IPENZ
TRANSPORTATION GROUP

Signals New Zealand User Group (SNUG)

National Traffic Signals Specification 2013 Rev01

Superseding the National Signals Specification 2005

Signals Specification 2013

CONTENTS

APPENDICES

DISCLAIMER

This specification has been produced by members of the National Signals Committee and the Signals New Zealand User Group (SNUG) and includes input from representatives of the traffic signal industry.

It is the combination of several specifications from the larger cities and brings together the best practice and procedures currently in use throughout the country. Users of this specification must ascertain for themselves that it represents the requirements of their clients or Road Controlling Authority (RCA).

REVISION DETAILS

Revision No.	Date	Section	Description

ABBREVIATIONS

Abbreviation	Description
AGD	Above Ground Pedestrian protection
CIS	Controller Information Sheet
DLP	Defects Liability Period
IGD	In Ground Pedestrian detection
JUMA	Joint use Signal Mastarm and Streetlight Pole
JUSP	Joint Use Signal and Streetlight Pole
KJB	Kerbside Junction Box
LED	Light Emitting Diode
MPa	Megapascals
NZTA	New Zealand Transport Authority
UMB	Upper Mounting Bracket
RCA	Road Controlling Authority
SCATS	Sydney Coordinated Adaptive Traffic System
SNUG	Signals New Zealand User Group
TMP	Traffic Management Plan

SPECIFICATIONS

No.	Description
AS/NZS 3000	Electrical Wiring regulations
AS/NZS 2144	Traffic Signal Lanterns
AS 1163	??
AS/NZS 4792	Galvanising ???
AS 2352	Pedestrian Push Button Assemblies
NZS 3910	Conditions of Contract for Building and Civil Engineering Construction
AS/NZS 2276.3	Cables For Traffic Signal Installations, Part 3 - Loop Cable for Vehicle Detectors
AS/NZS 2276.1	Cables for Traffic Signal Installations, Part 1 – Multicore Power Cables
NZECP 34	New Zealand Code of Practice for Electrical Safe Distances
NZS 3109	Concrete Construction
AS/NZS 4058	Precast Concrete Pipes
NZS 3144	Specification for Concrete Surface Finishes
AS 3996	Access covers and grates

Section 1 – GENERAL REQUIREMENTS

1.1 Introduction

Whilst this specification is intended to encompass the best practice for the supply and installation of traffic signals throughout the country it is recognised that individual Road Controlling Authorities (RCA's) will have their own specific requirements. Therefore this specification needs to be read in conjunction with the Regional Special Conditions to the National Signals Specification as produced by the local RCA in which the work is being undertaken.

1.2 Specifications / Standards

All cable, equipment and installation shall satisfy the requirements of the Electrical Wiring Regulations AS/NZS 3000 (and any amendments) and the Local Power Supply Authority.

Any communication equipment likely to be connected to the Telecom network shall be Telecom approved.

All Standards referenced in this specification maybe superseded by a revised version. Where a standard has been superseded the Standard referenced in this Specification shall be replaced most recent version of the Standard.

Section 2 - MINIMUM REQUIREMENTS OF SIGNAL EQUIPMENT

2.1 Scope

This Section of the Specification covers the requirements of all signal equipment offered for supply and installation, including the local signal controller, controller cabinet, detectors, lanterns, target boards, visors, poles and pole top assemblies and push button assemblies.

2.2 Signal Equipment Compliance and Approvals

All traffic signal components must comply with this specification and must either:

(a) Have been previously supplied to the Road Controlling Authority (RCA) / Client and found satisfactory in operation, or

(b) Be demonstrated in a working condition to the RCA / Clients Engineer before the closing date for tenders. The Engineer may give provisional approval if, in his opinion, the equipment is fit for purpose and is able to be connected to the SCATS Traffic Management System (if required to be connected to SCATS). – Refer Section 2.2.1 Provisional Approval

The equipment shall also comply with all relevant electrical regulations and local Power Supply Authorities requirements.

2.2.1 Provisional Approval

Provisional approval for non-complying equipment may be given by the RCA / Client providing it can be shown that the proposed equipment meets all specified requirements, including safety and other regulatory requirements, and provides the same desired outcome.

Equipment with provisional type approval will be required to operate in accordance with this Specification and will not remove the Contractors obligations under Section's 4 and 5 regarding maintenance. In many cases, equipment with provisional type approval may require maintaining for a longer period than one year. The Contractor will be notified of this period when granted provisional type approval. Maintenance, at no cost to the RCA / Client, will be required until full approval for the equipment is given.

In general, equipment will be required to operate under normal working conditions without failure for a period of 12 months. This may apply to one-off or a multiple number of units.

2.2.2 Guarantee Period

Unless specified elsewhere in this document, all equipment / hardware supplied or installed shall be guaranteed against faulty materials and workmanship for a period of one year from the date of commissioning. (Note: The Guarantee period commences from the date of commissioning and not the date of manufacture).

Where there is a difference between the main contracts Defects and Liability requirements and this specification the longer time period shall apply.

