

Roads

Master Specification

RD-EL-C2 Installation of Traffic Signals

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Document Amendment Record

Version	Change Description	Date
1	Initial issue (formerly R55). Updated SCATS Communication; added UPS requirement; updated referencing.	02/07/19
2	Formatting for publishing	19/09/19
3	Added requirement for separate fuse to be installed in traffic signal controller for RC1 signs fed off from signal controller which is more than 12 SGs. Emphasized spacing requirement between traffic signal controller and UPS cabinet and cross reference to Department standard drawing. Added the requirement of dual supply stickers. Added complementary process outlining switch-on requirements.	August 2020
4	Emphasized that excess cable to be stored in the nearby pit not at the signal post. Added requirement to extend signal controller door alarming to extension housing. Removed irrelevant list paragraphs in CI 7.5. Updated example connection chart in Appendix 1.	August 2021
5	KNet number inserted for ITS & Traffic Signals RITS Data Collection Template. Updated Section 8 to be consistent with the changes made in RD-EL-D2 about telecommunications method. Plus other minor changes.	July 2022

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RD-EL-C2 Installation of Traffic Signals

1 General

References

- 1.1 This Part specifies the requirements for the installation of traffic signals.
- a) "LV/ELV Cables" means cables complying with AS/NZS 2276.1.
 - b) "LV Cables" means cables complying with AS/NZS 5000.
 - c) "Detector Feeder Cables" means cables complying with AS/NZS 2276.2.

Definitions

- 1.2 The following definitions apply to terms used in this Part:

Table RD-EL-C2 1-1 Definitions

Term	Definition
SCATS®	Sydney Coordinated Adaptive Traffic System, property of RMS NSW.
TMC	Traffic Management Centre (Norwood unless stated otherwise)
TSOPR	Traffic Signal Operation Performance Report.

- 1.3 The Department, in the context of this Part of the specification, refers to officials of the department acting in a third party capacity to supply services or an administrative function not available elsewhere.
- 1.4 Documents referenced in this Part are listed below:
- a) AS 2144 Traffic Signal Lanterns.
 - b) AS/NZS 2276 Cables for Traffic Signal Installations.
 - c) AS 2578 Traffic signal controllers.
 - d) AS 2339 Traffic Signal Posts, Mast Arms and Attachments.
 - e) AS/NZS 3000 Electrical Installations (known as the Australian/New Zealand Wiring Rules).
 - f) AS/NZS 5000 Electric Cables – Polymeric Insulated.
 - g) Specification No.TSI-SP-069 Control Equipment for Road Traffic Signals by Transport for New South Wales Road and Marine Services.
 - h) Department Operational Instruction 14.2: Traffic Signal Faces.
 - i) Department RD-EL-D2 Traffic Signal Design.
- 1.5 The work shall comply with the following documents:
- a) TSOPR and Traffic Signals Design Report;
 - b) Traffic Signal Layout Drawings;
 - c) Traffic Signal Conduit Layout Drawings;
 - d) Site Wiring Diagram;
 - e) Cable Connection Schedule;
 - f) Detector Wiring Chart;
 - g) SA Power Networks Service Rules and Conditions of Supply; and
 - h) the following standard drawings, including all current published amendments:

Table RD-EL-C2 1-2 List of Department Standard Drawings referenced in this Part

Drawing No	Sheet No.	Title
S-4055	30	Combination T-S Road Lighting Mast Arms & Existing Impact Absorbing Light Poles, Base Plate Mounted Pole Footing and Anchor Details
	37	Impact Absorbing Light Pole - Base Plate Mounted Squat Footing & Anchor Detail
	40	Impact Absorbing Road Lighting Poles (Base Plate Mounted) Standard & Combination Road Lighting Pole
	41	Combination TS Road Lighting Mast Arm
	42	Traffic Signal Mast Arm
	48	Traffic Signals for Railway Crossing – Mast Arm
	49	Traffic Signals for Railway Crossings - Combination TS / Road Lighting Mast Arm
	50	Pits, Concrete Lids and Surrounds
	51	Pits and Lockable Lids
	66	Plastic Pits - Non Secured Concrete Lids & Surrounds
	73	Signal Controller - UPS Distribution General Layout & Interconnection Single Line Diagram
S-4500	1	Detector Loop Layout (1 of 2)
	2	Detector Loop Layout (2 of 2)
S-4512	3	Pavement Mounted Controller Base Details
S-4514	1	Post Mounted Controller, Foundation Details
S-4515	2	Standard Drawing - Traffic Signals Post - Post Footing and Installation
S-4516	2	Push Button Bracket for Stobie Poles
S-4517	1	Upper Mounting Assembly for Traffic Signal Post
S-4518	2	Terminal Box, Post Mounted
S-4537	6	Traffic Signal Post- Post Types and Post Mounting Details
S-4074	7	Kerb Ramps for Signalised Locations
S-4538	1	Traffic Signals Faces - Aiming Of Lantern Distances
	2	Template for Checking Visor & Louvre Requirements

1.6 Department Technical Standards and Guidelines are available from the following web site:
<https://www.dit.sa.gov.au/standards>.

1.7 Where this Part specifies a higher standard than that required by the above Australian Standards, the requirements of this Part will take precedence.

Approval of Traffic Control Devices

1.8 Traffic signals are traffic control devices requiring approval pursuant to the Road Traffic Act 1961(SA) and the Road Rules.

1.9 The Contractor is responsible for ensuring that the traffic signals are formally approved by the Department. A minimum notice of 15 working days is required for this process. (See also Clause 7.7 and 7.8 in relation to programming the controller(s).)

1.10 Provision of suitable drawings showing the traffic control devices shall constitute a **Hold Point**.

1.11 The provision of an approved drawing and request for the preparation of a traffic signal personality requires 8 weeks' notice. The provision of the approved drawing is a **Hold Point** as required in Clause 7.8. The Contractor should note that these periods run consecutively.

