SECTION 730 - TRAFFIC SIGNAL INSTALLATION

##This section cross-references Sections 732, 733 and 610, which should be included in the specification.:

730.01 GENERAL

(a) Scope

This section covers the requirements for the installation and remodel of traffic signals within the State of Victoria for works supervised by the Department of Transport (Roads) (formerly VicRoads).

For the purpose of this specification, traffic signals shall include:

1. intersection traffic signals
2. pedestrian operated traffic signals
3. pedestrian (zebra) crossings
4. emergency vehicle access signals
5. ramp metering signals.

(b) General Requirements

The Contractor shall be responsible for the supply, installation and commissioning of the traffic signal project as shown on the drawings and as specified.

(c) New Traffic Signals

At the time of release of this Standard Section, all new traffic signal installations shall be low voltage (LV).

(d) Availability of Existing Traffic Signals

Where the works involve remodeling or upgrades to an existing traffic signal installation, the Contractor shall be responsible for ensuring the availability of all existing, operational traffic signals and devices connected to the traffic signal site for the duration of the works. Works shall be planned such that the time the signals are off or on ‘flash’ is minimised.

(e) Condition of Existing Traffic Signals

The Contractor shall be responsible for determining the condition of existing traffic signals and all associated infrastructure.

(f) Updating of RAI database

The Superintendent shall be responsible for maintaining accurate data in the RAI database. This shall include:

1. details of scheduled works
2. Superintendent or Superintendent’s representative contact details
3. contractors contact details for business hours and after hors contact for fault attendance
4. for existing sites (i.e. remodel works), the status change when works commence
5. for new sites, updating status from proposed to ‘under construction’
6. building warranty contractor contact details
7. updating all required fields when works completed.

The Superintendent shall notify the Maintenance Team when works commence and details of building warranty during construction.

730.02 PREQUALIFIED CONTRACTORS

All works associated with the installation and commissioning or remodel of traffic signals shall be undertaken **only** by contractors that are prequalified at the STS level under the DoT (Roads) contractor prequalification scheme.

Such works shall include, but not be limited to:

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1. installation of any and all conduits
2. installation and termination of cabling
3. installation of poles
4. installation and termination of traffic signal hardware
5. installation and termination of any other equipment attached to traffic signal infrastructure (e.g. Bluetooth detectors, ramp control signs, CCTV, ESLS, etc.)
6. any routine or non-routine maintenance activities during construction.

Sub-contractors undertaking the installation of vehicle detector loops shall be prequalified at the SVDL level.

730.03 DEFINITIONS

The following terms are used in this section:

**DoT (Roads) representative** – An employee of DoT (Roads) such as an authorised DoT (Roads) surveillance officer. Where the Superintendent is not a DoT (Roads) employee, a DoT (Roads) representative shall also be present for specified activities as indicated throughout this document.

**Minor Remodel** – A remodel that involves works that affect less than 40% of the existing site.

**Major Remodel** –. A remodel that involves works that include a controller replacement and affect more than 40% of the existing site.

**Remodel** - The full or partial rebuilding of an existing traffic signal site for the purpose of upgrading site equipment and/or adding to, deleting from or modifying the existing traffic signals.

**Superintendent** – The authorised person, or the authorised persons representative, responsible for managing the contract works.

**Type Approved** – A product or device, that has been formerly approved by DoT (Roads) for use on DoT (Roads) projects.

730.04 ABBREVIATIONS

The following abbreviations are used in this section:

**2A Pedestal** - Traffic signal pedestal 3.2 m in length

**2B Pedestal** - Traffic signal pedestal 4.1 m in length

**2D Pedestal** - Traffic signal pedestal 5.36 m in length (mini mast arm vertical section)

**ACMA** - Australian Communications and Media Authority

**AS** - Australian Standard

**DC** - Direct current

**DJCS** - Department of Justice and Community Safety

**DoT (Roads)** - Department of Transport (Roads) – formerly VicRoads

**ELV** - Extra Low Voltage (i.e. 42 volts AC)

**GWTP** - Give way to peds’ sign

**HP** - Hold point

**ITS** - Intelligent transport systems

**JUMA** - Joint use mast arm

**JUP** - Joint use pole

**LED** - Light emitting diode

**LV** - Low Voltage (i.e. 240 volts AC)

**MA** - Mast arm

**MEN** - Multiple earthed neutral (as defined in AS/NZS 3000)

**NLT** - ‘No left turn’ sign

**NRT** - ‘No right turn’ sign

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**NZS** - New Zealand Standard

**RAI** - Road Asset Inventory database (database for the inventory and maintenance records for all on-road electrical devices including traffic signals)

**RCD** - Residual current device

**RoSTA - Roads Safety and Traffic Authority (traffic signal cable core allocation system)**

**RSLP** - Rigid street lighting pole

**TPS** - Thermoplastic sheathed electrical cable

**Type 3 Pedestal** - Push button post 1.4 m in length

**VESI** - Victorian Electricity Supply Industry

730.05 SITE PLAN

The scope of works, equipment requirements and placement of equipment shall be as shown on the VicRoads Site Plan.

Abbreviation and symbols used on VicRoads Traffic Signal Plans are detailed in Table 730.051 below and Guideline TCG 019.

**Table 730.051 Abbreviations and Symbols for Traffic Signal Plans**

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730.06 REFERENCED AND RELATED SPECIFICATIONS, STANDARDS AND DRAWINGS

All works associated with the installation and commissioning of traffic signals and other devices covered under this specification shall conform to all relevant DoT (Roads) specifications, DoT (Roads) Standard Contract Sections and Australian Standards.

All works associated with the installation and commissioning of all devices covered under this specification shall conform to the general requirements of the following, in the listed descending order of precedence:

(a) AS/NZS 3000 Wiring Rules

(b) Victorian Service and Installation Rules

(c) DoT (Roads) Contract Standard Sections

(d) DoT (Roads) ‘TCS’ series specifications

(e) DoT (Roads) ‘TC’ series drawings

(e) AS 1742 Manual of Uniform Traffic Control Devices

(f) Drawings included in the Principal’s preliminary design

(g) Technical specifications included in the Appendices

The relevant requirements of the ACMA shall apply to the provision of all communications facilities.

The individual requirements of VESI and the local electricity distribution business shall apply for matters relating to the provision of mains power.

All traffic signal works shall be conducted in accordance with the appropriate DoT (Roads) Traffic Control Series (TCS) Specifications and Contract Standard Sections.

Australian Standards referred to in this section are listed in Table 730.051 below.

**Table 730.061 List of Australian Standards**

|  |  |
| --- | --- |
| **Australian Standard** | **Title** |
| AS 1100.101 | Technical drawing – General principles |
| AS 1319 | Safety signs for the occupational environment |
| AS 1345 | Identification of the contents of pipes, conduits and ducts |
| AS/NZS 2053 | Conduits and fittings for electrical installations |
| AS/NZS 2648.1 | Underground marking tape - Non-detectable tape |
| AS/NZS 3000 | Electrical installations (known as the Australian/New Zealand Wiring Rules) |
| AS 3008.1.1 | Electrical installations - Selection of cables - Cables for alternating voltages up to and including 0.6/1 kV - Typical Australian installation conditions |
| AS/NZS 3017 | Electrical installations – Verification guidelines |
| AS/NZS 3100 | Approval and test specification - General requirements for electrical equipment |
| AS 4070 | Recommended practices for protection of low-voltage electrical installations and equipment in MEN systems from transient over-voltages |
| AS 60529 | Degrees of protection provided by enclosures (IP Code) |
| AS/NZS 61386 | Conduit systems for cable management |

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VicRoads Specifications, Guidelines and Technical Notes referred to in this section are listed in Table 730.062 below.

**Table 730.062 List of DoT (Roads)** **Specifications and Guidelines**

|  |  |
| --- | --- |
| **Spec Number** | **Title** |
| TCS 001 | Mast arms, joint use mast arms and joint use poles |
| TCS 004 | Ramp control signs |
| TCS 010 | Give way to peds sign |
| TCS 016 | The Supply and installation of traffic signal controllers |
| TCS 027 | Puffin crossings – Walk detectors |
| TCS 032 | No Right Turn signs |
| TCS 038 | The supply and installation of traffic signal lanterns and associated hardware  |
| TCS 043 | The supply of electrical distribution cabinets |
| TCS 055 | Emergency vehicle pre-emption |
| TCS 058 | UPS for traffic signals |
| TCS 066 | Linking traffic signals to rail crossings |
| TCS 067 | CCTV |
| TCG 018 | Register of ITS approved products |
| TCG 019 | ITS Final drawing presentation |
| TCN 009 | ELV implementation |
| TCN 010 | Conduit installation |

DoT (Roads) Standard Sections referred to in this section are listed in Table 730.063 below.

