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13 TRAFFIC SIGNALS**13.01 GENERAL**

This Specification covers the requirements for the supply and installation of all road traffic signal equipment.

All material and procedures, where not otherwise specified shall be in accordance with Australian Standard Specifications where such exist, and in their absence with the current Roads and Traffic Authority (RTA), NSW Specification for Traffic Light Signals.

All materials and equipment shall have the current NSW Roads and Traffic Authority (RTA) approvals.

The following Standards are referred to in this Specification

AS 1348	Terms used in Road and Traffic Engineering
AS 1428	Code of Practice for Design Rules for Access by the Disabled
AS 1906	Part 1 : Retroreflective Materials
AS 2053	Non-metallic Conduits and Fittings
AS 2144	Traffic Signal Lanterns
AS 2276.1	Cables for Traffic Signal Installations – Multicore Power Cables
AS 2276.2	Cables for Traffic Signal Installations – Feeder Cable for Vehicle Detectors
AS 2276.3	Cables for Traffic Signal Installations – Loop Cable for Vehicle Detectors
AS 2339	Traffic Signal Posts and Attachments
AS 2353	Pedestrian Push-button Assemblies
AS 2578	Traffic Signal Controllers: Part 1 : Physical and Electrical Compatibility
AS 2703	Vehicle Loop Detector Sensors
AS 2979	Traffic Signal Mast Arms
AS 3000	SAA Wiring Rules
AS 3100	Definitions and general requirements for Electrical Materials and Equipment
AS 3147	PVC Insulated Electric Cables and Flexible Cables
AS 4680	Hot-dip galvanised (zinc) coatings on fabricated ferrous articles

13.02 TRAFFIC SIGNAL POSTS AND ATTACHMENTS**13.02.1 General**

Traffic signals tubular steel posts and attachments shall conform to the requirements of AS 2339. The location of the signal pedestals and mast arm supports shall be as shown on the drawings.

The installation of pedestals and mast arms shall conform to the drawings .

13.02.2 Pedestals**(i) Foundations**

The foundations for the pedestals shall be constructed to the dimensions shown on the drawings unless otherwise specified. Prior to placing concrete, the bottom of the excavation is to be compacted to 95% of modified maximum dry density.

The holding down rag bolts shall be accurately set prior to pouring concrete and the surface of the footing is to be trowelled smooth and a bedding of sand/ cement mortar prepared for the base plate as shown on the drawings.

(ii) Erection

Erection of the pedestal shall not commence until 48 hours have elapsed since placing the concrete foundation. The pedestal shall be made vertical by means of the four levelling nuts under the base plate and secured by equal tension on the upper set of nuts.

Hold Point 13.1

Process Held: Installation of signal posts.

Submission Details: At least one (1) working day prior to the proposed commencement of signal post installation the Contractor shall submit evidence that all traffic signal equipment needed for the completion of the signal installation is available, the civil works have advanced to the stage where all components can be installed without creating a traffic hazard and set-out of pedestals is clearly marked on site.

Release of Hold Point: The Superintendent will inspect the equipment and set-out prior to authorising the release of the Hold Point.

The Contractor shall be wholly responsible for providing and making good any holes through awnings, which may be necessary for the erection of the pedestal. 25mm clearances 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.

Pedestals in unpaved areas will be provided with a cover slab 50mm. thick as indicated on the drawings. The top of the slab shall be trowelled smooth and finished to divert water away, from the steel tube.

Where the pedestal is placed in an existing footpath or median with a paved surface, a construction joint shall be formed to define the extent of the concrete slab surrounding the pedestal. The surface shall be neatly and squarely trimmed and finished to the levels of the adjacent pavement.

After the erection of pedestals and after all cables have been installed, excavations shall be backfilled as specified in Clause 3.03 of this Specification.

(iii) Combined use pedestals

Combined use pedestals shall comply with Electricity Authority requirements for streetlight cabling and shall be fitted with mounting brackets suitable for attaching vehicular and pedestrian lanterns and push button assemblies at the required height and orientation as shown on Electricity Authority Standard Drawing No. 794-23-02.

