD POINT

5. Any part of the installation found to be non-conforming shall be replaced with new materials and/or components or corrected to the satisfaction of the Superintendent. Street lighting circuits with an insulation resistance lower than 10 MΩ shall have the faulty cable sections replaced and re-tested to confirm that acceptable insulation resistance values have been attained.

Faulty Sections

6. **Prior to the Network Operator's approval of the installation and connection to the supply mains, the Contractor shall have completed all tests to the Superintendent's satisfaction.**

HOLD POINT

701.24 IMPACT ABSORBENT LIGHT POLE

701.24.01 IMPACT ABSORBANT LIGHT POLE

1. Impact absorbent light pole shall be designed and manufactured as per clauses 701.15 and 701.21 and typical Standard Drawing 0348-3122.

**Drawing
0348-3122**

701.24.02 TEE CONNECTIONS

1. The TEE connections for impact absorbing light poles shall be as per clause 701.22.10 item 1.

701.24.03 INTERNAL FRANGIBLE POLE WIRING

1. Generally a three core, 1.5 mm² stranded copper/PVC insulated /PVC sheathed 0.6/1 kV (TPS) cable shall be provided from the base of the pole to the luminaire. However, cable selection shall suit the temperature rating required by the luminaire terminal temperature. At the top of the pole a loop shall be formed in the cable using a nylon cable tie as shown on Drawing No. 0530-1456. The cable shall then be attached to the pole cap using this loop.

2. The control gear plate with drip shield and complete with all necessary equipment shall be installed at the base of the pole. The cables from the Tee connection shall be connected to the terminal strip and firmly clamped to the plate.
3. Brass or stainless steel M6 earth studs shall be fitted to the control gear plate and on the support strap for bonding the plate and the pole to earth.

701.25 SWITCHBOARD DOCUMENTATION AND SWITCHING

- | | |
|---|--|
| 1. Upon commissioning the installation, the Contractor shall place in each switchboard document pocket a copy of the relevant As Constructed Drawings and a copy of all tests required under this specification in a durable sealable plastic document holder. | <i>Documentation</i> |
| 2. When work under this specification involves modification work to an existing installation, the Contractor shall, at the conclusion of each day, leave in the switchboard a log of the pertinent activities undertaken for the day and the details of any circuits isolated and the reasons for this to prevent electrocution. | <i>Log Sheet</i> |
| 3. When work under this specification involves modification work to an existing installation, the Contractor shall keep to a necessary minimum the time that it requires to switch the installation, or any part of it, off. | <i>Switching Off</i> |
| 4. When work under this specification involves modification work to an existing installation, the Contractor shall contact the maintenance contractor prior to switching the installation or any part of it "on" or "off" for a significant period. Significant periods include all overnight periods. Details of the maintenance contractor can be provided by the Superintendent. | <i>Maintenance Contractor</i> |
| 5. For the purposes of this clause 710.30, existing installations includes new ones after the date of commissioning. | <i>Definition of Existing Installations</i> |

701.26 REMOVAL OF POLE MOUNTED LIGHTING

- | | |
|--|---------------------------------------|
| 1. Redundant poles shall be removed from the site and disposed off site by the Contractor, unless otherwise directed by the Superintendent. | |
| 2. Poles that are to be reused shall be properly handled and stored during transit and upon delivery. Luminaires shall be removed from the pole and disposed off site by the Contractor, unless otherwise directed by the Superintendent. | |
| 3. Light pole bases and foundations shall be removed and disposed off site by the Contractor, unless otherwise directed by the Superintendent. | <i>Light Pole Base Removal</i> |
| 4. If light pole bases, foundations and/or Luminaires are to be reused, the Contractor shall ensure that all luminaires, poles, control gear, switchboards and any other material is properly packaged, stored and handled during dismantling, transit, storage and upon delivery. | |

701.27 PEDESTRIAN SHARED PATH LIGHTING

701.27.01 POLE INSTALLATION

1. The design Drawings detail specific locations of all pedestrian shared path lighting poles.
2. Where hinged lighting poles are required by the design care shall be taken to ensure that the alignment of the pole is such that it can be hinged down to a suitable position for maintenance purposes. Each pole base shall be within 100 mm of its location and +0 mm -25 mm of its final level. **Pole Installation**
3. The pole shall be orientated so that when erected the pole is true and vertical and the outreach arm is at right angles to the path carriageway or edge of seal.
4. The pole access door shall face towards the path.
5. The luminaire lamp holders shall be adjusted to the nominated distribution and the luminaire spigot clamp shall be set to the correct angle.