Some exceptions to the above are traffic signal controller components, poles and painting.

LED (Lamp) module shall have a five year guarantee period. In terms of new installations the guarantee period shall commence from the date of commissioning. For replacement modules the guarantee period shall commence from the date of installation of the LED (Lamp) module.

For new installations, commissioning of the signals shall be deemed to have occurred on the date when the installation has passed all of the pre-commissioning tests and the RCA's Engineer has signed the Site Acceptance (or similar) form.

Refer Section 5.1 for procedure for cost recovery for any failure or fault during the contract Maintenance or Defects Liability Period.

2.3 Traffic Signal Controller

2.3.1 AS2578:2009 - Traffic Signal Controller

Subject to the following special conditions, the Traffic Signals Controller must comply with AS2578:2009. This includes all aspects of the controller, cabling, mounting, cabinet, and logic rack as detailed in AS2578:2009, including the provision of options as detailed in AS2578:2009 Appendix A.

2.3.2 New Zealand Special Conditions to AS2578:2009

The following amendments shall be made to AS2578:2009 for supply and installation in New Zealand. The numbers referred to are the item numbers in AS2578:2009.

AS2578:2009 Requirement 1.4.10 – Additional requirement for New Zealand
In accordance with AS/NZS3000, the RCD supplied must meet the conditions of AS/NZS3000:2007 2.6.2.2 for **New Zealand** installations.

AS2578:2009 Requirement 2.3.3 – Additional Requirement for New Zealand
The controller must have ventilation grilles in the base, above the finished ground level, and below the gland plate as detailed in Section 2.3.4. A recommended option is to fit a 'pedestal' between the base and the controller cabinet. This pedestal must be at least 100mm tall, and the same width and depth as the controller cabinet and base.

AS2578:2009 Requirement 2.3.4 – Additional requirement for New Zealand
A gland plate and removable access panel shall be fitted at the bottom of the controller cabinet. A suitable example is shown in Appendix K. Any unused cable entries must be 'plugged' with plugs that can be easily removed. The glands, gland plate and access panel must be capable of preventing entry for vermin etc into the bottom of the controller cabinet.
The access panel must be installed to allow easy removal for maintenance tasks in the bottom of the cabinet.

AS2578:2009 Requirement 2.3.7 – For New Zealand remove figure 2.5.
AS2578:2009 Requirement 2.3.7 - Additional requirement for New Zealand as per NOTE.
The purchaser requirement for New Zealand cabinet locking is as follows –
1. Recessed Handle(s),
2. Three-point locking at top, bottom, & side,
3. A single-key mechanism, with the lock as specified by the RCA in their "Regional Special Conditions to the National Signals Specification".

AS2578:2009 Requirement 2.3.12 – Change requirement for New Zealand
Replace second paragraph with –
The equipment shelf shall be mounted not less than 390mm below the top of the door opening, and this shelf shall be the width of the controller cabinet.

AS2578:2009 Requirement 2.3.12 – Additional requirement for New Zealand
The equipment shelf must be sufficiently deep enough to hold the logic module, but must have at least 50mm clearance from the front face to the inside of the door.

New requirement to AS2578:2009 for New Zealand
2.5.12 Communications Socket Outlet and MCB
A circuit breaker shall be installed in the 'spare position' as provided for in 2.5.11.(f). This circuit breaker shall be rated at 16 A, Type C, with a fault-make load-break fault current rating not less than 8 kA, and shall control a new double-socket outlet specifically for communications and camera equipment, where the 230v power for such equipment is supplied by 3-pin plug. The communications equipment socket outlet must be

clearly labelled "Communications Equipment Only – NOT RCD PROTECTED". RCD protection must not be provided for this socket.

New Requirement to AS2578:2009 for New Zealand
2.5.13 Street Lighting Power
Where there is a power supply to street-lighting fed through the traffic signals cabinet, it shall be installed as per the local RCA's "Regional Special Conditions to the National Signals Specification". This street lighting circuit must be supplied through the traffic signal controller mains power isolation switch.
*Note - the 'Detector' MCB detailed in 2.5.11 (d) may be re-tasked as the street-lighting circuit protection.

New Requirement to AS2578:2009 for New Zealand
2.5.14 Electricity Revenue Meter
Each electrical retailer, and each electricity lines company have slight variations with their electricity revenue meter requirements. For regional specifics, consult the local RCA's "Regional Special Conditions to the National Signals Specification".

AS2578:2009 Requirement 2.13.1 - Change requirement for New Zealand
Replace the entire paragraph with -
2.13.1 Conformance with New Zealand Communication Requirements
(a) Telepermit Requirements - Any device to be directly connected to the Chorus network must display the New Zealand Telepermit label. For more information visit **http://www.telepermit.co.nz**.
(b) Radio Requirements - Any wireless device must comply with the New Zealand Radio Communications Act 1989. For more information visit **http://www.rsm.govt.nz**

AS2578:2009 Requirement 2.18 – NOTE
The service light is a standard requirement for all New Zealand controllers.