**Table 730.063 List of DoT (Roads)** **Standard Sections**

|  |  |
| --- | --- |
| **Std Section** | **Title** |
| 731 | Street lighting installation |
| 732 | ITS devices installation |
| 733 | Conduits and pits for underground wiring and cabling  |
| 610 | Structural concrete |
| 611 | Steel reinforcement |
| 614 | Formwork |

All traffic signal works shall be conducted in accordance with the appropriate DoT (Roads) Traffic Control (TC) Series Standard Drawings.

DoT (Roads) Standard Drawings referred to in this section are listed in Table 730.064 below.

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**Table 730.064 List of DoT (Roads)** **Standard Drawings**

|  |  |
| --- | --- |
| **Drawing Number** | **Title** |
| **Layout of intersections, Ped Ops and other site types** |
| TC-1000 | Typical layouts |
| TC-1001 | Typical pavement marking - traffic signals |
| TC-1003 | Typical layouts for pedestrian operated signals |
| TC-1005 | Typical layout for PUFFIN pedestrian operated signals |
| **Posts and attachments** |
| TC-1100 | Traffic signal posts – Types 2A, 2B and Type 3 |
| TC-1101 | Lantern mounting brackets |
| TC-1103 | Traffic Signal Post Type 2D (Mini mast arm) |
| TC-1104 | Typical layout - flashing pedestrian crossing |
| TC-1105 | Traffic signal and street lighting poles |
| TC-1106 | Traffic signal MA’s, JUP’s & JUMA’s overhead lantern mounting assembly |
| TC-1107 | Traffic signal MA’s, JUP’s & JUMA’s base plate detail |
| TC-1108 | Weather cap for traffic signals and street lighting |
| TC-1109 | Outreach arm clamping details for MA’s, JUP’s & Juma’s |
| TC-1110 | Traffic signal MA’s, JUP’s & JUMA’s column conduit entry details |
| TC-1111 | JUMA, JUP, RSLP street lighting extension spigot cap |
| TC-1112 | Typical 5.5m mast arm installation (2.5m Outreach) |
| TC-1113 | MA, JUMA and JUP lantern support detail |
| TC-1114 | Terminal assembly – pedestal 51 way |
| TC-1115 | Lantern and mounting bracket orientation |
| TC-1116 | Traffic signal mounting arrangements |
| TC-1118 | MA, JUMA & JUP traffic signal and lighting door openings |
| TC-1119 | Lantern mounting details |
| TC-1120 | Joint use pole (JUP) base section |
| TC-1121 | Joint use mast arm (JUMA) base section |
| TC-1122 | Mast arm (MA) base section |
| TC-1123 | JUMA, JUP & RSLP street lighting extensions section |
| TC-1124 | Mast arm (MA) and joint use mast arm (JUMA) outreach sections |
| TC-1126 | Pedestal location under or through verandahs |
| TC-1127 | Traffic signal - Visor types and dimensions |
| TC-1128 | Terminal assembly - MA, JUP & JUMA 51 way |
| TC-1129 | Terminal assembly - pedestal 19 way |

 **Table 730.064 continued next page**

**Table 730.064 List of DoT (Roads)** **Standard Drawings… continued**

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|  |  |
| --- | --- |
| **Drawing Number** | **Title** |
| **Civil and electrical** |
| TC-1200 | Foundation for pedestals |
| TC-1201 | Bored pile foundation for MA, JUP and JUMA |
| TC-1202 | Spread footing foundation for MA, JUP and JUMA |
| TC-1203 | Traffic signal controller foundation details |
| TC-1204 | 51 Core for intersections – Single ring circuit |
| TC-1205 | 29 Core for pedestrian operated Signals |
| TC-1206 | Assembly and installation of consumer mains and meter box |
| TC-1207 | General layout – Traffic signal ducting |
| TC-1208 | Underground conduit warning sign |
| TC-1210 | Cable pit former – 600 mm diameter |
| TC-1211 | Heavy duty cable pit |
| TC-1214 | 51 Core for intersections – Dual ring circuit |
| TC-1215 | 51 Core for diamond interchanges – Dual ring circuit |
| TC-1216 | Cable connections for flashing pedestrian (Zebra) crossings |
| TC-1220 | Cable pit access cover and frame 600 mm diameter |
| TC-1230 | Cable pit - Installation details |
| TC-1601 | Rag bolt assembly - M24 CG and HS 600 mm x 350 mm PCD |
| TC-1603 | Rag bolt assembly for cabinet M12 600 x 460 x 255 |
| **Detection** |
| TC-1300 | Loop pattern and installation details - Symmetripole |
| TC-1301 | Vehicle and tram detector loops along shared and exclusive tram lines |
| TC-1302 | Wheelchair detector loops |
| TC-1310 | Detector pit and lid |
| TC-1320 | Detector pit installation details |
| TC-1332 | Advance tram detection (feeder cable details) |
| TC-1380 | Concrete slab for tram detectors |

 **Table 730.064 continued next page**

**Table 730.064 List of DoT (Roads)** **Standard Drawings… continued**

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|  |  |
| --- | --- |
| **Drawing Number** | **Title** |
| **Public information labels** |
| TC-2100 | Standard cabinet label |
| TC-2101 | Small cabinet label |
| TC-2104 | Pedestrian label |
| **Other** |
| 443016 | Traffic Signals Ahead, Prepare to Stop, active advance warning W3-V101 (VicRoads supplement to AS 1743 – Edition 1, Revision 1) |

NOTE: Current DoT (Roads) Standard Drawings, Specifications and Guidelines are available for downloading from the VicRoads website at:

<https://www.vicroads.vic.gov.au/business-and-industry/technical-publications/electrical-and-intelligent-transport-systems>

730.07 SUPPLY OF EQUIPMENT AND HARDWARE

(a) Equipment supplied by DoT (Roads)

DoT (Roads) will supply or arrange for the supply of the following items:

(1) the traffic signal controller and associated vehicle detector units, tram detectors, etc.

(2) communication devices, such as ADSL modems, 4G modems or NBN modem (possible future arrangement)

(3) Bluetooth Data Stations.

DoT (Roads) reserves the right to add to, delete from, or modify, the list of items to be supplied by DoT (Roads) for any specific project.

(b) Equipment supplied by the Contractor

Other than those items listed in Clause 730.07(a), the Contractor shall be responsible for the supply of all equipment and hardware, items and peripherals required for the completion of the works.

All equipment supplied shall hold current ‘Type Approval’ certification or Product Acceptance certification, where relevant.

All equipment, hardware, materials and fittings supplied by the Contractor are to be new.

The Contractor is to ensure that all equipment used is compatible with all other equipment in the installation.

730.08 PRELIMINARY WORKS

(a) Existing site conditions

Where works are being carried out on an existing site (i.e. a remodel) the Contractor shall be responsible for inspecting and identifying all existing site conditions. For older sites, this should include such things as:

(1) existing multicore traffic signal cable type (older sites may not use current cable types

(2) existing cable core allocations (older sites may pre-date the RoSTA core allocation system)

(3) existence of any ‘sand and slab’ arrangements on site

(4) extent of existing conduit network

(5) existence of any asbestos pits, conduits, or form tubes on site.

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(b) Pre-Construction

The Contractor shall be responsible for locating and proving all underground and overhead services which may be affected by the works and for coordinating the activities of the service authorities in the locating of services and carrying out of any alterations to services.

Any consultation with, and authorisation required from, other authorities under relevant utility regulations and codes shall be the responsibility of the Contractor.

(c) Pre-Installation Meeting

The Superintendent/Contractor *##strikethrough superintendent or contractor as required*: shall arrange a pre-installation meeting, to be convened by the Superintendent, consisting of representatives of the Contractor, DoT (Roads), service authorities, municipalities, and others as appropriate.

The Contractor shall ensure that the agenda for the meeting includes those matters that need to be resolved for the project to proceed expeditiously.

At the meeting, the Contractor shall mark the position of pedestals, poles, controller bases, pits and conduits in accordance with the drawings, in the presence of and with the approval of the Superintendent.

Where trees, poles, obstructions, services, or other site conditions prevent or adversely affect sight lines or obstruct the location as specified, the Contractor shall determine an alternate location for the affected aspect of the works and obtain approval of the Superintendent of the nominated change.

The marked location of each item approved by the Superintendent prior to excavation of foundations shall constitute agreement of the location only and shall in no way relieve the Contractor from his responsibilities under the Contract.

On satisfactory completion of the pre-installation meeting, the Superintendent will issue to the Contractor a copy of a Pre-Installation Report. A sample pre-installation report is attached.

**HP The Contractor shall not commence installation of the traffic signal pedestals, poles, controller bases or pits until the pre-installation report has been approved.**

(d) During Construction

Unless otherwise specified in individual contract documents, where works are being carried out on an existing operational site, the Contractor shall be responsible for the operation and maintenance of the traffic signals during the construction works. Any faults reported on site, either during or outside normal business hours shall be attended to, and rectified by, the Contractor. All after hours faults shall be attended and rectified within the times specified in DoT (Roads) maintenance contract.