Products for Installation

1.12 Products provided as part of this Contract shall be approved by the Department. Supply of the list of products shall constitute a **Hold Point**.

1.13 For a list of traffic signal products approved by the Department refer to:
https://www.dit.sa.gov.au/data/assets/pdf_file/0012/330105/DIT_Approved_Products_Contract_Works.pdf

1.14 The Contractor may submit a request for the approval of additional products.

2 Electrical Installation and Testing

- 2.1 Unless otherwise specified, the Traffic Signal Design shall incorporate extra low voltage (ELV) traffic signal controllers, Lanterns and other electrical equipment for new traffic signal sites.
- 2.2 All electrical installations shall be carried out by an electrical worker who is licensed to perform any electrical works. The installations shall comply with AS/NZS 3000 and the Service Rules and Conditions of Supply of SA Power Networks.
- 2.3 Prior to the commencement of this work, the Contractor shall provide evidence of the Licence and a **Hold Point** shall apply.

3 Trench Work, Conduits and Pits

- 3.1 The work shall comply with the following:
 - a) RD-EW-C2 "Trench Excavation and Backfill";
 - b) RD-EW-C3 "Boring";
 - c) RD-PV-C6 "Reinstatement of Existing Pavements";
 - d) RD-EL-C3 "Supply and Installation of Conduits and Pits"; and
 - e) RD-EL-D3 "Conduit Design for Road Lighting, Traffic Signals and ITS".

4 Construction of Footings

General

- 4.1 Cast-in-place concrete shall comply with ST-SC-S1 "Normal Class Concrete".
- 4.2 Unless specified otherwise, all footings shall be constructed of unreinforced Normal class concrete, Grade N20. The top surface of concrete shall be finished with a wooden float to a smooth even surface.

Signal Post Footings

- 4.3 Signal post footings shall be constructed as shown on Drawings No. S-4515, sheet 2.

Mast Arm Footings

- 4.4 Mast arm footings and reinforcement shall be constructed in accordance with the Department's Standard Drawing No. S-4055, sheet 30.
- 4.5 A **Hold Point** shall apply at the completion of excavation and prior to the construction of the footing to assess the suitability of the soil to support the footing.

Signal Controller Footings

- 4.6 The signal controller footing plus surround shall be of the type shown on the Traffic Signal Conduit Layout Drawing and shall be constructed as shown on the following Drawings:
 - a) Pavement Mounted Controller - Base Details: Drawing No. S 4512, sheet 3.
 - b) Holding Down Bolts for Traffic Signal Posts: Drawing No. S 4515, sheet 2.
- 4.7 The front of the housing is detailed on the Traffic Signal Conduit Layout Drawing.

5 Cabling

Cable Installation

General

- 5.1 LV / ELV cables shall be used for traffic signal multi-core power cables for both low voltage and extra low voltage applications. LV cables shall be used for low voltage applications.
- 5.2 Installation of cables shall be as detailed in the Site Wiring Diagrams, Cable Connection Schedules and in conjunction with the Traffic Signal Conduit Layout Drawing. All cables shall be continuous and without joins except at termination points.
- 5.3 The Contractor shall submit a Site Wiring Diagram prior to the installation of any cabling. The Site Wiring Diagram shall detail:
 - a) type of signal pole;
 - b) cable size and connection schedules;
 - c) pole, lantern and pedestrian signal groups;
 - d) detector feeder cables;
 - e) connections to audio and camera installations as applicable;
 - f) the installation shall include a minimum of 10 spare cores in road crossings and 3 spare cores to each signal post top; and
 - g) Junction Boxes.
- 5.4 Site Wiring Diagrams and Cable Connection Schedules shall be submitted in the format as shown in the sample in Appendix 1: Site Wiring Layout (Sample Only) shall constitute a **Hold Point**.
- 5.5 Cables shall be drawn through signal ducting using draw cords and shall be installed through pits and ducts without causing damage to the cable. Excessive strain shall not be placed on any individual core, individual cable or group of cables during the drawing in process. A draw cord shall remain in the conduit after the installation of the cable to enable the installation of additional cables in the future. Refer to Part RD-EL-C3 Supply and Installation of Conduits and Pits Clause 6.9.

Signal Post and Controller Cables (LV / ELV Cables)

- 5.6 The length of signal post cable tails required on installation at the base of signal posts and signal controllers shall be as follows:
 - a) Signal Post Base: 5.5 m.
 - b) Signal Controller Base: 1.8 m.
- 5.7 After termination all spare cable shall be stored in the base of the signal post and signal controller.

Detector Feeder Cables

- 5.8 Detector feeder cables shall be drawn around the signal site in separate ducts to LV and LV / ELV cables unless otherwise specified on the Traffic Signal Conduit Layout Drawing. The length of detector feeder cable tails required on installation at the signal controller base and detector pit shall be as follows:
 - a) Signal Controller Base: 2 m.
 - b) Detector Pit: 0.5 m.
- 5.9 After termination all spare cable shall be stored in the base of the signal controller and the detector pit.

Consumer Mains Cable (LV Cable)

- 5.10 A consumer mains service cable shall be drawn in between the SA Power Networks supply service point, the underground service pit, and the signal controller base as shown on the Traffic Signal Conduit Layout Drawing and in accordance with SA Power Networks Drawing E1163/B.
- 5.11 Where the electrical supply service point cannot be located conveniently close to the signal controller and the consumer mains cable is drawn to the signal controller base via the underground cable draw-in pits, this cable shall be drawn in through a separate conduit to all other cables unless otherwise specified on the Traffic Signal Conduit Layout Drawing and fixed with insulated saddles to the walls of such pits and clearly labelled as "CONSUMER MAINS SERVICE" in each pit.
- 5.12 The length of consumer mains cable tails required on installation at the signal controller base, underground service pit and the electricity supply authority service point shall be as follows:
- a) Signal Controller Base: 0.75 m.
 - b) Underground Service Pit: 0.75 m each end of active core only. Neutral core continuous.
 - c) Electrical Service Point: 1.5 m.
- 5.13 After termination all spare cable shall be stored in the base of the signal controller, the underground service pit and the Electricity Supply Authority service point.