AS2578:2009 Requirement 2.22.5(b) – change requirement for New Zealand
Replace entire requirement with "Telepermit label and PTC number"

2.3.3 Controller Firmware

Prior to testing and installation, the following requirements must be met -

1. The controller must be designed in accordance with RMS TSC4 specification,
2. The controller (including logic rack and all other modules) must have the current manufacturer software, firmware and hardware updates applied.

2.3.4 SCATS Compliance and TRAFF Version

Where the controller is to be connected to SCATS, the following conditions apply –

1. The controller must be running the latest version of TRAFF software, as notified by Roads & Maritime Services (RMS),
2. A copy of the RMS SCATS Compatibility Certificate for that model of controller must be supplied to the Engineer (if not already previously supplied).

2.3.5 New Controller Types

Where a contractor proposes to install a new controller type not previously installed in the area of the RCA, the following conditions must be met –

1. Written approval must be obtained from the Engineer,
2. The supplier (or their agent) must offer to make a presentation on the controller to the Engineer, and provide a loan logic rack at no charge to allow the Engineer to test the controller and become familiar with it,
3. The supplier (or their agent) must provide a training course to the RCA's existing Maintenance Contractor, at no charge to the Engineer or the Maintenance Contractor,
4. If the new controller requires special configuration tools, or will not work with the RCA's Maintenance Contractors HHT, the supplier (or their agent) must provide all equipment required to allow full HHT operation with the controller. This can include computer software, or a new HHT, as required to integrate with the operations of the current Maintenance Contractor,

5. The engineer has the final right to deny installation of any controller type in their area.

2.4 Signal Lanterns

2.4.1 General

The technical requirements for Traffic Signal Lanterns including cowls, visors and louvres shall be as stipulated in AS/NZS 2144:2002 (Including amendments as issued from time to time), with the exception that all new traffic signal lanterns shall be supplied with LED lamps.

2.4.2 Signal Sizes

The nominal size of pedestrian and general-purpose signals as referred to in clause 3.3 of AS/NZS 2144:2002 shall be 200 mm.

The nominal size of extended range signals as referred to in clause 3.3 of AS/NZS 2144:2002 shall be 300 mm. (Note: Extended range signals shall be used on all overhead mastarm displays and on high speed approaches).

2.4.3 LED Lanterns

All LED lanterns, visors, louvers and target boards **must** have an independent NATA certified laboratory report confirming compliance with AS/NZS 2144:2002

2.4.4 Lantern Body Construction

Lantern bodies shall be constructed from aluminium or polycarbonate and be installed to the manufacturers' installation instructions.

The lantern doors shall be capable of being hinged on both the left and right without the need for tools. Lantern doors shall be able to be replaced without the need to disturb the lantern mountings.

2.4.5 Visors (Cowls)

Each visor shall fit tightly against the door and shall not permit any perceptible filtration of light between the door and the visor.

All Visors **shall** be made from plastic.

Unless specified elsewhere all visors shall be one of the following:

(a) **Open Type Visor**: For use on primary lanterns.

(b) **Closed Type Visor**: For use on secondary or tertiary lanterns.

(c) **Pedestrian Visor**: Each standard 200mm diameter pedestrian lantern shall be fitted with an approved rectangular visor.

2.4.6 Target Boards (Backing Boards)

Target boards shall be fitted to each vehicle lantern supplied. The size of target boards shall be as specified in AS/NZS 2144: 2002 and shall be constructed using type 5005 aluminium alloy with a minimum thickness of 1.6 mm. Each target board shall be fully interchangeable in accordance with the criteria recommended in Appendix F of AS/NZS 2144: 2002. The surface treatment shall be baked enamel (black).

Target Boards for 200 mm lanterns shall incorporate a 20 mm white painted border around the outside as set out in Clause 7.9 of AS/NZS 2144: 2002.

Target Boards for 300 mm lanterns shall incorporate a 35 mm white baked enamel border.

2.5 Poles (Posts) and Pole Terminal Assemblies

The design requirements for all traffic poles shall be in accordance with the joint Australia/New Zealand Standard AS/NZS 4676:2000 Structural Design Requirements for Utility Service Poles and AS/NZS 4677:2010 Steel Utility Service Poles.

Design of the components for strength will be in accordance with the parameters set out below.

Only standard poles and arms in accordance with the drawings in appendix are to be manufactured.

All traffic style poles, including mast arm poles (curved or mitred), standard traffic signal and hinged traffic signal poles, JUMA, JUSP, ground planted, flange based or flange based stub shall be designed in accordance with AS/NZS1170.2.2002 parts 0 and 1 and include a 10 year structural guarantee. Additionally, the following specific design parameters are to be included:

Design Working Life	- 50 years
Importance Level	- 2
Wind Region	- Use code for region where traffic signals are to be installed
Terrain/Height Multiplier	- 2
Shielding Multiplier	- 1
Hill Shape Multiplier	- 1
Lee Zone Multiplier	- 1 (to a maximum of 1.35)

All JUSP, JUMA and Mast Arm Poles with curved outreach arms shall have a 10 degree tilt. In addition, poles and arms shall comply with all dimensions shown in the drawings min Appendix A. The minimum spigot diameter on JUSP and JUMA poles shall be 42mm o.d. In the case of the JUMA and JUSP poles, the street lighting luminaire fitted to the outreach arm shall not exceed 0.15m² in sail area and have a mass of no more than 15.0 kg. The tilt angle is detailed on the drawings.