701.27.02 POLE ASSEMBLY

1. Poles shall be erected according to the manufacturer's published procedures and Drawing No. 0448-3008. Care shall be taken when handling the poles so that the galvanising is not damaged. Metal slings, if used, shall have adequate protection so that metal to metal contact is not possible.
2. A circular hole, 450 mm minimum diameter shall be augured to accommodate the pole base. Poles shall be lowered into position using a crane or other lifting device; poles shall not be slid into their foundation excavation.

701.27.03 POLE NUMBERS

1. Numbers as detailed in the design Drawings shall be affixed to each pole. The numbers shall be made up of 25 mm black characters on a 25 mm x 30 mm background of adhesive class 2 yellow retro-reflective, material as per AS/NZS 1906.1.
2. The numbers shall be fixed vertically to the pole, be read from top to bottom, at a height of approximately 2.5 m from the ground and face towards the path.

701.27.04 POLE CONDUIT

1. One incoming and one outgoing heavy duty corrugated flexible PVC sized conduit, sized as per the design Drawings, shall be installed to a height of 500 mm above ground level inside the lighting pole. Couplings shall be used to attach the corrugated conduits to the in ground 50 mm heavy duty rigid conduits.

701.27.05 FOCUSING OF LUMINAIRES

1. Each luminaire shall be focused with a digital spirit level to the correct angle in accordance with the requirements of the Pole Schedule.

701.27.06 BIRD GUARD

1. A bird guard shall be provided with each luminaire to prevent birds entering the housing when the luminaire is installed on the outreach arm.

701.28 INSTALLATION OF UNDERPASS LIGHTING

1. Underpass lighting shall be installed in accordance with this clause 701.28.

2. **Prior to any modification or attachment to any bridge and/or other structure the Contractor shall notify and receive approval for the proposal from the Superintendent before commencing any such work.**

HOLD POINT

3. Luminaires shall be as per the design Drawings.

Luminaire Type

4. Luminaires shall be fixed to the concrete structure using four size #10 x 40 mm stainless steel mushroom headed screws into plastic masonry plugs.

***Luminaire
Fixing***

5. Each luminaire shall be protected against vandalism by a 9.5 mm thick sheet of General Electric Lexan MR-AC sheet or similar approved by the Superintendent, drilled with 9.5 mm diameter holes as indicated on Drawing No. 0448-3011.

***Vandal
Resistant Cover***

6. A moisture and insect resistant gasket shall be fabricated from 20 mm x 6 mm cross section self-adhesive, dense grade neoprene foam rubber strip and affixed to the rear side of the Lexan MR-AC sheet.

7. The Lexan MR-AC sheet shall be fixed in place by eight 14 gauge 50 mm long pan head hex socket self-tapping stainless steel screws complete with stainless steel washers to suit.

8. The concrete rebate shall be accurately drilled to a diameter of 10 mm and a depth of 50 mm to align with the Lexan MR-AC sheet fixing screws and to suit the 50 mm plastic masonry plugs that shall be installed to accept the Lexan MR-AC fixing screws.

9. Circuit wiring shall be single core stranded copper/PVC insulated/PVC sheathed 0.6/1 kV (SDI) cables that shall not be looped into the luminaires.

Wiring

10. Conduit cabling shall be "Teed off" at the junction box behind the luminaire to flexible three core copper double insulated cable using "blue point" connectors of suitable size taped with PVC insulating tape of a similar colour.

11. The flexible cable shall be brought into the luminaire through the base of the luminaire and sealed with RTV108 silicone sealant so as to maintain IP65 rating.