Footings for combined use pedestals shall be in accordance with the standard drawings.

Double-davit mast arms shall comply with Electricity Authority Standard Drawing No. EW 177G.

(iv) Cabling

Cable shall be installed and 2.0m of spare cable shall be left coiled in the pit box at the base of each pedestal.

Adequate provision shall be made for the replacement of the inter-connection cables without disturbing the pedestal foundations.

13.02.3 Mast Arms

(i) Type

Mast Arms shall conform to the requirements of AS 2979 and shall be Type A as shown in the standard.

(ii) Foundations

All concrete work shall comply with the requirements of AS 1480. The concrete shall be Class Twenty Five (25).

Unless otherwise detailed the top surface of the base is to be dressed with a wooden float to a smooth even surface.

(iii) Erection

The erection of the mast arm shall not commence until 7 days have elapsed since the pouring of the concrete footings.

(iv) Cabling

The inter-connecting cables from other pedestals shall be terminated in a terminal assembly fitted within the main upright of the mast arm.

The cabling shall be completely enclosed within the mast arm.

13.03 VEHICLE SIGNAL LANTERNS, BRACKETS AND TARGET BOARDS

13.03.1 General

Standard multi-aspect and single aspect lanterns, target boards and brackets shall conform with the requirements of AS 2144.

The vehicle signal lanterns shall be attached to signal pedestals or other poles indicated on the drawings.

Where vehicle lanterns are attached to supports, the brackets shall be constructed from mild steel and then cadmium plated.

13.03.2 Positioning

The vehicle lantern assemblies, including cowls are to be positioned 300mm clear of the kerb line and sited such that the signal indications being displayed on the primary vehicle lanterns (i.e. the first vehicle lanterns for a particular approach) are continuously and clearly visible at all distances on the approach from 150m to 15m from the stop line.

The vehicle lantern cross-section and attachment facilities shall be such that an arrangement, consisting of three vehicle lanterns and two pedestrian lanterns, can be grouped on a pedestal within a reasonable area and aligned to provide:

- (a) An unobstructed view of the intended signal face to any pedestrian on the associated footcrossing; and
- (b) Sufficient clearance between lanterns so that the lantern doors may be opened through 90 degrees without fouling adjacent lanterns.

Provision shall be made for a cowl to be fitted to each optical system. Unless otherwise specified, vehicle lanterns shall be supplied complete with cowls and target boards with a white edge strip. Louvres shall also be supplied where specified.

All materials shall be selected or adequately treated to prevent corrosion, particularly with respect to galvanic action. The optical system shall be proofed against the ingress of moisture or foreign material.

All positioning attachments shall be capable of being locked in position other than by friction alone.

The vehicle lanterns shall be provided with mounting straps, screws and nuts suitable for attachment to a standard pedestal.

Drainage provision shall be made for any water which accidentally enters any part of the vehicle lantern including the optical system to escape to the exterior.

13.04 PEDESTRIAN SIGNAL LANTERNS

13.04.1 General

Pedestrian signal lanterns shall conform to the requirements of AS 2144.

The pedestrian signal lanterns shall be attached to signal pedestals by upper and lower mounting brackets, or if attached to a pedestal supporting a vehicle signal lantern, by two lower mounting brackets as indicated on the drawings.

Where pedestrian signal lanterns are attached to other supports, the brackets shall be constructed from mild steel and then cadmium plated.

13.04.2 Positioning

The pedestrian signal lantern assemblies, including cowls are to be positioned 300mm clear of the kerb line and sited so the pedestrians have a clear indication of the signal from the opposite side of the carriageway.

When correctly positioned, it shall be possible to open the pedestrian signal lantern door through 90 degrees without having to shift the signal lantern.

13.05 PEDESTRIAN PUSH BUTTON ASSEMBLIES

13.05.1 General

Push button assemblies are to be used in conjunction with marked foot crossings for the purpose of registering pedestrian demands.