All fixtures and fittings are detailed (traffic signals, pedestrian signals, street lights, signage and any other fittings or fixtures required for the specific installation) along with the height at which their weight and windage is to be calculated as a minimum. Drag coefficients are to be in accordance with table E4 of AS/NZS 4676:2000.

The JUSP pole door cavity/fuse opening shall be of a suitable weatherproof design and shall be positioned to permit safe access for maintenance i.e. not facing the street/traffic lane. The ideal position would be to allow the technician to view on-coming traffic. The cover plate shall be secured by a minimum of two child and vandal resistant 304 grade stainless steel fasteners and will require a specialised tool to remove the fasteners for maintenance.

In the case of octagonal JUSP poles, the door cavity/fuse opening shall be a standard size of 300mm x 140mm and be positioned 600mm (to the base of the opening) above the finished ground level. In the case of the JUMA pole, the door cavity/fuse opening for the street light isolation shall be a standard size of 180mm x 80mm and be positioned just below the mounting flange for the street light outreach arm.

All steel tube used for manufacture of the 5.1 metre traffic light poles shall be a minimum of 100nb CHS to C250LO in accordance with AS/NZS1163:2009.

Pole strengths are based on AS/NZS 3404:2009 Steel Structures Standard. Steel sections strength requirements apply to the base of the pole at the top of the concrete footing.

All welding shall be carried out in accordance with AS/NZS 1554.1:2004 Structural Steel Welding Part 1 and welders must be qualified to AS/NZS 2980:2007. Inspections certificates by a duly qualified independent inspection company are to be supplied for each batch manufactured.

Poles will be permanently marked (prior to painting) by way of indentation stamp to indicate date of manufacture (dd/mm/yyyy) and the name of the manufacturer. This indentation stamp shall be located immediately under the lower pedestrian mounting lug. Arms are to be identified in the same manner with the location being on the outer surface, immediately above where the arm connects to the pole. The indentation stamp letter and number size is to be of a size suitable to be easily identified. Lettering shall have a minimum height of 7mm and a maximum height of 14mm. All marking is to be applied prior to painting.

All JUMA, JUSP and Mast Arm Poles and arms shall be finished, both internally and externally in accordance with AS/NZS4680:2006, Hot Dip Galvanising Standard. Ready galvanised steel, spray on galvanising or thermal zinc will not be accepted. In addition, pole coatings shall be in accordance with AS/NZS 2312:2002 with certification to Category 'D' for a 10 year warranty to first maintenance.

Each pole type will require a PS1 certificate to be issued by suitably qualified CPENZ Registered Engineer. This certificate shall include the specific design details for both the pole and when requested, the foundation details and will be supplied at time of tender.

Mounting of the poles are of two possible types - ground planted and concrete pad.

Ground planted poles are an extension of the pole below the finished ground surface. The length below ground will vary depending on the model of pole being installed and ground conditions in the location. The minimum soil bearing capacity should be 100kPa. If any less than this, a site specific foundation design will be required. Concrete pad mounted poles will typically be of a flange based type. These poles will require a concrete pad or pile to be constructed that will include during casting of a suitable holding down bolt cage. Pads and piles are typically used in locations where the ground conditions aren't stable enough to maintain overturning resistance.

2.5.1 Pole Terminal Assemblies

2.5.1.1 *Switch Terminations (Terminal Assemblies)*

The terminal assembly shall consist of sufficient 2.5 mm^2 2-in-2-out knife edge disconnect terminals for the number of cores to be terminated. The terminals shall spring loaded screw locked incorporating a screw and spring-tensioned system or have a minimum of one screw per cable core. The neutral and earth terminals shall be double through terminals to facilitate a greater number of terminations. The terminals shall be mounted on aluminium rails and end clamps shall be provided at each end of the rail. Each terminal shall be clearly labelled.

2.5.1.2 *Neutral Terminations*

The terminals shall meet the requirements of Clause 2.5.1.1 excepting that they shall not use switch terminations.

2.5.1.3 *Earth Terminations*

The earth bus bar shall provide ten outputs with connectable cross-sections measuring 10 mm^2 and 16 mm^2 configured alternately. The bar shall be rail mounted and have a rated voltage of 450V and be rated IP20. The insulating material shall meet the reference standard IEC 60998-1 and IEC 60998-2-1.

2.5.1.4 5 meter Pole Termination (Terminal Assembly Unit)

The top of each standard 5m pole shall be fitted with a terminal assembly unit and cover meeting the requirements as shown in Appendix B.