Telecommunications Cabling

- 5.14 Where the installation requires a physical connection to a telecommunications supplier, prior to completion of the installation, a telecommunications cable (provided by the telecommunications supplier) shall be drawn from the telecommunications pit shown on the Traffic Signal Conduit Layout Drawing to the line terminating box on the side of the signal controller housing.
- 5.15 A cable tail of 0.4 m in length shall be provided at the terminating box, any excess cable shall be neatly coiled in the service providers' telecommunications pit. The contactor shall arrange with the telecommunications service provider for the installation of the telecommunications service into the traffic signal controller housing.

Cable Termination

General

- 5.16 Cable cores shall be terminated in such a manner to ensure that no movement of wires is possible.
- 5.17 All cables shall be terminated and labelled as detailed in the Site Wiring Diagrams and Cable Connection Schedules.
- 5.18 Labels shall be permanent in nature and stamped or embossed to avoid loss of identification. Hand written labels shall not be used.

Signal Posts

- 5.19 Upper Mounting Bracket Assembly shall be terminated as follows:
- a) The signal post cable shall be secured to the terminal plate with cable ties.
 - b) The cores shall be separated into LV and ELV groups.
 - c) The resulting LV and ELV core forms shall be tied and further restricted to prevent movement of the core forms.
 - d) All work shall be in accordance with Drawing No. S-4517, sheet 1.
- 5.20 Post Mounted Terminal Box shall be terminated as follows:
- a) Cables to mast arms, signal posts and other locations where an upper mounting bracket assembly cannot be utilised shall be terminated in a post mounted terminal box.
 - b) Cores shall be separated into LV and ELV allocations and terminated in the terminal strip as per the Site Wiring Diagram and Cable Connection Schedules and shall be tied and restrained to prevent movement of the LV and ELV core forms as per Drawing No. S-4518, sheet 2.

- 5.21 Excess cables shall be stored in the nearby base, S or D pit. Cable storage at signal post is not allowed.

Consumer Mains

- 5.22 Department / SA Power Networks underground service pit shall be terminated as follows:
- a) The active core tails shall be terminated in a fully waterproof, insulated fuse holder which are suitable for installation in an underground service pit, to be connected quickly and safely by one person avoiding the need for stripping, compression tooling or heat shrinking. Fuse holding clamps shall be placed onto the wall of the pit at a point 150 mm below the pit lid as shown on Drawing No. S-4055, sheet 56.
 - b) The main earth stake shall be installed in a trench in the ground through the hole provided in the pit base and shall provide a clearance from the pit lid of 150 mm.
- 5.23 The active and neutral cores of the consumer mains service cable shall be terminated at the signal controller or UPS power distribution panel and the main earth core terminated to comply with the MEN system of earthing

LV / ELV Cables at the Signal Controller

- 5.24 LV / ELV Cables shall be located and secured under the cable retaining clamps at the bottom of the controller frame. The outer sheath shall be stripped back to the top of the retaining clamps and cable cores separated into LV and ELV allocations. Each cable shall be clearly labelled to indicate the number of the post or junction box to which it is connected.
- 5.25 LV and ELV cores shall be formed and separately tied with cable ties and run to the relevant terminal strips within the controller. Segregation between LV and ELV cable forms shall be maintained.
- 5.26 All spare cores shall be earthed.

Lanterns

- 5.27 Traffic signal vehicle and pedestrian lanterns shall be terminated at the terminal strip located on the upper mounting bracket assembly. Where the lanterns are mounted on a support other than a signal post with an upper mounting bracket assembly, the lantern cables shall be terminated in a post terminal box located on the support.
- 5.28 Termination to LV and ELV terminal strips in either the upper mounting bracket assembly or post terminal box shall be as detailed in the Site Cable Termination Chart.

Push Button and Audio Tactile Driver Unit

- 5.29 Push Button assemblies shall be terminated to ELV terminals at the terminal strip located on the upper mounting bracket assembly or as detailed in the Site Cable Termination Chart. Where the push buttons are mounted on a support other than a signal post with an upper mounting bracket assembly, the push button cables shall be terminated in a post terminal box located on the support.
- 5.30 The cable harness from the audio tactile amplifier assembly shall be terminated to the LV and ELV terminal strips on the upper mounting bracket assembly or post mounted termination box as detailed in the Site Cable Termination Chart.

Detector Feeders

- 5.31 Detector feeder cable screens shall be insulated and joined by crimping drain wires into a through crimp connector and extended with an insulated earth core to a terminal earth point.
- 5.32 The detector feeder cables shall be neatly formed, tied with cable ties and labelled to identify the loop to which it is connected.

Spare Cable Cores

- 5.33 Spare cores from signal post cables shall be separated from terminated cores, tied with cable ties and connected through crimp connector and extended with an insulated earth core to a terminal earth point.

6 Installation of Equipment

- 6.1 General traffic signal aspects will be 200 mm or 300 mm diameter arranged in accordance with the requirements of Operational Instruction 14.2 Traffic signal faces.
- 6.2 Signs clearly labelled "Signals Not Operating" (T1-SA1185) shall be installed on all signal posts at the same time as the lanterns are installed and shall remain in place until the signals are commissioned, in accordance with the Department's Operational Instruction 3.16 Signals Not Operating.
- 6.3 Where additional lanterns are to be provided at an existing signal site, refer to RD-EL-D2 for lantern requirements. 200 mm or 300 mm aspects and shall be provided in accordance with the Department's Operational Instruction 14.2 Traffic Signal Faces.