Pedestrian push button assemblies shall conform to the requirements of AS 2353. They shall be standard and / or audio tactile as specified in the contract documents.

13.07.2 Physical Requirements**(i) Housing****(a) General**

The housing shall comprise the weatherproof enclosure for the protection of the computer, interfacing equipment, power supplies and associated components.

(b) Door

Each housing door shall be fitted with two locks type E 352 short, or with two threaded stainless steel fasteners operated by means of a standard facility key. The head of the fasteners shall be fully recessed into the door.

The tapered mating sections on the housing shall be self-aligning with the movement of tolerance of the door in respect to the housing. When locked or fully tightened, the door shall be held securely against the weatherproof gaskets to provide a weatherproof seal. The door shall open and close freely without binding on any portion of the housing.

Two door keys are to be supplied for each Controller.

(ii) Telecommunication Line Connections

The 20mm conduit for the telecommunication line shall be positioned to match the corresponding conduit cast into the concrete footing.

The above described connection and assembly shall be to the approval of the telecommunication authority and the Superintendent.

(iii) Facility Switch

Two facility keys shall be supplied with each Controller.

13.07.3 Installation

The Controller housing shall be located and oriented as shown on the drawings.

The housing shall be mounted on a concrete foundation block not less than 75mm thick protruding a minimum of 50mm above the surface level except where the housing is mounted adjacent to a footpath when the foundation shall be finished flush with footpath pavement. A concrete surround shall extend 600mm beyond the back and sides, and 1000mm beyond the front of Controller housing.

The exposed concrete shall be finished to dressed timber or steel form and free of honeycomb.

The holding down bolts for the Controller housing shall be cadmium plated or other non-corrodible material. The holding down bolts shall be in accordance with the drawings and shall be sufficient in number and size to maintain the housing rigidly in position under all likely external loads.

The Controller shall be positioned to ensure good alignment of the conduit providing for the connection of the telecommunication line to the Controller. An insulated draw-wire shall be installed in the telecommunication conduit between the terminal box on the side of the controller housing, and the telecommunication pit. Refer to the drawings for details..

13.08 CABLING**13.08.1 General**

Multi-core power cables and feeder cables for detector loops are to conform to the requirements of AS 2276.1 and AS 2276.2.

Conduits carrying cables shall comply with Clause 3.07.

13.08.2 Cable Installation

Before any cables are installed the Contractor shall ensure that the cable has been tested and fully meets the requirements of AS 2276.1 and AS 2276.2.

Hold Point 13.3

Process Held:	Installation of cabling.
Submission Details:	At least three (3) working days prior to the proposed commencement of cable installation the Contractor shall submit documentary proof that the cable has been tested and fully meets the requirements of AS 2276.1 and AS 2276.2.
Release of Hold Point:	The Superintendent will consider the submitted documents prior to authorising the release of the Hold Point

Prior to the pulling in of the cables a steel mandrel shall be drawn through each conduit to clear it of any foreign material. A 2.00mm galvanised draw wire shall be left in the conduit at the completion of the installation.

The cable sheath shall be removed for an adequate length and cable cores neatly formed and laced to allow all individual cores to be connected to the appropriate numbered terminal. In the Controller housing each core shall be appropriately labelled for identification as to its function in accordance with the Cable Connection Chart. All earth wires are to be joined by twisting together and soldering.

Each multi-core cable shall be clearly identified at the Controller housing and each pedestal top.

At least 2.0m of excess cable shall be provided in junction boxes adjacent to each pedestal and Controller housing.

13.08.3 Cable Conduits

All twin screened cable running between a JC-1 small conduit junction box and a JB-R large conduit junction box shall be in a uPVC conduit with a minimum internal diameter of 50mm.

All cabling running between JB-R junction boxes) shall be in uPVC conduit with an internal diameter of 140mm. Each conduit run between JB-R junction boxes shall comprise 2 x 140 mm conduits. One of these conduits shall be available for Street Lighting cable if required.