All after hours, non-routine fault calls to site MUST be recorded in the RAI database.

730.09 CONDUITS

The Contractor shall install all conduits in accordance with Section 733 and Technical Note TCN 010.

All electrical conduit installation works for traffic signals must be carried out by, or under the direct supervision of, a VicRoads prequalified traffic signal Contractor and in accordance with the requirements of Energy Safe Victoria.

All communication conduit installation works are to be carried out under the ‘on site’ supervision of a licensed cabler.

Conduits for VESI lighting schemes shall be installed in accordance with the requirements of the local Distribution Business.

A plan showing the as‑constructed conduit locations and depths shall be provided to the Superintendent and a copy left in the controller cabinet.

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730.10 PITS

All pits, pit lids and frames shall be Type Approved.

The Contractor shall install all pits in accordance with Section 733.

All cable pit installation works for traffic signals must be carried out by, or under the direct supervision of a VicRoads prequalified traffic signal Contractor and in accordance with the requirements of Energy Safe Victoria.

All communication pit installation works are to be carried out under the ‘on site’ supervision of a licensed cabler.

Pits for VESI lighting schemes shall be installed in accordance with the requirements of the local Distribution Business.

Unless otherwise approved by the Superintendent, pits shall be installed for the purposes as detailed in Table 730.101 below.

**Table 730.101 List of Typical Pits and Applications**

|  |  |
| --- | --- |
| **Pit Type** | **Typical Application** |
| 600 mm Cable Pit | Traffic signal cables, detector feeder cables and AS/NZS 3000 lighting |
| 750 mm Cable Pit | Traffic signal cables and detector feeder cables where required due to large numbers of cables (e.g. sites more than 24 signal groups or 32 vehicle detectors). This larger pit may be useful for accommodating cables feeding into the controller or where multiple multicore traffic signal cables are required. |
| Detector Pit | Joining detector feeder cables to detector loop cables |
| Earth Pit | Locating earth stake for main switchboard |
| P2 Communications Pit | Demarcation point between DoT (Roads) ADSL line and the Communications Carriers ADSL line. |
| VESI Pit | ONLY used where a VESI lighting scheme is installed and VESI pits are required by the local distribution business for lighting cables. |

730.11 FOUNDATIONS

All rag bolts and reinforcing cages used in foundations shall be Type Approved.

Foundations shall be located in accordance with the drawings and as approved at the Pre‑Installation Meeting.

When locating foundations, the Contractor shall ensure that all the required clearances of the installed hardware are achieved.

No part of the signal hardware is to be closer than 500 mm behind the face of the nearest kerb line, or closest vehicle path if no kerb is present.

In accordance with VicRoads Standard Drawing TC‑1112, the minimum clearance of 5.5 m shall be achieved between the lowest part of a lantern installed on an outreach and the roadway directly beneath it. This does not apply to lanterns installed on a 2D pedestal (i.e. mini mast- arm).

Foundations and footings shall be as specified in the VicRoads Standard Drawings for the specific item of equipment they are to support, as listed in Table 730.111 below.

The standard foundation for an MA, JUMA and JUP shall be a bored pile. A 600 mm diameter tube former shall be used for any exposed parts of the bored pile foundation above ground level.

Where the installation of a bored pile foundation is not feasible and the Contractor proposes to install a spread footing, or adopt an alternative design, the Contractor shall obtain the prior approval of the Superintendent.

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**Table 730.111 Standard Foundation Types**

|  |  |  |
| --- | --- | --- |
| **Foundation Type** | **Used For** | **Standard Drawing** |
| Pedestal | 2A, 2B, Type 3 | TC-1200 |
| Bored Pile | MA, JUMA, JUP, 2D (mini mast arm) | TC-1201 |
| Spread Footing | MA, JUMA, JUP, 2D (mini mast arm) | TC-1202 |
| Rag Bolt Assembly | All poles | TC-1601 |
| Controller | Traffic signal controllerUPS cabinet | TC-1203 |
| Street lighting | Distribution box | TC-1062 |
| Rag bolt assembly | Traffic signal controller | TC-1603 |

**NOTE**: Where the Contractor proposes an alternative foundation design to those shown on the DoT (Roads) Standard Drawings, the Contractor shall provide sufficient evidence and proof engineering to the Superintendent to confirm that the proposed footing arrangement is suitable.

**HP Where alternative foundations are proposed, they shall be approved by the Superintendent prior to the Contractor installing the foundations.**

Wherever possible, when foundations for pedestals and poles are cast into concrete structures, two rag-bolt assemblies shall be installed similar to the arrangement shown in VicRoads Standard Drawing TC‑1202.

**HP All conduit, pit and foundation works shall be inspected by the Superintendent prior to the Contractor covering the works.**

730.12 BRIDGE DECKS AND OTHER CONCRETE STRUCTURES

Where traffic signals are to be installed onto a bridge deck or other concrete structure and the thickness of the bridge deck does not allow for the standard conduit, pit and foundation arrangements, the following process shall be followed.

(a) Conduits

Where conduits are required to be placed within a bridge deck, or other concrete structure, and the standard conduit size or depth of cover is not achievable, alternative conduit arrangements may be considered.

A reduced diameter conduit may be considered where additional quantity of conduits is provided to compensate for the reduced capacity.

Any variation to standard conduit arrangements must be approved by the Superintendent prior to installation.

(b) Pits

Where pits are required to be placed within a bridge deck, or other concrete structure, the pits may be shallower than standard where standard depth is not achievable or smaller where a standard pit is not achievable.

Any variation to a standard pit arrangement must be approved by the Superintendent prior to installation.

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(c) Foundations

Where foundations are required to be placed within a bridge deck, or other concrete structure and the standard foundation or rag-bolt assembly is not achievable, an alternative foundation will be required.

Any alternative foundation arrangement shall be proof engineered and approved by the Superintendent prior to installation.

730.13 CONSTRUCTION OF CONCRETE FOUNDATIONS

Concrete used in foundations shall be constructed in accordance with the requirements of Section 610 using a minimum concrete grade of VR330/32.

Concrete placed in a bored pile foundation bore hole shall be poured as specified in Section 610.18(a).

Sampling of concrete shall be carried out in accordance with Section 610.16. The frequency of sampling shall be in accordance with Section 610, Table 610.161. For information, Table 730.131 has been included (This is a reproduction of Table 610.161).

**Table 730.131 Frequency of concrete sampling**

|  |  |
| --- | --- |
| **Volume Cast in One Continuous Operation****(cubic metre)** | **Minimum Number of Samples** |
| 0 to 10 | 1 |
| 10 to 25 | 2 |
| 25 to 50 | 3 |
| 50 to 100 | 4 |

Note: This is a reproduction of Table 610.161

730.14 TRAFFIC SIGNAL HARDWARE

All traffic signal hardware shall be Type Approved.

Individual contract documents shall specify whether the traffic signals are LV or ELV. The Contractor shall ensure all supplied traffic signal hardware is suitable for the specified voltage. For details of ELV traffic signal hardware requirements see Specification TCS 038.

The Contractor shall ensure that the combination of ELV lanterns and traffic signal controller are compatible. For details of compatibility see TCG 018.

(a) Standing of Pedestals and Poles

Pedestals and poles shall be installed in accordance with the following requirements:

(1) for all new and major remodels, all Type 2 pedestals shall be 2B

(2) for minor remodels with existing 2A pedestals, where required, 2A pedestals may be used for consistency

(3) for tertiary and secondary lanterns at pedestrian operated signals, 2A pedestals may be used as detailed in Standard Drawing TC-1003. Alternatively, 2B pedestals may be used with all tertiary and secondary lanterns mounted at the equivalent of a 2A height

(4) where specified, Type 3 pedestals shall be installed for pedestrian detectors

(5) pedestals installed through or under a verandah shall be installed in accordance with Standard Drawing TC-1126

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(6) pedestals and poles shall be fastened to the rag bolt assembly cast into the foundations, as detailed in Standard Drawing TC‑1201, with the nuts tightened to 150 Nm of torque

(7) pedestals and poles shall be installed such that they are vertical when fully loaded

(8) pedestals shall not be stood within 48 hours of casting of the foundations

(9) JUP, MA and JUMA poles shall not be stood within 7 days of the casting of the foundations

(10) pedestals and poles shall be fastened to the rag bolt assembly cast into the foundations, as detailed in Standard Drawing TC‑1201, with the nuts tightened to 150 Nm of torque

(11) JUP, MA and JUMA poles shall be installed such that the access door is on the face furthest from the traffic flow.