The pole top and full upper mounting bracket (UMB) must be a combined unit complete with cable terminal and lantern lead supports, and a final cap capable of being fastened into position so that it cannot be removed if the securing bolts are loose.

The finial cap must be made of plastic and constructed to fit snugly over the pole top to minimise the ingress of dirt and grime. The finial cap shall be secured to the UMB by a wire lanyard to prevent it from blowing away if not fastened correctly. Metal finial caps will not be acceptable.

All nuts, washers, bolts and fasteners shall be galvanised, and the pole top/mounting bracket shall be constructed in a non-corrosive material.

2.5.1.5 Mastarm Pole Termination

All mastarm poles shall have a terminal assembly box (Montrose box) mounted no lower than 3.5 meters from the adjacent ground level.

The box shall be constructed from aluminium or polycarbonate with minimum dimensions of 400 x 350 x 120mm rated to lP 65. It shall be bolted to the pole and shall include a rubber seal or gland between the box and the pole metalwork to create a waterproof seal. The Lantern leads shall enter through the underside of the box. Any cables entering through the back of the box shall be held by a compression gland. No holes will be permitted in the box that will allow condensation or moisture to enter.

All cables shall be terminated in accordance with the details shown on the Cable Termination Chart (Refer Appendix F for example).

2.6 Pedestrian and Cycle Detection

2.6.1 Pedestrian Push Button Assemblies

Pedestrian push-button assemblies shall contain audio and tactile facilities and shall comply with AS 2353-1999 "Pedestrian Push Button Assemblies".

In addition the following requirements shall be met:

(i) The call box shall provide an audible locating and "WALK" signal.

(ii) The push button assembly shall incorporate an ambient noise control device .

(iii) The tactile function must be continually operational; however the audio signal should be able to be muted.

2.6.2 In Ground (IGD) or Above Ground (AGD) Pedestrian Detection

All IGD /AGD detection and related equipment must have prior approval from the Engineer.

2.6.2.1 In Ground Pedestrian Detection (IGD)

All IGD units shall comply with the layout and form as described in "RTS 14 – Guidelines for Installing Pedestrian Facilities for People with Vision Impairment" and the Pedestrian Planning and Design Guide produced by NZTA.

The detection output must be compatible with the standard inductive loop detector unit technology.

They shall be made from colour fast material and be capable of withstanding vehicle loadings.

2.6.2.2 Above Ground Pedestrian Detection (AGD)

All AGD units must be located such that they are able to cover the required area of detection and must be compatible with the traffic signal controller detection and operation.

2.6.3 Cycle Push Button Assemblies

Cycle push button assemblies shall be the same as the pedestrian push-button assemblies accept that:

(a) They shall be coloured blue.
(b) The audio and tactile facilities are not required.
(d) The embossed arrow disc shall be replaced with a red lens similar to a vehicle signal lens and embossed with the cycle symbol.
(e) They shall incorporate a visual call accept signal.

2.7 Inductive Loop Detectors (Vehicle and Cycle)

Inductive loop detectors may be either preformed or saw cut on site.

Where preformed loops are to be installed they must have site specific approval of the Engineer. Each preformed loop must be constructed to meet the dimensions and lane offsets as in the diagram in Appendix C

Where non inductive detection technology is to be used (e.g. camera technology) it must have site specific approval of the Engineer.

2.8 Testing of Equipment

All signal equipment supplied and/or installed including the signal controller, load switching equipment, cable terminals, plugs etc is to be fully tested under simulated working conditions before being installed on site.

For acceptance and testing during installation refer Section 3.15 – Acceptance and Testing

Section 3 - INSTALLATION AND COMMISSIONING OF TRAFFIC SIGNAL EQUIPMENT

3.1 Scope

This Section of the Specification covers the installation and commissioning of signal equipment including the controller, cabinet, vehicle and pedestrian signals, call boxes, detection equipment and detector loops. It also covers the painting of equipment.

3.2 Temporary Traffic Management

The contractor shall be responsible for the supply and erection of all necessary barricades, warning notices, lights, etc, as required under Section 5.7.2 of NZS 3910: 2003 Conditions of Contract for Building and Civil Engineering Construction and as required by the Transit New Zealand Code of Practice for Temporary Traffic Management or to any other specific documents that may be provided by the RCA / Client.

The contractor shall obtain from the RCA whatever approvals are required to be able to work on the roadway under the RCA's control.

3.3 Supply of Electric Power

The contractor shall be responsible for arranging, with the Road Controlling Authority's power supply company, for the provision of a power meter and the switching on of power to the signal control cabinet. The contractor shall pay all costs (including fees) associated with this work and shall get all necessary permits and shall provide the Certificate of Compliance to the Engineer on completion of the works.

3.4 Waterproofing

All equipment below ground level shall be constructed and treated to permit continuous operation without fault due to immersion in ground water or other corrosive agents commonly encountered on or beneath roads.

3.5 Electrical Wiring

All electrical work shall be completed in accordance with the current AS/NZS 3000 standard.