All cabling running between a JB-R junction box and a signal pedestal shall be in a 100mm diameter uPVC conduit. 2 x 100mm conduits shall be provided for cabling running between a JB-R junction box and the signal controller. A single 140mm conduit shall be provided for cabling running between a JB-R junction box and a combined use pole.

The minimum depth of cover to conduit below the roadway, footpath or median surfacing shall be 600mm. No angles are allowed in conduit runs. Where a change in direction in a conduit run is necessary due to site

conditions and an additional junction box is not practical, a bend of minimum radius 450mm and not exceeding an angle of 45 degrees may be used

At signal pedestals, the end of the cable conduit shall connect to the pedestal foundation conduit. At junction boxes the ends of the cable conduits shall terminate 25mm inside the junction box.

13.09 VEHICLE DETECTOR LOOPS

13.09.1 General

Loop cable for vehicle detector loops shall conform to the requirements of AS 2276.3.

Slots for vehicle detector loops shall be saw cut as shown on the drawings. Immediately prior to the installation of the cable, the slot shall be thoroughly cleaned with compressed air. The loop cable shall be pressed into the bottom of the slot with a piece of softwood or similar material which will not damage the cable or its insulation. The loops shall be wound in the configuration as shown on the drawings.

The slots shall then be filled flush with the road surface with "Scotech" loop sealant or similar and any excess sealant that flows on to the road surface shall be removed.

The jointing of the loop and feeder cables shall be carried out in a junction box situated on the footpath or median.

The loop and feeder cables shall be jointed by twisting together and soldering at a terminal block located in the junction box. All completed connections shall be sealed by use of Raychem 1/4 P1) heat-shrink caps or equal.

It is important that the joint between the two-core screened cable and the loop cables be water-proofed to prevent entry of moisture into the interstices of the two-core screened cable. Adequate precautions shall be taken to prevent entry of moisture into the two-core screened cable before the joint is finally sealed as shown on the drawings.

Each loop and the ends of each loop cable shall be clearly marked for identification.

13.10 JUNCTION BOXES

13.10.1 General

The junction boxes shall be telecommunication type JC- 1 (small type for detector cables) and JB-R junction box as shown on the drawings. The Contractor shall install JB-R pits as detailed on the drawings.

One JC-1 junction box marked "TELECOMMUNICATION" shall be provided for the telecommunication SCATS connection.

One JB-R junction box marked "ELECTRICITY" shall be provided immediately adjacent to and behind the controller as shown on the drawings.

13.10.2 Installation

Junction boxes should be positioned and installed as indicated on the drawings.

Holes for entry of cable conduits shall be neatly drilled to match the outside diameter of the conduit. Any gaps between the junction box wall and conduit shall be sealed with a suitable sealant. Any gaps between the top of a JB-R junction box wall and the underside of the frame for the lid shall be sealed with cement mortar.

All dirt and foreign matter shall be removed from the box prior to the completion of the Contract.

13.11 MEASUREMENT AND PAYMENT

Payment shall be made for all activities associated with completing the work detailed in this Specification in accordance with Pay Items 1302P1-P4; 1303P1, 1304P1, 1305P1, 1307P1, 1308P1-P4; 1309P1 and 1310P1-P2 inclusive.

A lump sum price for any of these items will not be accepted.

If any pay item for which a quantity of work is listed in the Contract has not been priced by the Contractor, it shall be understood that due allowance has been made in the prices of other pay items for the cost of the activity which has not been priced.

The Contractor shall allow in the pay items generally for the costs associated with all testing required to prove conformance of the works as specified.

Pay Item 1302P1 Standard Traffic Signal Post

The unit of measurement shall be per standard post installed.

This pay item shall include holding down bolts and all foundation and installation work for each standard traffic signal post.

Pay Item 1302P2 Short Post / Push Button Post

The unit of measurement shall be per short post installed.

This pay item shall include holding down bolts and all foundation and installation work for each short push button post.

Pay Item 1302P3 Mast Arm Post

The unit of measurement shall be per mast arm post installed.