(b) Lanterns

Lanterns shall be installed in accordance with the following requirements:

(1) all traffic signal lanterns installed shall be LED type

(2) for all remodels all existing non-LED lanterns shall be replaced with LED

(3) the lantern voltage (i.e. LV or ELV) shall be specified in individual contract documents.

(c) Installation of Hardware

Hardware shall be installed in accordance with the following requirements:

(1) all lanterns shall be mounted vertically, using standard straps securely fixed to mounting brackets or lugs

(2) upper mounting brackets shall be oriented and fixed to the top of pedestals in accordance with Standard Drawing TC‑1115

(3) two-way and four-way lower mounting brackets shall be fixed as required to provide suitable mounting points for the installation of lanterns

(4) the top and bottom of each lantern must be firmly attached to ensure that it will not rotate

(5) each lantern shall be attached so as to provide an unobstructed line of sight to the traffic which it controls, and such that the potential to be hit by vehicles is minimized

(6) external cables and conduits shall be fixed to pedestals, poles or supports using suitable plastic cable ties

(7) cable connections to lanterns shall be of sufficient length to hang below the cable entry point on the lantern (this is referred to as a drip loop), but not hang below the lower mounting strap, as shown in Standard Drawing TC‑1119, and shall be securely fixed by means of cable ties

(8) cable connections to lanterns shall be made with continuous lengths of cable; no joins shall be allowed; this will typically require the cables supplied with lanterns to be replaced with longer cables when installed on mast arm outreaches

(9) junction boxes, key switches, and all other electrical hardware shall comply with the relevant Australian Standards.

(d) Lantern Mounting Heights

Lantern mounting heights shall be in accordance with the following requirements:

(1) mounting heights for lanterns on 2A and 2B pedestals shall be as specified in Standard Drawing TC‑1116

(2) lanterns installed on the vertical section of an MA, JUP and JUMA shall be mounted on lugs so as to give the same mounting heights for the respective lantern positions as specified in Standard Drawing TC‑1116

(3) lanterns on the outreach of an MA or JUMA shall be mounted in accordance with Standard Drawing TC‑1112

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(4) 1 and 2 aspect lanterns shall be installed to achieve the mounting height of an aspect of the same colour as if it were part of a 3-aspect lantern

(5) 2 aspect bicycle lanterns shall be mounted at the same height as pedestrian lanterns

(6) aspects fitted with white or lunar white lenses shall be mounted at the same height as a green aspect

(7) lanterns mounted on poles not belonging to VicRoads shall be mounted at the same heights as specified in Standard Drawing TC‑1116

(8) internally illuminated signs shall be mounted at a height to provide a clearance of not less than 2.4 m from the finished surface level

(9) flashing yellow signals used at pedestrian crossings shall be mounted at the height specified in Standard Drawing TC‑1104.

(e) Lantern Mounting Locations

Lantern mounting locations shall be in accordance with the following requirements:

(1) lanterns shall be mounted as indicated in Standard Drawing TC‑1115 and TC-1116

(2) pedestrian lanterns shall be mounted not more than 1 m from the projection of the nearest crosswalk line

(3) where 2 aspect bicycle lanterns are installed adjacent to pedestrian lanterns, the bicycle lanterns shall be located on the furthest side from the pedestrian crossing (i.e. left side of the pedestrian lantern when looking at the displays).

(f) Lantern Alignment

The alignment of lanterns shall be in accordance with the following requirements:

(1) vehicle lanterns shall be aligned so as to provide optimum visibility for approaching traffic considering road alignment, speed, visibility and other site characteristics

(2) generally, lanterns shall be aimed at a point on the centre of the approach, at a distance before the stop line as shown in Table 730.131 below

(3) pedestrian lanterns shall be aimed at the mid-point of the cross walk on the opposite side of the carriageway to which it applies.

**Table 730.141 Lantern Alignment Distances**

|  |  |
| --- | --- |
| **Lantern** | **Distance** |
| Primary | 240m |
| Tertiary | 5m |
| Secondary | 150m |

(g) Target Boards, Visors and Louvres

All target boards shall be metal type.

Target boards shall be fitted to all lanterns in accordance with VicRoads Standard Drawing TC‑1119.

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Visors for LED Lanterns shall be fitted as specified in Table 730.132 below.

**Table 730.142 Visors for LED Lanterns**

|  |  |  |
| --- | --- | --- |
| **Lantern location** | **Visor type** | **Cutaway** |
| MA or JUMA Outreach | 1 | Both Sides |
| L/H Primary | 1 | Both Sides |
| R/H Primary | 1 | Both Sides |
| Secondary and Tertiary | 3 (short) | None |
| Pedestrian and Bicycle | 4 | None |

Note: Refer to VicRoads Standard Drawing TC‑1127 for details of the visor types.

Louvres shall not be installed on LED lanterns unless otherwise specified.

(h) Installation of Pedestrian Push Buttons

Pedestrian push buttons shall be installed in accordance with following requirements:

(1) pedestrian push button assemblies shall be mounted clear of any access openings and such that the centre of the button is 1.0 m above finished surface level, as shown in Standard Drawing TC‑1116

(2) the face of the button shall be at right angles to the direction of the associated walk lines

(3) the tactile arrow indicator shall be oriented to indicate the walk direction to which the button relates, with the arrow pointing up to indicate a straight ahead walk direction

(4) where a single button is mounted in a median, a double headed arrow plate shall be used with the arrow oriented horizontally and the front face of the button shall be parallel with the walk direction

(5) a seam of silicone sealant shall be applied between the back of the button housing and the pole to prevent the ingress of water into the pole; the sealant shall be applied across the top and on both sides of the button

(6) a label complying with Standard Drawing TC‑2104 shall be installed on the pedestal or pole directly above each pedestrian push button.

(i) Audio Tactile Devices

Where specified on the drawings, audio tactile units shall be mounted as shown on VicRoads Standard Drawing TC‑1116.

(j) Puffin Pedestrian Operated Signals

Where a ‘Puffin’ (Pedestrian User Friendly and Intelligent) Crossing is specified, the Contractor shall install approved Puffin Crossing ‘Walk’ detectors in accordance with VicRoads Specification Puffin Crossing ‘Walk’ Detectors, TCS 027, and VicRoads Standard Drawing TC‑1005.

Where Pedestrian Occupancy Detectors (POD’s) are specified, the Contractor shall install approved POD detectors at the nominated pedestrian waiting area. POD’s shall be installed in accordance with the site-specific operational requirements and the manufacturers requirements.

(k) Flashing Pedestrian Crossings

Flashing pedestrian crossings shall be installed in accordance with VicRoads Standard Drawing TC‑1104.

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(l) Attaching of Equipment to Other Supports

Attachment of traffic signal equipment to service poles or structures which are not owned by VicRoads shall be by means of matt stainless-steel straps, coach bolts or masonry bolts as applicable, or such other methods as approved by the relevant authority, the owner of the pole or structure and the Superintendent.

Above ground conduits attached to structures or poles owned by other agencies shall be 25 mm diameter galvanised wrought iron conduit or steel sheathing of an approved type.

Above ground conduits shall extend up to a termination point for the electrical cables or to a height of 3 metres whichever is the lower.

All traffic signal equipment and cabling mounted on tramway poles shall be externally attached to the pole and must be electrically insulated from the pole to minimise the risk of a DC injection resulting from a fault with the overhead tramway cable.

(m) Non-Commissioned Lanterns

The faces of all installed but not yet operating lanterns shall be covered.

At sites that have not been switched on, all vehicle lanterns shall be covered with ‘NOT IN USE’ signs.

At remodel sites, or sites where existing lanterns are operating, all non-operating lanterns shall be covered with a blanking sign or other approved method. Alternatively, the lanterns may be turned so as not to be visible to traffic.

(n) Awnings

Where pedestals need to be installed under or through awnings or verandahs, the installation shall be in accordance with Standard Drawing TC‑1126.

The Contractor shall be wholly responsible for providing and making good any holes through awnings which may be necessary for the erection of pedestals.

Where pedestals pass through awnings, a clearance all round shall be left between the pedestal and the awning and finished such that water from the awning cannot flow into the opening.

Any alterations to the awning shall be carried out by a qualified plumber and with the agreement of the owner of the awning.

**HP All installed hardware shall be inspected by the Superintendent prior to works proceeding.**

730.15 OTHER HARDWARE

(a) Uninterruptable Power Supply

Where specified, a ‘stand-alone’ UPS shall be installed in accordance with TCS 058.

(b) CCTV Camera

Where specified, CCTV camera equipment shall be supplied and installed in accordance with TCS 067.

(c) Bluetooth Detector Stations

Where specified, Bluetooth data stations shall be supplied and installed in accordance with TCS 069.

(d) Ramp Control Signs

Where specified, ramp control signs shall be supplied and installed in accordance with TCS 003.

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(e) No Right/Left Turn sign

Where specified, NRT/NLT signs shall be supplied and installed in accordance with TCS 032.