701.29 RETROFITTING OF UNDERPASS LIGHTING

- | | |
|--|-------------------------|
| 1. Prior to any modification or attachment to any bridge and/or other structure the Contractor shall notify and receive approval for the proposal from the Superintendent before commencing any such work. | HOLD POINT |
| 2. Where underpass lighting is to be installed in a structure where no previous allowance for such lighting has been allowed for, then installation shall generally be in accordance with this Specification. | |
| 3. Bulkhead luminaires shall be as per the design Drawings and installed complete with wire guards at the locations specified. | |
| 4. Luminaires shall be fixed to the concrete structure using four size #10 x 40 mm stainless steel mushroom headed screws into plastic masonry plugs. The four screws shall be accessed from within the luminaire. | Luminaire Fixing |
| 5. Cabling shall be completely contained within a conduit system complying with this Specification. | |
| 6. Circuit wiring shall be single core stranded copper/PVC insulated /PVC sheathed 0.6/1 kV (SDI) cables. | Wiring |
| 7. Cabling may be looped through the luminaire where cabling size and temperature rating is compatible with the luminaire terminals. Where this is not possible junction boxes shall be installed adjacent to the luminaires and these shall be used to "Tee off" flexible three core copper double insulated cable and this shall be taken to the luminaire inside conduit. | |
| 8. Tee terminations shall be made using "blue point" connectors of suitable size. | |

701.30 BRIDGE MOUNTED INSTALLATION

- | | |
|--|-------------------|
| 1. Prior to any modification or attachment to any bridge and/or other structure the Contractor shall notify and receive approval for the proposal from the Superintendent before commencing any such work. | HOLD POINT |
| 2. Bridge mounted poles and underbridge lighting shall be in accordance with Drawing Nos. 0530-1456, 0530-1457, 200231-0057, 0448-3010, 0630-1903 and 0630-1904 and unless otherwise approved by the Superintendent, shall be installed according to the requirements of this Specification. | |

701.31 – 701.80 NOT USED

AS BUILT AND HANDOVER REQUIREMENTS

701.81 AS BUILT DRAWINGS

- | | |
|--|-----------------------|
| 1. The Contractor shall make an accurate record of all changes where the actual installation differs from that shown in the design Drawings and Specification. | Record Changes |
|--|-----------------------|

- | | |
|--|--|
| 2. The Contractor shall record the results of all testing and include the test results on the design Drawings. | |
| 3. As Built Drawings shall comply with Main Roads As Constructed Drawing presentation requirements. | <i>Amendments</i> |
| 4. The Contractor will sign the As Built Drawings certifying that the Drawings accurately depict the installation as constructed. | <i>Certify As-Built</i> |
| 5. The Contractor shall submit As Built Drawings to the Superintendent within two weeks from commissioning of the relevant lighting. | <i>Submission to Superintendent</i> |

701.82 MAINTENANCE DURING DEFECTS LIABILITY PERIOD

- | | |
|--|-----------------------------|
| 1. The Contractor shall provide the Superintendent with a report detailing all defects, together with actions taken to remedy the defect, at regular intervals not exceeding four weeks. Notwithstanding this reporting period, the Contractor must repair all defects within 14 days of first being made aware of the defect. | <i>Defect Repair</i> |
| 2. Incidence of graffiti attack shall be dealt with in accordance with Specification 908 ANTI-GRAFFITI. | <i>Graffiti</i> |

701.83 MAINTENANCE AND HANDOVER

1. The Contractor shall liaise as required with the maintenance contractor to ensure a smooth handover at the conclusion of the Defects Liability Period with no outstanding defects left unresolved.
2. All records, logs and other documents relative to the operation of the installation shall be provided to the maintenance contractor through the Superintendent, or direct to the maintenance contractor if agreed with the Superintendent prior to the issue of a Certificate of Practical Completion.

701.84 – 701.90 NOT USED

CONTRACT SPECIFIC REQUIREMENTS

701.91 – 701.99 NOT USED

ANNEXURE 701A**SUPPLY OF ELECTRICAL MATERIALS**

The following is a summary of electrical materials required for the Works. The list shall be completed and amended in accordance with the design Drawings.