Signal Posts

- 6.4 The type of signal post installed shall be as shown on the Traffic Signal Drawings. Post details are shown on Traffic Signals Post - Post Types and Post Mounting Details Drawing No. S-4537, sheet 6 and Drawing No. S-4055, sheet 42, 48 and 49.
- 6.5 The threaded lower end of the signal post and the threaded collar on the prefabricated post base plate, together with the holding down bolts in the base foundation shall be treated with a rust inhibiting lubricant prior to erection of the post.
- 6.6 The base plate shall be firmly bolted down to the concrete foundation. Non-corrosive metal packing shims shall be used to ensure that the signal post is vertical. The signal post shall be tightened down to the base plate.
- 6.7 As mechanical means are used to tighten the signal post into the base plate, care shall be taken to ensure that the galvanized outer surface of the signal post is not damaged.
- 6.8 The push button assembly mounting holes shall be located correctly to match the alignment requirements for push buttons. Arrow legends and buttons shall be correctly oriented to guide visually impaired pedestrians to cross the road in the same direction indicated by cross walk markings.

Vehicle Signal Lanterns

- 6.9 Lanterns shall be attached to the signal post by upper and lower mounting brackets assemblies using appropriate galvanized mounting straps.
- 6.10 Where lanterns are to be attached to other supports (e.g. Stobie poles), brackets shall be supplied by the Contractor.
- 6.11 The lantern assembly including visors and backing boards shall be positioned 300 mm clear of the kerb line and sited as detailed on Drawing S-4538 sheets 1 and 2.
- 6.12 Three aspect lanterns shall be installed so that the centre of the red lens is 4.0 m above the footpath or median surface unless otherwise specified on the Traffic Signal Drawings.
- 6.13 Adjacent aspects shall be mounted so that doors giving access to internal lantern aspects open away from each other.
- 6.14 Disk and arrow signal faces shall be arranged so the same coloured signal aspect is horizontally aligned, and located in a six aspect lantern configuration. Right arrows shall be on the right of the corresponding disk and left arrows should be to the left of the corresponding disk. Where the signal face comprises less than three aspects, the vacant positions shall be blanked out.

Pedestrian Signal Lanterns

- 6.15 Lanterns shall be attached to the signal posts using appropriate galvanized mounting straps and two lower mounting brackets.
- 6.16 The lantern assembly including visors shall be positioned 300 mm clear of the kerb line and sited so that pedestrians have a clear view of the signal from the opposite side of the carriageway.

- 6.17 The lantern shall be installed with the centre of the walk lens 3 m above the foot pavement or median surface.

Mounting of Vehicle and Pedestrian Lanterns

- 6.18 Vehicle and pedestrian lanterns shall be secured to their respective lower mounting brackets with a locking mechanism as detailed in AS 2339.

Push Button Mounting Assemblies - Pedestrian and Cyclist

- 6.19 Push button assemblies shall be attached to signal posts indicated on the Traffic Signal Drawings.
- 6.20 Where push button assemblies are attached to other supports, mounting brackets shall be used as shown on Drawing No S-4516, sheet 2.
- 6.21 Where the push button assembly is mounted on a support other than a signal post it shall be terminated directly to the nearest ELV termination strip as detailed in the Site Wiring Diagram and Cable Connection Schedule. The cable connecting the push button assembly to the post mounted termination box shall be placed into a PVC sheathed flexible metal conduit (ANACONDA or similar). This conduit shall be attached to the push button by means of a flexible metal conduit terminator. The flexible conduit shall be securely attached to the support to prevent any movement of the conduit.

Pedestrian Push Buttons

- 6.22 Pedestrian push buttons shall include arrow legends in the audio tactile display.
- 6.23 Pedestrian push buttons driving different audio tactile signals shall be located on separate posts.
- 6.24 The Pedestrian push button assembly shall be positioned such that the face of the device is parallel with the direction of cross walk and the arrow shall point in the direction of crosswalk. (As shown on standard drawing S-4074 "Kerb Ramps for Signalised Locations".)
- 6.25 Pedestrian Push button assemblies shall be located 1015 mm above the walking surface or standing place used by pedestrians when operating the button, measured to the Cable entry hole of the push button assembly. The height of the push button is measured to the Cable Entry hole as described on standard drawing S-4537 Post Types and Post Mounting Details Sheet 6. The height drilled to the bottom of the post is consistent with the 300 mm buried depth of the post shown on standard drawing S-4515 Post Footing and Installation Sheet 2.

Cyclist Push Buttons

- 6.26 Cyclist push buttons are not audio tactile and will include a cycle symbol in the assembly above the button.
- 6.27 Cyclist push buttons are orientated with the face of the device parallel to the direction of traffic, i.e. pointing generally towards a cyclist stopped at the stop line.
- 6.28 Cyclist push buttons shall be located 1015 mm above the adjacent road surface measured to the Cable Entry hole of the push button assembly. The cycle push button will normally be located on the same post as the primary traffic signal face. Where this signal post is located out of reach of a cyclist when waiting at the stop line an additional short post will be required. i.e. 1 metre offset from the cyclist stop line.
- 6.29 Where the cycle button is co-located on the same post as a pedestrian push button, the cycle push button shall be positioned at the same level as determined by the height of the pedestrian push button.

Alternative Forms of Pedestrian Detection

- 6.30 Where the traffic signals design requires novel forms of pedestrian detection either to determine the presence of pedestrians or the clearance of pedestrians the equipment products shall be approved by the Department. This detection equipment shall be installed in accordance with the manufacturer's recommendations in terms of its setup, location and orientation. (Note: Supply of product details is a **Hold Point** as per Clause 1.12.)