(f) Give Way to Peds sign

Where specified, GWTP signs shall be supplied and installed in accordance with TCS 010.

(g) Other detection devices

Where specified, other detection devices (e.g. video detector, microwave detector, radar detector, etc) shall be supplied and installed in accordance with the manufacturer’s requirements.

(h) Traffic Signal Ahead / Prepare to Stop (advanced warning signs)

Where specified in individual contract documents, Traffic Signal Ahead / Prepare to Stop advance warning signs shall be installed in accordance with the site plan. Advanced warning signs shall comply with VicRoads standard drawing 443016 for W3-V101 signs.

Where a pair of signs are installed on the same approach, the flashing yellow lanterns shall flash the outside aspects (i.e. the widest pair of aspects) together then the inside aspects (i.e. the narrowest pair of aspects) together.

730.16 POINT OF SUPPLY

(a) Point of Supply

All electrical works, conduits, fittings, materials and installations related to the point of supply shall comply with the requirements of AS/NZS 3000 Wiring Rules.

At any location, only a single point of supply shall be allowed. A second point of supply shall not be installed within 100 m of an existing point of supply.

Point of supply for traffic signal installation shall be in accordance with the following requirements:

(1) the ‘Application for Supply of Power’ shall be completed and submitted by the Superintendent or Superintendent’s representative

(2) the Contractor shall arrange for the installation of the point of supply with the local power distribution company, at the location approved at the pre-installation meeting

(3) where permitted by the distribution company, the point of supply shall be installed in accordance with Standard Drawing TC‑1206

(4) where required by the distribution company, the point of supply shall be an approved, unmetered, supply pillar

(5) where the distribution company requires a metered supply a distribution cabinet shall be provided as detailed in Table 730.161

(6) the supply enclosure should be located between 3 m and 6 m from the controller cabinet to minimise the risk of both the controller and the point of supply being hit by an errant vehicle in the same incident

(7) the main switchboard shall contain a main switch and/or suitably sized circuit breaker

(8) access to the main switchboard shall be via a VicRoads Power Industry Lock key

(9) the earth stake shall be installed in the associated earth pit

(10) the main switchboard shall contain the MEN (Multiple Earthed Neutral) link

(11) if a street lighting distribution cabinet is to be installed as part of the project, the point of supply for the traffic signals shall be provided by means of a separately metered circuit within the cabinet

(12) the circuit breaker controlling the traffic signals shall be clearly marked.

Where there is additional load added to an existing point of supply, the Contractor shall ensure that the point of supply has sufficient capacity for the additional load.

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Where multiple types of installations are supplied from the same point of supply, multiple meters may be required.

**Table 730.161 Typical Electrical Distribution Cabinets for Metered Supplies**

|  |  |  |
| --- | --- | --- |
| **Site asset** | **DB Type** | **Number of meters** |
| Traffic signals and ITS devices | Type 2 | 1 |
| Traffic signals and ITS devices, and Dot (Roads) street lighting | Type 3 | 2 |

The Contractor shall lodge all relevant associated documentation to comply with the requirements of the Office of the Chief Electrical Inspector and the local Distribution Business for the provision of a 240 v 50 Hz single phase power supply for final termination on not less than a 32 amp service fuse.

**NOTE:** Any arrangements for the supply of power that are not consistent with current VicRoads practice shall be submitted to the Superintendent for approval.

(b) Connection of Traffic Signal Controller

The Contractor shall install a 3 core low voltage power supply cable (i.e. TPS) in a 50 mm conduit between the point of supply and the controller base in accordance with the requirements of the local power distribution company.

Sufficient cable shall be provided to reach 1.0 m above the controller base.

An additional length of at least 1.5 m of the power supply cable shall be left coiled in the pit closest to the controller base.

The active and neutral cores of the power supply cable shall have a cross sectional area not less than 6 mm².

730.17 TRAFFIC SIGNAL SITE CABLING

All traffic signal site cabling shall be installed in accordance with the following requirements.

Only type approved traffic signal cables shall be used.

The only joints allowed in cables shall be those detailed in the following clauses.

**No cable joints in any cable type shall be allowed in any conduits, pits or other non-approved location or in any non-approved manner.**

(a) Multicore traffic signal cabling

Multicore traffic signal cabling shall be installed in accordance with the following requirements.

(1) Where practicable, traffic signal power cables shall be installed in independent road crossing conduits.

(2) Inter-connecting traffic signal power cables shall be drawn through the conduits and pits as shown on the drawings.

(3) A draw cord shall be left in each conduit at the completion of the cabling.

(4) A spare length of not less than 1.5 m of each inter-connecting cable shall be coiled in each cable pit.

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(5) All cables shall be installed in a manner which ensures that sheathing and insulation are not damaged.

(6) Any cables damaged during installation or remodel works shall be immediately replaced by the Contractor at no additional cost to VicRoads.

(7) Site cables shall be appropriately restrained at the point of termination (e.g. top of pedestals, access points in MAs, JUPs, etc.) to ensure that stress on terminations (due to the self-weight of the cable) is minimized.

(8) Cabling shall be terminated in the upper mounting assembly (UMA) terminal strip on Type 2 pedestals.

(9) Cabling shall be terminated in the terminal strip located behind the access door on all MA’s, JUP’s and JUMA’s.

(10) Where the terminal strip is a ‘twin connector’ type (i.e. four screwed connectors on each terminal as per TC-1114B) the traffic signal cable shall be terminated in the lower (or rear) terminals and the traffic signal lantern cables shall be terminated in the upper (or front) terminals.

(11) No cable joints or terminations shall be made in any location or manner other than that described in clauses 8, 9 and 10 above.

(12) Only one terminal strip shall be installed in any pedestal or pole.

(13) Spur cables shall be connected into the ring circuit in the terminal strip in a pedestal or pole, or directly in the traffic signal controller.

(14) Unterminated cables located at the traffic signal controller base shall be coiled in the adjacent pit and appropriately secured.

(15) Sufficient cable shall be provided to reach 1.5 m above the controller base.

(b) Multicore traffic signal cable sizes and wiring arrangements

With the exception of terminations at the controller, all cables and wiring shall be installed by the Contractor and shall comply with the following requirements.

(1) At **standard intersection traffic signals**, the traffic signal controller and all upper mounting assemblies and/or terminal assemblies (in MAs, JUMAs and JUPs) shall be connected by a **51 core cable** in a continuous ring circuit arrangement in accordance with VicRoads Standard Drawing TC‑1204.

(2) At **larger intersection traffic signals**, where the standard allocation of cores (i.e. standard single 51 core ring circuit) cannot be readily adopted, the traffic signal controller and all upper mounting assemblies and/or terminal assemblies (in MAs, JUMAs and JUPs) shall be connected by a **dual 51 core cable** arrangement in accordance with DoT (Roads) Standard Drawing TC‑1214.

(3) At **freeway diamond interchanges,** where the standard allocation of cores (i.e. standard single 51 core ring circuit) cannot be readily adopted, the traffic signal controller and all upper mounting assemblies and/or terminal assemblies (in MAs, JUMAs and JUPs) shall be connected by a **dual 51 core cable** arrangement in accordance with DoT (Roads) Standard Drawing TC‑1215.

(4) At **pedestrian operated signals (single and dual carriageway)**, the traffic signal controller and all upper mounting assemblies and/or terminal assemblies (in MAs, JUMAs and JUPs) shall be connected in sequence by a **29 core cable** circuit in accordance with VicRoads Standard Drawing TC‑1205.

(5) At **flashing pedestrian crossing (Zebra) signals**, the control equipment and all upper mounting assemblies and/or terminal assemblies shall be connected by a **13 or 19 core cable** in accordance with VicRoads Standard Drawing TC‑1216.

(6) For **spurs and flashing (red or yellow) signals**, the control equipment and all upper mounting assemblies and/or terminal assemblies shall be connected in sequence by a **19 core cable** branch circuit.

(7) At **ramp metering signals**, the traffic signal controller and all upper mounting assemblies and/or terminal assemblies (in MAs, JUMAs and JUPs) shall be connected by a **13 core cable**.

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(8) For t**raffic signals ahead / prepare to stop** (advanced warning) signs as detailed in clause 730.15(h), the signs shall be connected to the controller by a suitably sized cable. The required cable size will depend on the distance the signs are from the controller. The cable size shall be determined to ensure compliance with voltage drop requirements of AS/NZS 3000.

The Signal Installation Contractor shall provide the Controller Installation Contractor with a copy of the site cabling core allocations, with a copy left in the controller cabinet.

**HP For large signal installations where the arrangements detailed in standard drawings TC‑1214 or TC‑1215 are required to be adopted, the Contractor shall draw up a proposed cabling scheme and submit this to the Superintendent for approval.**

(c) Cabling of Pedestrian Push Buttons

Pedestrian push button detectors shall be connected by flexible 5 core cable (each core shall have a cross sectional area of not less than 1.5 mm²) to the appropriate termination positions for the multi-core traffic signal cables.