Component	Description/Type/Model etc.
Cable Pits	
Conduits	
Wiring	
Switchboards	
Lighting Poles	
Luminaires	

(NOTE: Complete/expand the above table as necessary, and delete this note)

GUIDANCE NOTES

FOR REFERENCE ONLY – DELETE GUIDANCE NOTES FROM FINAL DOCUMENT

1. All edits to this specification are to be made using track changes, to clearly show added/deleted text.
2. If **all** information relating to a clause is deleted, the clause number should be retained and the words **“NOT USED”** should be inserted.
3. The proposed document with tracked changes must be submitted to the Project Manager for review, prior to finalising the document.
4. Once the Project Manager’s review is complete, accept all changes in the document, turn off track changes and refresh the Table of Contents.
5. The Custodian of this specification is the Principal Electrical Standards Engineer

CONTRACT SPECIFIC REQUIREMENTS TO ADD OR DELETE

The following clauses are to be placed under the CONTRACT SPECIFIC REQUIREMENTS as required.

1. SCOPE
 - 1.1 This Specification primarily covers the requirements for new street lighting installations on Controlled Access Highways (CAHs) using slip-based lighting poles.
 - 1.2 Where modifications to existing CAH lighting is proposed, then the scope (Clause 701.01) will need careful editing to clearly outline the extent of the Works.
 - 1.3 This Specification is **not** suitable for street lighting installations undertaken by Western Power Corporation. In such cases, the Project Manager should define the Contractor’s obligations under the terms of the Contract. A common arrangement is that such lighting installations can be organised by the Contractor in liaison with Western Power using sub-contractors accredited by Western Power. Payment is then made from a Provisional Sum provided in the Contract for the purpose.
 - 1.4 References to High Pressure Sodium (HPS) luminaires and hardware have been removed from this version. If required, the previous revision with HPS references can be requested via the Main Roads Electrical Asset Management Technical Query and Request for Information process.
2. SUPPLY OF ELECTRICAL MATERIALS (Annexure 701A)
 - 2.1 Annexure 701A represents a summary of electrical materials required to be supplied by the Contractor. Complete as necessary.
3. ROADWAY LIGHTING CONTRACTS
 - 3.1 Where this specification is used in a contract that is solely or predominantly for the installation of roadway lighting, inclusion of and cross-referencing to other relevant specifications is likely to be required, such as:

- Specification 100 GENERAL REQUIREMENTS
- Specification 302 EARTHWORKS
- Specification 901 CONCRETE – GENERAL WORKS

CONTRACT SPECIFIC REQUIREMENTS

The following clauses are to be placed under the CONTRACT SPECIFIC REQUIREMENTS, as required. After inserting the clause, change the clause number and heading to style “H2 SP” so it appears in the Table of Contents.

XXX.XX SUB-HEADING (H2 SP)

- 1. Insert text (Main Table SP) XXXX
- 2. Insert text (Main Table SP)

XXX.XX SUB-HEADING (H2 SP)

- 1. Insert text (Main Table SP)
- 2. Insert text (Main Table SP)

AMENDMENT CHECKLIST

Specification No. **701** Title: **ROADWAY LIGHTING** Revision No: _____

Project Manager: _____ Signature: _____ Date: _____

Checked by: _____ Signature: _____ Date: _____

Contract No: _____ Contract Name: _____

ITEM	DESCRIPTION	SIGN OFF
<i>Note: All changes/amendments must be shown in tracked changes until approved.</i>		
2.	Project Manager has reviewed the specification and identified additions and amendments.	
6.	Standard clauses amended? MUST SEEK approval from the Specification Custodian.	
7.	Any unlisted materials/products proposed and approved by the Project Manager? If "Yes" provide details at 16.	
8.	Deleted clauses shown as " NOT USED ".	
9.	Ensure appropriate INSPECTION AND TESTING parameters are included in Specification 201 (test methods, minimum testing frequencies verified).	
10.	AS-BUILT AND HANDOVER requirements addressed.	
11.	CONTRACT SPECIFIC REQUIREMENTS addressed? Contract specific materials, products, clauses added? (refer Specification Guidance Notes).	
12.	ANNEXURES completed (refer Specification Guidance Notes).	
13.	Estimates Manager has approved changes to SMM .	
14.	Project Manager certifies completed specification reflects intent of the design.	
15.	Independent verification of completed specification arranged by Project Manager.	
16.	Project Manager's review completed.	
17.	SPECIFICATION GUIDANCE NOTES deleted.	
18.	TABLE OF CONTENTS updated.	
19.	FOOTER updated with Document No., Contract No. and Contract Name.	
20.	Supporting information prepared and submitted to Project Manager.	
Additional information or further action:		

Signed: _____ (Project Manager) Date: _____