Audio Tactile Devices

Audio Tactile Push Button Assemblies

- 6.31 All pedestrian push buttons shall be audio tactile. The audio tactile push button assemblies shall be installed where shown on the Traffic Signal Drawings.
- 6.32 All push button assemblies including the driver unit on relocated / new poles shall be new Department approved equipment.
- 6.33 Audio tactile signal arrows shall be positioned horizontally and point to the far side of the road in the direction that a disabled person is expected to walk.

Audio Tactile Driver Unit

- 6.34 The audio tactile driver shall be mounted on the same support nominated for the audio tactile push button assembly it controls, otherwise on the closest suitable signal support. The brackets supplied as part of the housing shall be used to mount the audio tactile driver at a height of 4 m above the footpath or median surface.

CCTV Camera and Camera Supports

- 6.35 Where CCTV equipment is required to be installed at intersections, the roadside equipment shall be housed in an extension housing attached to the top of the traffic signal controller cabinet.
- 6.36 CCTV equipment and its mounting arrangement including the detail of supporting brackets should be approved by the Department. (Note: Supply of product details is a **Hold Point** as per Clause 1.12.)

Flexible Conduits to Equipment

- 6.37 Flexible black PVC conduits from the upper mounting bracket assembly or termination box to lanterns and audio tactile drivers shall be tied together and securely fixed using approved UV protected cable ties to the signal post or other support to prevent excessive movement. The flexible conduits shall be free from distortion and shall be positioned away from strap brackets and other supports likely to cause mechanical damage in the event of the equipment being hit by a vehicle.
- 6.38 The flexible conduit shall extend 50 mm inside the final assembly cap.

7 Traffic Signal Controller

General

- 7.1 The signal controller shall be installed as shown on the Traffic Signal Layout and Traffic Signal Conduit Layout Drawings.
- 7.2 It is the Contractor's responsibility to ensure the traffic signal controller has sufficient capability in terms of the number of signal groups and detectors that can be terminated in the cabinet. There should be at least 2 spare signal groups and detectors for future expansion. Where an intersection is large, i.e. requiring 14 signal groups or more, and / or more than 22 detectors, the Contractor will need to supply a single controller capable of controlling 32 signal groups and 48 detectors (VC6 personality).
- 7.3 When RC1 signs are fed off from a traffic signal controller which is more than 12 signal groups, the Contractor shall install separate fuse in the traffic signal controller cabinet for the RC1 signs in order to balance the electrical load. Fuse type, fuse rating and holder type should be supplied in accordance with RMS Specification TSI-SP-069.
- 7.4 Door alarms for signal controller cabinet shall be extended to extension housing and remotely monitored by the Department TMC Operator via SCATS. Opening of controller cabinet/extension housing doors shall result in an alarm being generated at the TMC via SCATS which identifies the cabinet ID and the door status (i.e. open / closed).

Documentation Requirements

- 7.5 Traffic Signal hardware requirements should be documented in the Traffic Signal Design Report in accordance with RD-EL-D2.
- 7.6 Upon written request, the Department will supply the necessary information to enable the purchase of the communications services. The Department does not warrant the time of delivery of this information and at least 2 weeks from the request to delivery shall be allowed. The provision of the request for communications information is a **Hold Point**.

Controller Programming

- 7.7 The Contractor shall provide the Department with the Programmable Controller Personality Module(s) (PCPM) to contain the personalities for the controllers. The Contractor shall formally request that the Department undertake programming of the personalities. The Department requires 8 weeks from the formal request for personality programming to the delivery of programmed (PCPM) to the Contractor.
- 7.8 The formal request shall be accompanied by The Traffic Signal Operational Performance Report and traffic signal plans approved by the Department, which clearly show the required phasing. Provision of this documentation shall constitute a **Hold Point**. (Note: Clause 1.10 "Approval of Traffic Control Devices" requires an additional 15 days' notice which is sequential to this **Hold Point**).

Installation

- 7.9 The signal controller shall be mounted on the controller base and bolted down to the frame as detailed on Drawing No. S-4512, sheet 3.
- 7.10 Where required, the white telecommunications conduit shall be extended within the controller housing and joined to the line terminating box. The draw cord shall be drawn into the line terminating box.

8 Provision of Telecommunications for SCATS® and CCTV

- 8.1 The form of telecommunications connection for SCATS® and CCTV shall be determined and accepted by the Department as part of the traffic signal design. Refer to Part RD-EL-D2 Clause 6.25 to 6.27. The Contractor is responsible for making a written application to the Department for this information.

New Traffic Signal Sites

- 8.2 Traffic signal controllers shall be fitted with all the necessary hardware for SCATS® connection, and CCTV communications if CCTV cameras are installed. The Contractor is responsible for all costs associated with the communications connections, including but not limited to:

- a) SCATS® compatible Modem hardware;
- b) Bluetooth / 4G / 5G / GPS Antenna and Bluetooth transceiver;
- c) telecommunications 4G/ 5G/ Ethernet (WAN)*;
- d) direct access to the Department network via fibre optic connection*; and
- e) traffic site specific parameters.

Note: * Refer to the Department approved final design in terms which telecommunication methods are required.

- 8.3 The provision and connection into the Department's fibre optic communications network includes:

- a) installation of conduit and fibre optic cable from the specified Department access pit and the traffic signal controller;
- b) splicing or patch panel connections in the Department network;
- c) fibre optic transceivers, patching leads and rugged switch utilising power rails inside the traffic controller extension housing; and

- d) SCATS® compatible modem / network hardware.

SCATS® Compatible Modem or Network Hardware

- 8.4 The Contractor is responsible for the procurement, installation and programming of the SCATS® compatible modem / network devices.