This pay item shall include all foundation and installation work for each mast arm post, complete with outreach arm.

Pay Item 1302P4 Combined Use Post

The unit of measurement shall be per combined use post installed.

This pay item shall include all foundation and installation work for each combined use post to the Electricity Authority requirements.

Pay Item 1303P1 Vehicle Signal Lanterns

The unit of measurement shall be per vehicle signal lantern set installed.

This pay item shall include the supply and installation of each set of vehicle signal lanterns, cowls, louvres, brackets and target boards.

A separate pay item shall be included in the Contract for each vehicle signal lantern set, optic size and lamp type.

The pay item description shall be 1303P1. A. B. C. where:

A = Set type	1 =	Single aspect vehicle signal lantern
	2 =	Three aspect vehicle signal lantern
	3 =	Four aspect in line vehicle signal lantern

- 4 = Four aspect L configuration vehicle signal lantern
 5 = Five aspect vehicle signal lantern
 6 = Six aspect vehicle signal lantern

B = Optic diameter 2 = 200mm diameter
 3 = 300mm diameter

C = Lamp type Q = Quartz halogen
 L = LED

For Example 1303P1.2.2.Q = Four aspect in line vehicle signal lantern, 200mm diameter, Quartz halogen set

Pay Item 1304P1 Pedestrian Signal Lanterns

The unit of measurement shall be per pedestrian signal lantern set installed.

This pay item shall include the supply and installation of each set of pedestrian signal lanterns, cowls and brackets.

Pay Item 1305P1 Pedestrian Push Button Assemblies

The unit of measurement shall be per set of pedestrian push button assembly installed.

This pay item shall include the supply and installation of each set of pedestrian push button assemblies and for audio tactile push button assemblies, the cost of the associated driver unit.

A separate pay item shall be included in the Contract for each type of pedestrian push button assemblies.

1305P1.1 Standard push button assembly
 1305P1.2 Audio tactile push button assembly

Pay Item 1307P1 Control Equipment

The unit of measurement shall be per traffic signal controller installed.

This pay item shall include the supply and installation of a traffic signal controller inclusive of vehicle detector sensor units.

Pay Item 1308P1 Multi-core cabling

The unit of measurement shall be per metre length of multi-core cable installed.

This pay item shall include the supply and installation of multi-core cabling, including identification and all connections.

Pay Item 1308P2 Twin Screen cabling

The unit of measurement shall be per metre length of twin screen cable installed.

This pay item shall include the supply and installation of twin screen cabling, including loop cable identification and all connections.

Pay Item 1308P3 Multi-core cable conduit

The unit of measurement shall be per metre length of conduit installed.

This pay item shall include the supply and installation of Multi-core cable conduits, including all connections to junction boxes, but excluding trenching .

Pay Item 1308P4 Twin Screen cable conduit

The unit of measurement shall be per metre length of conduit installed.

This pay item shall include the supply and installation of Twin Screen cable conduits, including all connections to junction boxes but excluding trenching.

Pay Item 1309P1 Vehicle detector loops

The unit of measurement shall be per lane detector loop installed.

This pay item shall include the supply and installation of vehicle detector loops in the pavement.

Pay Item 1310P1 JB-R Large Conduit Junction Box

The unit of measurement shall be per JB-R. large conduit junction box installed.

This pay item shall include the supply and installation of JBR large junction box, inclusive of all excavation, provision for conduit entry, lid and drainage material and footpath and verge reinstatement.

Pay Item 1310P2 JC-1 Small Conduit Junction Box

The unit of measurement shall be per JC-1 small conduit junction box installed.

This pay item shall include the supply and installation of JC-1 junction boxes, inclusive of all excavation, provision for conduit entry, lid and footpath and verge reinstatement.

13.12 SCHEDULE OF HOLD POINTS

Hold Points	Clause	Description
13.1	13.02.2	Installation of signal posts.
13.2	13.07.1	Installation of traffic signal controller.
13.3	13.08.2	Installation of cabling.