3.5.1 Pole Top Cable Terminations

All cables shall be brought up the interior of the signal pole or mastarm and terminated on the specified terminal assemblies. All cables shall be firmly supported at the point of termination in such a manner that the weight of the cable shall not impose mechanical strain on the electrical connections.

The cores of each cable are consecutively numbered on the core insulation and each core shall be terminated into the terminal labelled with the same number.

Where a 36 core cable is not used (generally in existing installations) and there is more than one cable coming into a pole then the largest cored cable or cable labelled 'A' (see Clause 4.8), shall start at terminal 1 with the smaller cables following on. For example with a 25 plus a 12 core cable, core 1 of the 25 core will be terminated into terminal 1 with core 1 of the 12 core terminating into terminal 26. It is not necessary to label each core since core 6 say will always terminate into terminal 6.

The cable sheath shall be removed for an adequate length with due precautions being taken not to damage the insulation of the individual cores. The cable cores shall be neatly formed and laced to allow individual conductors to be connected to the appropriate numbered terminal in accordance with the approved Cable Termination Chart (refer Appendix F for example). The cores of different cables shall not be laced together.

The bunching and tying of cores shall be arranged such that all terminal labelling remains visible, and individual cores may be conveniently disconnected from any terminal for subsequent maintenance. All cable cores including spares shall be allocated terminals, and shall be terminated within the pole top.

3.5.2 Earthing (Bonding)

All metal components must be individually earthed in accordance with the AS/NZS 3000:2007 wiring regulations, using a minimum size earthing cable of 4.0 mm^2. Particular attention should be given to poles (including mastarms), callboxes, finial caps, metal bodied signals, unused cable cores, controller and cabinet, mastarm termination box and audio tactile driver box.

All unused cable cores shall be bonded to earth in the controller cabinet.

3.5.3 Cable Termination Chart

For all new installations, a cable termination chart (Refer Appendix F for example) shall be completed prior to termination of cables onsite and supplied to the Engineer.

At existing sites the contractor shall amend the existing cable termination chart supplied by the Road Controlling Authority. If no cable termination chart exists, the contractor shall be required to produce one from existing cable documentation as appropriate.

All cabling both at the controller cabinet and at the pole must comply with the details of the cable termination chart.

3.6 Controller Cabinet

The controller cabinet shall be securely fixed to a concrete foundation or preformed base with, at minimum, four hot dipped galvanised bolts (minimum size M12) such that the cabinet is aligned true to the vertical and cannot be rocked from side to side. Where a standard preformed base is not to be used the foundation details must be supplied to the Engineer for approval.

Where the cabinet is not surrounded by concrete or asphalt a 300 mm wide concrete apron shall be provided around the base of the controller. The apron shall be 100 mm thick and be widened to 600mm on the side adjacent to the door. The apron shall be installed to provide drainage away from the controller to the adjacent ground but to maintain a comfortable working platform.

3.7 Controller Terminations

All cables entering the controller cabinet shall be securely supported at their outer sheath to ensure that no mechanical strain is transmitted to the electrical connections. The individual cores shall be neatly formed and tied, and positioned such that access to housing terminals is not obstructed and terminal designations are not obscured. Each cable shall be individually labelled in accordance with its designation as shown on the approved cable termination chart.

All field wiring terminals in the controller cabinet shall be vertically mounted with sufficient terminals to cater for the maximum number of signal group outputs within the Logic Rack. Each signal group (both pedestrian and vehicle groups) shall be provided with three terminal groups. Each group shall consist of two 2 in-2 out spring loaded screw locked terminals designed for 2.5mm^2 cable.

Both terminals and signal groups shall be counted and labelled from the bottom up in the order: grp 1 green, grp 1 yellow, grp 1 red, grp 2 green, grp 2 yellow, grp 2 red etc. Group 1 to 4 shall be on the right-hand side.

Terminal separation plates shall be used between each signal group and end clamps shall be used at each end of the rail.

An additional non-switched terminal unit shall be used and located on the left-hand side of the gear plate. This unit shall include three terminal blocks for both earth and neutral, plus one separate terminal block for GP

phase (wired through the GP circuit breaker), detector returns, pedestrian buttons, special inputs and outputs etc.

The terminals shall be grouped together with the earth and neutral at the bottom, then any 230V supplies and then the low voltage supplies at the top. A terminal separation plate shall be used between the earth and neutral terminals and between the 230V and low voltage terminals.

Each terminal shall be clearly labelled with its function using labels supplied by the terminal manufacturer. Where there is a schematic wiring diagram provided within the controller (generally on the inside of the controller door) it shall provide a true representation of the physical on site wiring configuration.

3.8 External Vehicle Loop Detector Units

For all new signal installations the detector units shall be located in the controller cabinet.

In special cases, or where an existing installation is involved, detector equipment may have to be accommodated in the weatherproof boxes attached to the signal pole nearest to the loop. Attachment of detector units to poles on medians or small islands shall be avoided as far as practicable. Pole-mounted detector units shall be mounted in an unobtrusive manner and such that convenient access can be obtained to it from a ladder placed on the footpath.