Telstra TRT (Telstra Remote Telemetry) Access

- 8.5 The Telstra TRT access consists of a 3G / 4G wireless service and in critical sites an additional ADSL copper connected service. The Contractor shall apply to Telstra for a Department TRT service on behalf of the Department. The Contractor shall confirm with the Department the type of service required and quote to Telstra the following products when making the Telstra application:
 - a) TRT 400 T wireless 10GB only (Non Department Critical site); or
 - b) TRT 400 T wireless 10GB and ADSL (256/64 90 GB) (Department Critical site).
- 8.6 Telstra will provide a modem and SIM registered to the TRT solution. Telstra will also supply an ADSL connection for high availability if the site is determined critical by the Department.

Traffic Site Specific Parameters

- 8.7 The Contractor shall liaise with the Department to determine the following:
 - a) TRT modem username and password;
 - b) traffic site SIM and ADSL details; and
 - c) configuration parameters.
- 8.8 A formal request by the Contractor to provide this information shall constitute a **Hold Point**.

9 Bluetooth Capture Stations

- 9.1 The Contractor shall provide, install, test and commission Bluetooth Capture Stations within all new or upgraded traffic signal controller cabinets including intersections and pedestrian crossings or as nominated and approved by the Principal.
- 9.2 Bluetooth capture station shall comprise an industrial DIN-mount Programmable Communications platform capable of Bluetooth (Classic and Low Energy) and Wi-Fi MAC address capture from passing vehicles, which shall be connected into a port at the nearest network (TrafficNet) access point (Layer 2 switch).
- 9.3 The installation shall include an external antenna configured to provide full intersection coverage.
- 9.4 Bluetooth Capture Stations shall be compatible with the Department's AddInsight – Traffic Intelligence System, including beacon / broadcast functionality. Bluetooth Capture Station hardware shall be compatible with both "Classic" Bluetooth (v2.1), Bluetooth Low Energy (v4.x) and Wi-Fi (2.4GHz and 5GHz) technology.
- 9.5 Bluetooth Capture equipment shall be approved by the Department. The supply of Bluetooth capturing product detail for approval is a **Hold Point** in accordance with Clause 1.12.

10 Detector Loop Installation

General

- 10.1 Detector loops shall be installed as specified on the Drawings. Loop types are detailed on Drawing No. S-4500, sheet 1. Loops located at the intersection stop bar shall be the quadruple type, while other loops shall be the passage type. Loop cable shall be polypropylene insulated detector loop cable.
- 10.2 A slot shall be cut to the pattern shown, and of the dimensions detailed, on Drawing No. S-4500, sheet 1 and 2 to suit the individual detector loop requirements. The cut depth detailed on Drawing

No. S-4500, sheet 1, shall be strictly adhered to where cuts intersect to prevent any variation in level between cuts. All cuts shall be straight, over-run of cuts shall be to the minimum to maintain the 50 mm depth where cuts intersect.

- 10.3 The Contractor shall remove the cutting residue from the vicinity of the loop slots and within the loop slots, prior to the installation of loop cable, in a controlled manner that will not disperse the cutting residue into the surface drainage system.
- 10.4 The loop cable shall be laid in the slot in accordance with diagrams on Drawing No. S-4500, sheet 1 and 2 and care shall be taken to ensure that no damage is caused to the cable. Where loop cable enters the detector pit, individual loop cables shall be twisted together to ensure there are no secondary loops formed in the detector pit. Loop cables entering the detector pit shall be cut to a length of 0.5 m.
- 10.5 The loop cable shall be securely held in the slot in accordance with Drawing No. S-4500, sheet 1 and the slot sealed with a sealant which is compatible with both the loop cable insulation and the road surface material the sealant type is to be submitted for approval of the Department and submitting the sealant product for approval is a **Hold Point**. The approved sealant shall be applied in accordance with the manufacturer's instructions.
- 10.6 Loop cables shall be connected to relevant detector feeder cables by soldering. The exposed screen drain wire shall be cut off level with the outer sheath and left unconnected. The resulting connection shall be encapsulated in a waterproof medium to prevent corrosion of the electrical joint. This encapsulation shall also include the outer insulating sheath of the detector feeder cable. All loops shall be identified in the pit by means of labelling (refer Clause 5.18) on the feeder cable.

Road Surface Condition

- 10.7 The road surface is to be in a good condition to be able to support the installation of loop detection, including feeder cable that is to be cut into the surface. The surface shall be in good condition for a minimum of two metres on all sides of the loops.
- 10.8 The road surface is considered not in a good condition if it has been repaired by patching, is rutted, cracked or the road has subsided. Where the road surface is not in a good condition, the road surface is to be made good by a suitable asphalt surface prior to installing the loop detection. Spray sealed surfaces are not suitable for cutting loops and will be replaced with an asphalt surface.

Testing and Acceptance

- 10.9 The Contractor shall verify the integrity of detector loops immediately following installation of the loop cable and again on connection of the loop feeder cables to the controller.

11 Uninterrupted Power Supply (UPS)

- 11.1 The provision of UPS shall be in accordance with RD-EL-D2.
- 11.2 The spacing between UPS and the signal controller base shall be in accordance with Drawing No. S-4055 Sheet 0073.
- 11.3 The UPS shall be capable of providing back up power for normal operation of the traffic signals and any attached CCTV equipment for a minimum period of 4 hours. (NOTE: this requirement does not extend to road lighting.)
- 11.4 UPS equipment products shall be approved by the Department. The supply of the list of UPS products for approval is a **Hold Point** in accordance with Clause 1.12.
- 11.5 Subject to the approval of the Department, an internal UPS integrated into the signal controller cabinet may be allowed.
- 11.6 "Danger, Dual Supply" sticker (Refer to Appendix 2) shall be installed at the following locations to provide sufficient warning:
 - a) exterior of UPS and Traffic Signal Controller Cabinets, near upper key lock; and
 - b) interior of Traffic Signal Controller Cabinet, below TSC switchboard.