The termination of push button cable connections shall be as detailed in Table 730.171 below.

**Table 730.171 Pedestrian Push Button Cable Connections**

|  |  |
| --- | --- |
| **Nominal core colour** | **Function** |
| White | Push Button |
| Blue | Push Button return |
| Brown | Call Record |
| Orange | Call Record return |
| Green/Yellow | Earth |

(d) Detector Feeder Cables

Detector feeder cables shall be used to connect detector loops to the traffic signal controller and shall be installed in accordance with the following requirements.

(1) Where practicable, detector feeder cables shall be installed in independent road crossing conduits.

(2) Detector feeder cable shall be a Type Approved 2 core or 8 core shielded cable, 1 cable per loop and each cable pair shall be clearly and durably marked at both ends to enable positive identification.

(3) The maximum length of any individual detector feeder cable shall not exceed 200 m.

(4) The only permissible joint in a detector feeder cable is where it joins to the associated loop feed-in wires in the associated detector pit. Joints in feeder cable to extend the length of the feeder cable are not permitted.

(5) The Contractor shall connect the detector loop cables to the detector feeder cables in accordance with this section by soldering.

(6) The 4 wires for each individual loop (e.g. 9SA, 9FA, 9SB and 9FB as shown in Standard Drawing TC‑1300) shall be tied together in a knot located close to the conduit end.

(7) Unused loop cable ends shall be left open circuit.

(8) All terminations, joined or unjoined, shall be separately insulated and sealed against the ingress of moisture with heat shrink containing resin or another acceptable method approved by the Superintendent.

(9) Detector feeder cables shall be left unterminated and coiled in the pit closest to the controller base.

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(10) Each detector feeder cable shall have sufficient length to allow 1.5 m to be coiled in the pit and to reach 1.5 m above the top of the controller base.

(11) Each feeder cable shall be clearly marked or labelled to clearly identify the connected loop.

(12) A cable diagram shall be provided to the controller installation contractor detailing the loop cable/feeder cable connections.

(e) Miscellaneous Cabling

For miscellaneous cable usage, refer to Table 730.172 below.

**NOTE:** No cable joints in any cable type shall be allowed in any conduits, pits or other non-approved location or in any non-approved manner.

**Table 730.172: Miscellaneous Cable Usage**

|  |  |
| --- | --- |
| **Application** | **Cable Type** |
| Branch circuits off a ring circuit (also known as a spur) | 19 or 29 core traffic signal cable |
| Connection to advance warning signs (e.g. traffic signals ahead/prepare to stop with flashing yellow lanterns) | Suitable size cable that ensures compliance with voltage drop requirements of AS/NZS 3000. |
| Linking cable between a UPS and the controller for alarm monitoring | Suitable multi-core data cable |
| Linking cable between the controller and public transport or emergency service facilities (left labelled but unterminated at the controller base) | Suitable multi-core data cableor13 or 19 core traffic signal cable |

(f) Installation of Detector Loops

The Contractor shall arrange for the installation of vehicle detector loops by a DoT (Roads) prequalified SVDL Contractor in accordance with the drawings.

Vehicle detector loop installations shall conform to VicRoads Specification for the Installation of Inductive Detector Loop, TCS 054.

Where there is a single lane, loops may be cut back to either the left kerb or the right (median) kerb.

Where there are 2 lanes, each loop may be cut back to the same side of the road, or 1 to each side.

Where there are 3 or more lanes, the loops shall be cut back to the closer side of the road. Table 730.173 shows some examples for typical installations.

**Table 730.173: Cutting of Detector Loops**

|  |  |  |
| --- | --- | --- |
| **Number of lanes** | **Loops cut to left kerb** | **Loops cut to right (median) kerb** |
| 3 | 2 | 1 |
| 4 | 2 | 2 |
| 5 | 3 | 2 |
| 6 | 3 | 3 |

Where a median does not exist, loops shall not be cut back to the kerb on the opposite side of the road. In this instance, loops for the approach should all be cut back the left kerb.

Wherever possible, cutting loops into steel reinforced concrete bridge decks should be avoided.

The termination of detector loops to detector feeder cables in detector pits shall be carried out by a DoT (Roads) prequalified STS contractor.

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(g) Testing of Electrical Works

The electrical installation shall be tested for correct cabling by the Contractor.

The Contractor shall be responsible for all testing associated with the proving of the electrical circuits in accordance with the requirements of AS/NZS 3000 Wiring Rules and AS/NZS 3017.

In particular, the following tests shall be carried out prior to installation of lanterns and hardware:

(1) continuity of all active conductors

(2) continuity of neutral and ELV conductors

(3) continuity of earthing system in accordance with clause 8.3.3 of AS/NZS 3000.

(4) insulation resistance test of all field cables in accordance with the requirements of AS/NZS 3000.

**HP The results of the above tests shall be recorded on the forms provided at the end of this section and a copy provided to the Superintendent.**

Following the installation of all lanterns and hardware, the Contractor shall carry out a flash test.

730.18 ELECTRICAL WORKS FOR STREET LIGHTING

Where DoT (Roads) owned and operated street lighting is to be installed, all works shall be carried out in accordance with DoT (Roads) Standard Section 731.

Where the isolation switch for a traffic signal installation is located within a street lighting distribution cabinet, the Contractor shall ensure that a key to the street lighting cabinet is installed in the traffic signal controller cabinet.

Any Distribution Company (VESI) street lighting to be installed shall be installed in accordance with the local distribution company standards and requirements.

A separate conduit and pit network shall be installed in accordance with the local Distributor’s requirements for VESI lighting cables. VESI lighting cables shall not be installed in DoT (Roads) traffic signal conduits.

730.19 PROVISION OF COMMUNICATIONS LINE

Where an ADSL line is required, it is the responsibility of the contractor to liaise with the Communications Carrier or any other third party to ensure the ADSL line is available at the location.

The Contractor shall supply and install a 20 mm white ‘Telstra’ communication conduit together with a two pair telecommunication cable from the controller to the associated P2 pit as shown in Standard Drawing TC‑1207. The P2 pit is the demarcation point between DoT’s asset and the Communication Carriers asset. A minimum of 1.5 m of telecommunications cable shall be left coiled in the P2 pit.

The P2 pit shall be installed as close as practicable to the controller foundation apron and not more than 3 metres from the traffic signal controller by the Contractor. The Communications Carrier is responsible for all works from the P2 pit to the nearest Communications Carrier pit. The Contractor shall not undertake any works between the P2 pit and the Communication Carriers pit.

Under no circumstances shall the Contractor connect conduits or cables into the Communication Carrier’s pit. The Contractor is not authorised to enter, break into, undertake any works on or within, or in any other way tamper with or interfere with, any Communications Carriers pits, conduits or another Communications Carriers asset. ONLY the Communication Carrier is authorised to carry out any works on their asset.

The Superintendent shall make application for the line and advise the Contractor on availability of same.

Connection of the communication line shall be the responsibility of others.

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730.20 PUBLIC TRANSPORT INTEGRATION

(a) Signals at Railway Level Crossings

The Contractor shall obtain all the necessary permits and approvals for working on and adjacent to the rail track owner’s, or the railway operator’s, property and equipment.

Where specified on the drawings, the Contractor shall install a 10 pair approved communication cable (colour coded) between the traffic signal controller and the railway control equipment.

Where traffic signals are to be installed on each side of the railway, the Contractor shall supply and install 2 x 100 mm diameter conduits with draw cords as shown on the drawings and agreed by the railway track owner.

The Contractor should note, one of these conduits shall be for the traffic signal ring circuit cables, the other for any ancillary site equipment.

(b) Tram Detection

Tram detection may be provided by one of the following:

(1) transponder

(2) loop within tracks

(3) out of pavement detection technology

(4) manual or automatic points

(5) manual input

(6) other means as detailed in individual tender documents.

Tram detection shall be installed by the Contractor as shown on the drawings.

Where tram track loops are shown on the drawings, the Contractor shall arrange for the installation of the tram track loops in accordance with VicRoads Standard Drawings TC‑1301, TC‑1332 and TC‑1380.

Where advance detection is specified, the Contractor shall install the conduits and pits at each end of the run in accordance with VicRoads Standard Drawing TC‑1332, connect the detector feeder cable to the advance detector loop and run the cable to the controller base.

730.21 CO-ORDINATION WITH EMERGENCY VEHICLE OPERATIONS

(a) Emergency Vehicle Pre-Emption

Where specified in individual contract documents the Contractor shall install an approved Emergency Vehicle Pre-Emption system and associated equipment in accordance with TCS 055, on nominated poles.

All associated cabling shall be installed and connected at the receiver.