The power supply for all detectors that are mounted external to the controller shall be taken from the output side of the lamp isolation relay.

The connection of the loop feeder cable to the detector rack shall be carried out through terminals to allow easy isolation of the loop/loop feeder side of the circuit for testing purposes. The terminals must be suitable for low voltage and therefore standard disconnect terminals are not appropriate. The terminals should preferably be mounted vertically down the left-hand side of the gear plate. The terminal rail shall be long enough to mount sufficient terminals for 24 detectors.

The terminals shall be labelled with the on-street detector number.

The loop feeder shall be securely clamped with clamping bars to the gear plate so that no strain is placed on the core conductor.

3.9 Pole (Post) Locations and Installation

All poles shall be sited in accordance with the approved design drawing with the appropriate clearances

Prior to installation the pole locations shall be marked on site and their locations approved by the Engineer.

Poles are to be positioned to ensure that no part of the signal lantern or backing board is closer than 300mm to the face of the kerb.

Where not surrounded by concrete or asphalt the pole shall have a 500mm square 300mm deep 20Mpa concrete surround. The concrete surround must be sufficient in width to ensure that the ducting finishes within the area of the concrete in order to protect all cabling. (Refer Appendix D)

3.10 Signal Lanterns

3.10.1 Lantern Mounting Supports and Straps

All mounting hardware, bolts etc. must be hot dipped galvanised.

Pole top mounting assemblies or top mounting lugs must have a fixed mounting stud.

Each vehicle / pedestrian lantern group must be mounted individually.

All signals attached to pole top assemblies must have their leads securely fixed to the assembly using clamping bolts, nuts and washers or studs not less than 10 mm in diameter.

Each signal lantern shall be attached to its mounting brackets by galvanised steel mounting straps of sufficient length to permit the lantern to be adjusted laterally to provide an adequate signal indication and vertically to conform to the approach gradient. Straps shall comply with the table below:-

Strap Length (mm)	Strap Thickness
Up to 150	3mm
151 to 250	5mm
251 to 400	6mm

Straps shall be in a continuous length without joints and one strap shall not be hung off another strap.

All nut and bolt assemblies shall be provided complete with locking washers.

3.10.2 Lantern Leads

The lantern leads shall:

(a) Be covered with a continuous 15mm flexible hose from their exit point from the lantern to the clamping point on the Upper Mounting Bracket.

(b) The pole-connecting end of the hose shall be prepared so as to enable it to be firmly clamped in a recess in the pole top assembly without undue distortion or crushing of the hose.

(c) When hanging freely, the lantern lead shall extend down to approximately the halfway point of the lantern.

3.10.3 Siting of Signal Lanterns

(a) *Siting and Alignment*

Each lantern shall be sited and aligned in accordance with Austroads publications - *"Guide to Traffic Engineering Management Part 10 – Traffic Control and Communication Devices"*.

(b) *Lantern Mounting Height*

Except where the tertiary or secondary lanterns are mounted within 10 metres of the vehicle limit line all vehicle lanterns shall have a mounting height of 4.1 metres measured to the top mounting bracket of lantern.

Where low level tertiary or secondary signal lanterns are located within 10 meters from the vehicle stop line the mounting height shall be 3.1 meters to the top of mounting bracket the lantern.

The minimum clearance from ground level to the bottom of a target board for signals restricted by an overhead obstruction is to be 2 meters.

The minimum clearance from the road surface to the bottom of the target board for overhead lanterns is to be 5.3 meters. The maximum clearance is to be 5.8 meters.

Where the position of the signal poles as installed does not allow the recommended positioning or appropriate visibility to be achieved, the contractor shall notify the Engineer before installing the lantern.

3.10.4 Covering of Lanterns

Immediately following installation and during periods when the lanterns are not in use they must be covered to completely obscure vision of lanterns at all times during installation.

The lanterns shall be covered using a shroud as detailed in Appendix E.

Where commissioning will take place within one day of lantern installation, the Engineer may allow a dispensation from this clause but otherwise shrouding shall be necessary for the full period from installation until commissioning.

3.11 Inductive Loops

Inductive loops shall be positioned so as to record the specified output from vehicles passing or occupying the positions indicated on the appropriate plans and to the dimensions and locations shown in Appendix C.

The Contractor shall mark the required position of the inductive loop on the ground and inspect the road surface to ensure that the site conditions, including seal conditions and roadway integrity, will in no way reduce the operational performance of the detection equipment. If the contractor feels that the conditions are not satisfactory they shall notify the Engineer before installing the detector loops. The contractor shall notify the Engineer prior to closing the traffic lanes for the purpose of installing the loops so that the Engineer may attend the site to carry out installation inspections as they consider appropriate.

The inductive loop wire shall consist of single core polypropylene insulated cable with a nominal cross-sectional area of 1.5 mm^2 complying with AS/NZS2276.3: -2002 “Cables For Traffic Signal Installations, Part 3 - Loop Cable for Vehicle Detectors”.

The cable shall be laid in one continuous un-jointed length, laying it twice around each loop as shown in Appendix C. Tails for up to two loops can be laid in the same slot if required.