12 Switch-On

General

- 12.1 Prior to the switching on of any traffic signals the Contractor shall:
- a) allow in the pre switch-on program at least 2 days testing with the Principal;
 - b) liaise with the Principal to arrange a suitable date for switch-on following completion of electrical and functional testing;
 - c) audit the site against drawings and provide the record in accordance with PC-CN2 Asset Handover RAMA-AM-PRC-005 Road & Marine Assets – Asset Data Collection Manual and in the format of ITS & Traffic Signals RITS Data Collection Template (KNet # 17518794);
 - d) ensure that the SCATS® co-ordination plans have been installed by the Principal and confirmed as operational by the Principal; and
 - e) ensure that the lantern alignments have been reviewed prior to switch-on. (This is in addition to the requirements for the Site Acceptance Test.)
- 12.2 The Contractor shall supply and install DPTI asset identification sticker (300mm H × 250mm W) on the traffic signal controller and Pole number sticker (85mm H × 47mm W for single digit or 85mm H × 100mm H for double digit) as per the approved drawings. Asset Labels shall be yellow quality reflective type with black print and clear gloss laminate. Refer to RD-ITS-C1 Appendix 2 for an example of the artwork.

Site Acceptance Test

- 12.3 At switch-on the Contractor shall undertake a Site Acceptance Test. The Contractor shall produce a Site Acceptance Test Schedule detailing the results of the following tests:
- a) each traffic signal post, pedestal and the attached equipment is satisfactorily erected and is properly aimed at the appropriate traffic;
 - b) lanterns shall not be easily seen by traffic on the wrong approach;
 - c) the controller responds to the demands from each vehicle, pedestrian and other detector;
 - d) the controller is communicating with the SCATS®; and
 - e) the installation does not allow any unsafe situation.
- 12.4 The Contractor shall provide as built traffic signals and conduit drawings, connection chart, electrical Certificate of Compliance, Signal Installation Information Sheet, Controller Operations Sheet, and asset data table as part of the asset handover documents. A copy of the documents shall be stored inside the cabinet door pocket with sealable folder.
- 12.5 After the signals have been switched on, operation has been transferred to SCATS and the installation of traffic signals is completed, the Contractor shall remove all temporary traffic control devices and associated equipment from site.

13 Hold Points

13.1 The following is a summary of Hold Points referenced in this Part:

Table RD-EL-C2 13-1 Hold Points

Document Ref.	Hold Point	Response Time
1.10	Drawings submission showing the traffic control devices for approval	15 Working Days
1.12	Supply of the list of product details for approval	10 Working Days
2.3	Provision of Electrical Workers Licence prior to commencement of electrical work	2 hours
4.5	Inspection after excavation of mast arm footing	1 Working Day (metro) 2 Working Days (other locations)
5.4	Submission of a Site Wiring Diagram.	5 Working Days
7.8	Provision of formal request and accompanying materials for traffic signal controller programming.	8 weeks for delivery of traffic signal personality
7.6 & 8.8	Provision of formal request for communications information	10 Working Days
10.5	Submission of sealant product for approval.	5 Working Days

14 Verification Requirements and Records

Test Records

14.1 The Contractor shall undertake the testing specified in this Clause and supply written evidence of compliance with the lot package.

Table RD-EL-C2 14-1 List of Test Records Required

Document Ref.	Subject	Property	Test Procedure	Test Frequency	Acceptance Limits
10.9	Detector Loop Integrity	Loop Continuity	Measure with continuity tester	Each Loop	Full continuity
		Insulation Resistance	Measure the insulation resistance between the loop circuit conductors and a good earth point with the two conductor ends comprising the loop circuit connected together	Each Loop	The insulation resistance between the loop circuit conductors and a good earth point shall be 10 Megohms or greater measured at a test voltage of 500 V DC applied for at least a minute
		Inductance of loop circuit	Measure with no vehicles over or traversing the loop and with no other adjacent loop circuit energised	Each Loop	Not more than 20% from the theoretical value

Other Records

14.2 The Contractor shall supply the following records:

Table RD-EL-C2 14-2 List of Other Records Required

Document Ref.	Subject	Record to be Provided
12.1	Switch On	Electrical Certificate of Compliance
12.1c)	Switch On	Traffic Signal Asset Data in the format of RITS Data Collection Template (KNet #17518794)
12.3	Switch On	Site Acceptance Test Schedule