(b) Emergency Station Input

Where specified in individual contract documents and on associated drawings the Contractor shall provide a suitable cable (refer to Table 730.162) within a 50 mm conduit, between the controller and the Emergency Panel located within the emergency premises (i.e. Fire, Ambulance or Police).

The location of the emergency panel shall be in a location approved by the Superintendent and the owner of the affected properties.

For details of the Emergency Panel and cabling connections, refer to TCS 016.

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730.22 PRE-COMMISSIONING

(a) Pre-Commissioning Site Inspection

Upon completion of the installation works, a complete pre-commissioning inspection shall be undertaken by the Contractor.

The Contractor shall provide 24 hours’ notice to the Superintendent of the time of the inspection.

Pre-commissioning inspection shall confirm that all field works have been completed before the installation of the traffic signal controller. The inspection shall cover such things as:

(1) all pole foundations are installed correctly

(2) the controller foundation is installed correctly

(3) distribution cabinet foundation is installed correctly

(4) traffic signal cables have been installed and connected in the field

(5) traffic signal cables are coiled in the pit adjacent to the controller foundation

(6) traffic signal cables have been clearly marked as appropriate

(7) all lanterns are installed and connected

(8) all other associated hardware has been installed and connected

(9) a cable numbering diagram has been provided (this is usually written on the ‘op-sheet’)

(10) feeder cables have been connected to loops and the controller end of each feeder cable clearly marked as to what loop it is connected to

(11) communications cable is installed and coiled in comms pit adjacent to the controller foundation

(12) power is available.

The Contractor shall complete the Pre-Commissioning Report provided at the end of this section and provide a copy to the Superintendent.

The Superintendent shall provide a copy of this report to the controller installer prior to the installation of the controller.

Any item found to be defective or incorrectly installed shall be replaced and/or rectified prior to commissioning.

The Contractor shall advise the Superintendent if any aspect of the works has not been completed.

(b) Provision of Power

The Contractor shall arrange for the submission of all necessary paperwork, inspections, payment of fees, etc., to obtain connection to mains supply.

The Contractor shall advise the Superintendent when power is available at the site.

The Contractor shall arrange for the issuing of the Certificate of Electrical Safety and be responsible for the submission of all necessary paperwork, inspections, payment of fees, etc., to obtain connection of mains supply to the site.

730.23 TRAFFIC SIGNAL CONTROLLER INSTALLATION

The traffic signal controller shall ONLY be installed by the controller Supplier (if the Supplier holds STS1 prequalification) or an STS1 prequalified contractor authorised by the controller Supplier.

Under no circumstances shall a Contractor that is not authorised by the controller supplier install the traffic signal controller.

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(a) Pre-controller Installation Field Works

Unless a remodel of an existing site prevents all field works being completed before the installation of the traffic signal controller the installation contractor shall ensure that all site works have been completed including, but not limited to, the following:

(1) traffic signal cables have been installed and connected in the field

(2) traffic signal cables are coiled in the pit adjacent to the controller foundation

(3) traffic signal cables have been clearly marked as appropriate

(4) all lanterns are installed and connected

(5) all other associated hardware has been installed and connected

(6) a cable numbering diagram has been provided (this is usually written on the ‘op‑sheet’)

(7) feeder cables have been connected to loops and the controller end of each feeder cable clearly marked as to what loop it is connected to

(8) communications cable is installed and coiled in comms pit adjacent to the controller foundation.

(b) Pre-controller Installation Documentation

The Installation Contractor shall provide copies of the following completed reports to the Superintendent:

(1) a copy of the Certificate of Electrical Safety for all electrical works as required by ESV

(2) continuity test report

(3) insulation resistance report

(4) pre-commissioning report.

A copy of each of the above reports shall be provided to the controller installer prior to the installation of the controller.

(c) Traffic Signal Controller Installation

The Installation Contractor shall advise the Superintendent when the site is complete and tested and ready for the traffic signal controller to be installed. This advice shall include provision of all documents as detailed in (b) above.

The controller installer shall carry out the controller installation works as specified in TCS 016.

The controller installation contractor is responsible for the removal of the existing controller (for controller replacement works) and the installation of the new controller and connection of all field cabling into the controller including:

(1) mains power cable

(2) traffic signal cables

(3) detector loop feeder cables

(4) communications cable

(5) public transport and emergency vehicle interface cables

(6) power supply cables for other ITS devices such as CCTV, ESLS, Ramp Control signs

(7) existing DJCS connections.

If there are any field works required as part of the controller installation works, the Installation Contractor shall undertake such works at the same time the controller is installed.

**NOTE:** The controller installation contractor is not responsible for any site related field works.

The Superintendent shall advise the Contractor when the controller installation contractor’s works have been completed.

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730.24 COMPLETION OF SITE WORKS AND COMMISSIONING

(a) Participants

The following participants shall be present for works as described in (b) and (c) below.

(1) Installation Contractor representative

(2) Controller Installation Contractor (where associated controller works are or have been carried out)

(3) Superintendent or Superintendent’s representative.

(b) Flash Test

Following the connections of the mains supply cable and all traffic signal cables in the controller, the controller installer shall carry out a ‘flash test’. The ‘flash test’ is to ensure that all lanterns and signal aspects are connected to the correct cable core and signal group.

The Superintendent or Superintendent’s representative shall witness the ‘flash test’ for all lanterns and confirm that the site is connected correctly.

**NOTE: Where the Superintendent is not a DoT (Roads) representative, an authorised representative from DoT (Roads) (e.g. Surveillance Officer) MUST be present to witness and approve the flash test prior to switch-on.**

Any lanterns observed to be connected to an incorrect cable core or signal group shall be rectified by the traffic signal installation Contractor.

**HP The site shall not be switched on before a successful ‘flash test’ has been witnessed by an authorised DoT (Roads) representative (e.g. Surveillance Officer) and confirmed as acceptable.**

(c) Switch-On

DoT (Roads) shall co-ordinate the site switch-on and arrange for all involved parties to be on site.

It is recommended that the local area maintenance contractor be present at the switch on.

On agreement from the Superintendent, the traffic signal installation shall be switched on and thoroughly checked and monitored to ensure safe and proper operation.

**NOTE: Where the Superintendent is not a DoT (Roads) representative, an authorised representative from DoT (Roads) (e.g. Surveillance Officer) MUST be present to carry out the checking and monitoring of the site to ensure safe and proper operation.**

The Contractor shall lodge copies of all applications and notices relating to the supply of power and wiring of the site, together with the Certificate of Electrical Safety to the Superintendent.

The time and date of the switch-on shall be recorded on the Controller Record Card in the controller.

The controller supplier is responsible for recording the time and date of switch‑on and for the power consumption readings as required in the Electrical Test Report.

(d) Commissioning

Once steps detailed in (b) and (c) above have been successfully completed, the site shall be deemed to have been commissioned. Upon the completion of commissioning of the site, the Superintendent shall ensure that the RAI database is updated within 24 hours.

The Superintendent shall provide to the Maintenance Team, within 5 business day, the following:

(1) notification that the site has been commissioned

(2) a copy of the Commissioning report

(3) details of any building warranty or defects liability period affecting the site

(4) the date of scheduled handover.

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(e) Removal of Redundant Hardware

All redundant components of the hardware and equipment (except those components below the finished surface level at the pedestals) shall be removed unless otherwise specified or shown on the drawings.

Hardware and equipment attached to the redundant pedestals shall be removed prior to cutting off and removal of the pedestals.

All holes and depressions formed by the cutting off and removal of pedestals and by the removal of any other items shall be made safe and reinstated to the level of the surrounding surface.

All surface areas such as footpaths, paved areas, grassed areas, etc., shall be reinstated to a finish and condition that is not inferior to the original surface finish and condition (e.g. grass to grass, concrete to concrete, asphalt to asphalt, etc.). All surfaces areas shall be reinstated to the satisfaction of the Superintendent.

The Contractor shall be responsible for disposal of all redundant materials and hardware.

Existing traffic signal equipment and hardware which is not re-used, but is to be salvaged, shall be delivered in good condition to a location specified by the Superintendent.

Any disused cable pits shall be backfilled to the satisfaction of the Superintendent.

(f) Handover

Upon completion of any building warranty or defects liability period, the site shall be ‘handed over’ to the Maintenance Team to be placed under the relevant maintenance contract.

The ‘hand over’ process shall be managed by the Superintendent who shall provide the Maintenance Team with the following:

(1) opportunity to carry out an audit of the site to ensure compliance with DoT (Roads) specifications and requirements

(2) a completed ‘maintenance hand-over’ form (available from the Maintenance Team)

(3) copies of all Certificates of Electrical Safety for all electrical works

(4) copies of the ‘electrical test report’

(5) copies of the switch-on report

(6) details of the installation contractor

(7) details of all hardware installed on site

(8) copies of the ‘as-built’ drawings as detailed in (g) below.