15 Appendix 1: Site Wiring Layout (Sample Only)

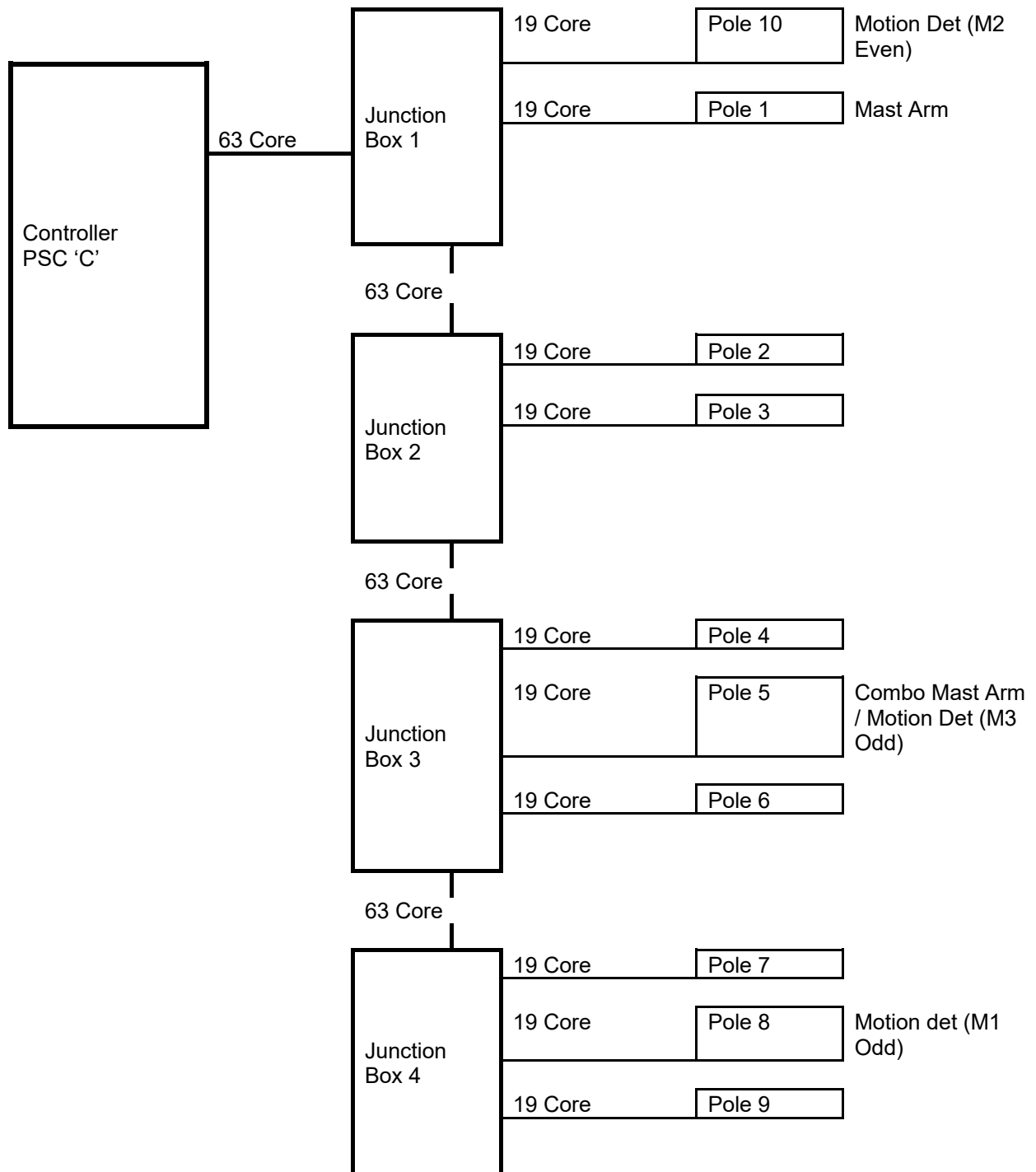
LOCATION: GRAND JUNCTION ROAD / PROSPECT ROAD														
TS160			PSC 'C'									Date: 06/11/2007		
	Main cable size		63	J. BOX 1		J. BOX 2		J. BOX 3			J. BOX 4			
	Pole cable size			19	19	19	19	19	19	19	19	19	19	
	Pole Numbers			10	1	2	3	4	5	6	7	8	9	
Group	Cont	Function												
SG1	A3	Green	1					1				1		
	A4	Amber	2					2				2		
	A5	Red	3					3				3		
SG2	A6	Green	4					4				4		
	A7	Amber	5					5				5		
	A8	Red	6					6				6		
SG3	A9	Green	7											
	A10	Amber	8											
	A11	Red	9											
SG4	A12	Green	10											
	A13	Amber	11											
	A14	Red	12											
SG5	B3	Green	13	1			1	7				7		
	B4	Amber	14	2			2	8				8		
	B5	Red	15	3			3	9				9		
SG6	B6	Green	16					10				10		
	B7	Amber	17					11				11		
	B8	Red	18					12				12		
SG7	B9	Green	19											
	B10	Amber	20											
	B11	Red	21											
SG8	B12	Green	22			1				1	1			
	B13	Amber	23			2				2	2			
	B24	Red	24			3				3	3			
SG9	C3	Green	25											
	C4	Amber	26											
	C5	Red	27											
SG10	C6	Green	28											
	C7	Amber	29											
	C8	Red	30											
SG11	C9	Green	31		1	4					4			
	C10	Amber	32		2	5					5			
	C11	Red	33		3	6					6			
SG12	C12	Green	34											
	C13	Amber	35											
	C14	Red	36											

LOCATION: GRAND JUNCTION ROAD / PROSPECT ROAD														
TS160			PSC 'C'									Date: 06/11/2007		
	Main cable size		63	J. BOX 1		J. BOX 2		J. BOX 3		J. BOX 4				
	Pole cable size			19	19	19	19	19	19	19	19	19		
	Pole Numbers			10	1	2	3	4	5	6	7	8	9	
Group	Cont	Function	37											
P1	D12	Walk	38							4	7			
	D14	Don't Walk								5	8			
		WAIT												
	F28	Push Button	56							15	15			
P2	D9	Walk	39		4	7								
	D11	Don't Walk	40		5	8								
	F1-2	WAIT												
	F27	Push Button	57		15	15								
P3	D6	Walk	41				4		4					
	D8	Don't Walk	42				5		5					
	F1-3	WAIT							15					
	F26	Push Button	58				15							
P4	D3	Walk	43	4							4			
	D5	Don't Walk	44	5							5			
	F1-4	WAIT												
	F25	Push Button	59	15							15			
	E3	PB Return	60	16	16	16	16	\\\\\\	16	16	16	16	\\\\\\	
	A2	240VActv	GREY											→
	A1	Neutral	BLACK											→
	=	Earth	GREEN/YELLOW											→
		Spare	45	6	6	9	6	13	6	6	9	6	13	
			↓	↓	↓	↓	↓	14	↓	↓	↓	↓	14	
			↓	↓	↓	↓	↓	15	↓	↓	↓	↓	15	
			55	14	14	14	14	16	14	14	14	14	16	

LOCATION: GRAND JUNCTION ROAD / PROSPECT ROAD

TS160

Date: 06/11/2007



- 16 Appendix 2: UPS Warning Label sticker template, 110mm (w) × 80mm (h)