**NOTE: If, during the site audit listed in (1) above, the site is deemed not to comply with DoT (Roads) specifications and requirements, the Maintenance Team may, at its sole discretion, elect not to accept the site until such non-compliances have been satisfactorily rectified.**

The project ‘handover’ shall not be deemed to be completed until the maintenance team has provided written acceptance of the site.

(g) As-built drawings

At the completion of works, the Contractor shall provide ‘as-built’ drawings:

(1) as soft copies, prepared in digital cad format (e.g. Microstation)

(2) as soft copies in PDF format

(3) that clearly show all changes from the IFC drawings and reflect what is on site

(4) that are clearly dated and marked as ‘As-built’.

**NOTE: PDF files with ‘mark ups’ will not be accepted as ‘as-built’ drawings.**

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**Attachments**

The following documents shall be completed, signed and provided to the Superintendent as detailed in this standard section and as shown in the table below.

The Superintendent shall provide copies of all reports to the Maintenance Team upon handover.

|  |  |  |
| --- | --- | --- |
| **Document** | **When** | **Responsible Person** |
| Pre-installation report | Prior to works commencing | Installation Contractor and Superintendent |
| Continuity test report | On completion of cabling and connecting the traffic signal cable and before lanterns are connected | Installation Contractor |
| Insulation resistance test report | On completion of cabling and connecting the traffic signal cable and before lanterns are connected. | Installation Contractor |
| Pre-commissioning report | Prior to installation of controller | Installation Contractor and Superintendent |
| Commissioning report | Post ‘switch-on’ | Superintendent |
| Power consumption record | After ‘switch-on’ | Controller Installation Contractor |

The following documents shall be completed as required by ESV, signed and provided to the Superintendent as required. The Superintendent shall provide copies of all reports to the Maintenance Team upon handover.

|  |  |  |
| --- | --- | --- |
| **Document** | **When** | **Responsible Person** |
| Certificate of Electrical Safety | On completion of conduit installation. | Installation Contractor |
| Certificate of Electrical Safety | On completion of all electrical field works. | Installation Contractor |
| Certificate of Electrical Safety | On completion of controller installation and switch-on | Controller Installation Contractor. |

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**Traffic signal installation**

**Pre-Installation Inspection Report**

|  |  |
| --- | --- |
| SITE: | FILE NO: |
| PLAN NO: | JOB NO: |
| OFFICERS IN ATTENDANCE (INCLUDE AUTHORITY NAME, CONTACT NUMBER) |
| DOT: | SIGNATURE: |
| CONTRACTOR: | SIGNATURE: |
| COUNCIL: | SIGNATURE: |
| OTHER | SIGNATURE: |
| DATE: |
| CHANGES TO PLAN (TO BE CONFIRMED BY EMAIL) |
|  |
|  |
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|  |
| ITEMS TO BE CHECKED: |
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| NOTES: |
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**Traffic signal installation**

**Electrical Test Report - Continuity test of all cables**

|  |
| --- |
| Site Name: |
| Suburb/City: | Site No: |

|  |
| --- |
| Cable number (where more than one ring circuit): |
| **Core** | **Ω** | **Core** | **Ω** | **Core** | **Ω** |
| Earth |  | 15 |  | 32 |  |
| Neutral |  | 16 |  | 33 |  |
| ELV |  | 17 |  | 34 |  |
| 1 |  | 18 |  | 35 |  |
| 2 |  | 19 |  | 36 |  |
| 3 |  | 20 |  | 37 |  |
| 4 |  | 21 |  | 38 |  |
| 5 |  | 22 |  | 39 |  |
| 6 |  | 23 |  | 40 |  |
| 7 |  | 24 |  | 41 |  |
| 8 |  | 25 |  | 42 |  |
| 9 |  | 26 |  | 43 |  |
| 10 |  | 27 |  | 44 |  |
| 11 |  | 28 |  | 45 |  |
| 12 |  | 29 |  | 46 |  |
| 13 |  | 30 |  | 47 |  |
| 14 |  | 31 |  | 48 |  |

|  |  |
| --- | --- |
| Signed: | Date: |
| Print Name: |
| Company: |

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**Traffic signal installation**

**Electrical Test Report – Insulation resistance test of all field cables**

|  |
| --- |
| Site Name: |
| Suburb/City: | Site No: |

|  |
| --- |
| Cable number (where more than one ring circuit): |
| **Core** | **MΩ** | **Core** | **MΩ** | **Core** | **MΩ** |
| Neutral |  | 16 |  | 33 |  |
| ELV |  | 17 |  | 34 |  |
| 1 |  | 18 |  | 35 |  |
| 2 |  | 19 |  | 36 |  |
| 3 |  | 20 |  | 37 |  |
| 4 |  | 21 |  | 38 |  |
| 5 |  | 22 |  | 39 |  |
| 6 |  | 23 |  | 40 |  |
| 7 |  | 24 |  | 41 |  |
| 8 |  | 25 |  | 42 |  |
| 9 |  | 26 |  | 43 |  |
| 10 |  | 27 |  | 44 |  |
| 11 |  | 28 |  | 45 |  |
| 12 |  | 29 |  | 46 |  |
| 13 |  | 30 |  | 47 |  |
| 14 |  | 31 |  | 48 |  |
| 15 |  | 32 |  |  |  |

|  |  |
| --- | --- |
| Signed: | Date: |
| Print Name: |
| Company: |

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**Traffic signal installation**

**Pre-Commissioning Report**

|  |
| --- |
| Site No: |
| Site Name: |
| Suburb/City: |
| Instructions:* This report must be completed 10 business days prior to the switch-on and forwarded to the ITS Project Manager.
* The controller installation and switch-on must occur on the same day.
 |

|  |  |  |
| --- | --- | --- |
| **Item** | **Checked** | **Completed****Y/N** |
| 1 | Controller foundation complete |  |  |
| 2 | All poles installed |  |  |
| 3 | Traffic signal cables installed and connected in the field |  |  |
| 4 | Traffic signal cables clearly marked as appropriate (e.g. where two ring circuits are installed) |  |  |
| 5 | A cable number allocation diagram has been provided |  |  |
| 6 | No unapproved cable joints |  |  |
| 7 | All lanterns installed and connected |  |  |
| 8 | All other hardware installed and connected (e.g. push buttons, audio tactiles, GWTP signs, NRT signs, etc) |  |  |
| 9 | All detector loops installed |  |  |
| 10 | Detector feeder cables connected to detector loops |  |  |
| 11 | Detector feeder cables clearly marked as to what loop they are connected to |  |  |
| 12 | No unapproved joints in feeder cables |  |  |
| 13 | Communications cable installed between controller and P2 pit |  |  |
| 14 | Telecommunications cable installed by Telstra into P2 pit and connected to controller cable |  |  |
| 15 | Power available on site |  |  |
| 16 | Electrical continuity test report provided |  |  |
| 17 | Electrical insulation resistance report provided |  |  |
| 18 | Copy of CEOS for ALL electrical installation works, including conduit installation, provided |  |  |
| 19 | Kerb structures completed |  |  |
| 20 | Line marking completed |  |  |

|  |
| --- |
| For any items above where the response in ‘NO”, please provide reasons for DoT ITS assessment. |

|  |
| --- |
| STS Prequalified Contractor: |
| Contractor representative: |
| Signed: | Date: |
| Superintendent representative: |
| Signed: | Date: |

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**Traffic signal installation**

**Commissioning Report**

|  |
| --- |
| Site No: |
| Site Name: |
| Suburb/City: |

|  |  |  |
| --- | --- | --- |
| **Item** | **Checked** | **Completed Y/N** |
| Flash test conducted and witnessed by authorised DoT representative |  |  |
| Controller switched on |  |  |
| Controller connected to SCATS |  |  |
| Controller operating correctly on SCATS |  |  |
| All field works completed |  |  |
| All traffic signal lanterns operating correctly. |  |  |
| All pedestrian detectors and audio tactiles operational |  |  |
| All internally illuminated signs operational |  |  |
| All vehicle detectors operational |  |  |
| Other detectors operational |  |  |
| RAI database updated with all required information |  |  |

|  |
| --- |
| **Superintendent representative** |
| Signed: | Date: |
| **DoT representative (if Superintendent representative is not DoT employee)** |
| Signed: | Date: |
| Date report provided to Maintenance Team: |

|  |
| --- |
| Building warranty details |
| Date of building warranty | Start date: | Finish date: |
| Building warranty Contractor details |  |

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**Traffic signal installation**

**Commissioning Report**

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|  |
| --- |
| Site Name: |
| Suburb/City: | Site No: |

|  |  |
| --- | --- |
| Voltage |  |
| Current Reading (minimum) |  |
| Current Reading (maximum) |  |

**Readings carried out by:**

|  |
| --- |
| STS Prequalified Contractor: |
| Contractor representative: |
| Signed: | Date: |