In general the detector loop wire shall be installed in a saw cut slot that is approximately 5 mm wide and 40 mm deep to provide a minimum top cover to the wire of 12 mm. All saw cuts shall be straight and shall extend past the loop corners to ensure the full depth of cut throughout. Prior to placing the loop wire, the slot shall be dried and cleaned and free of debris to provide a smooth bed for the wire. The recommended method of doing this is with compressed air.

When re-cutting loops, the new saw cut must be at least 300mm away from the old saw cut to minimise road surface damage. If the saw cut for the loop tails is to go through the kerb, then it should go through an existing mortar joint to minimise unsightly appearances.

The loop wire shall be “rolled” into the slot without damaging the insulation. This can be achieved using a thin disc such as a modified saw blade but not a screwdriver. Special care shall be taken at the corners to ensure the wire is curved rather than bent. Each loop shall be wired as shown in Appendix C.

Immediately following the installation of the loop wire, and prior to sealing, an insulation resistance test shall be performed. The loop should have a resistance to earth of not less than 10 mega-ohms. Sealing shall be done immediately following the loop insulation test has been completed.

The loop wire slot shall be sealed with Tixophlate or an approved equivalent flexible epoxy sealant, ensuring a continuous seal over the complete length of the loop and loop tails. The sealant shall be finished flush to the road surface.

Where the loop tail is cut through the kerb & channel the tails shall be inserted in a 5mm wide saw cut made with a minimum 450mm diameter blade .The saw cut kerb and channel must be sealed with a sand cement mortar.

Loop Testing

All loops shall be tested by measuring the insulation to ground (earth) and the results recorded on the commissioning sheet. The test shall be taken at 250v conductors to earth and a result of not less than 10M (megohms) will be acceptable.

Saw cutting

The Contractor shall ensure that no solid matter enters any waterway as a result of the saw cutting operation. This could require the placement of filters or similar on catchpits etc.

On completion of the installation the contractor shall ensure that the surrounding area is swept clean of all sand and debris. This material shall be suitably disposed of.

Note: Due to noise and/or traffic flow conditions the RCA / Client may restrict the time at which detector loops may be installed.

Preformed loops must be installed according to the manufacturers details and retain the correct shape and dimensions as shown on Appendix C when installed.

3.11.1 Loop Feeder Connections

Where multi-pair feeder cable is used, the convention for terminating the loops shall be:-

(a) Pair 1 connected to the kerbside detector loop
(b) All remaining connections numbered consecutively from the kerb.

All unused pairs shall be sealed in a similar method to the loop connections.

The contractor shall make a clean, dry, waterproof electrical connection between the loop tails and the loop feeder wires. The connection shall be located within a kerb side junction box. The feeder cable sheathing must be sealed to ensure that no water may enter into the cable.

3.12 Pedestrian and Cycle Push Button Assembly

The push button assembly shall be mounted so that the underside of the assembly is 900 mm above the pavement.

Unless specifically detailed, the pedestrian assembly shall be located in accordance with Section 5 of *RTS 14 – Guidelines for Installing Pedestrian Facilities for People with Vision Impairment* (i.e. the pedestrian assembly shall be located so that the front of the assembly is perpendicular to the pedestrian crossing lines and so the arrow disc will always be orientated so that the arrow is pointing straight up.

On non-staggered medians, the assembly shall be orientated parallel to pedestrian lines ensuring that the arrow disc will be orientated so that the arrow is pointing parallel to the ground.

The cycle assembly shall be located so that the front of the assembly is parallel with the kerb. Note that wiring for the call-accept is required for cycle call boxes.

3.13 Painting / Surface Coating of Equipment

All surface coatings shall carry a 10 year guarantee from their date of installation excepting where the degradation is caused by vandalism.

The contractor shall supply the Engineer with the paint manufacturers documentation specifying their maintenance requirements.

All painting of signal poles and equipment shall be as follows:

(a) General

- All new poles shall be pre coated prior to delivery on site
- All coatings shall be applied in strict accordance with the manufacturer's recommendations.
- No painting shall be carried out in wet, foggy, frosty, windy or dusty weather.
- The colour yellow described in this specification shall be colour number 08E53 Golden Yellow as described in BS 5252

(b) Painting Schedule

Standard Poles Gloss yellow to the pole top or as specified in the local RCA's amendments to this Specification.

Overhead and Joint Use Poles

Unless modified in the local RCA's amendments to this Specification all overhead or joint use poles shall be painted gloss yellow to the level of the top mounting bracket supporting the low level vehicle lantern The remainder of the pole is to be left unpainted.

Lanterns:	- Signal face	gloss black
	- Signal housing	gloss black
	- Target boards	flat black
	- Signal visors	flat black internally gloss black externally
Illuminated Signs		
	- Sign face	gloss black
	- Sign housing	gloss black
	- Sign visors	flat black internally gloss black externally
Pedestrian call boxes		gloss black
Cycle call boxes		gloss blue
Other Items (pole caps, detector boxes etc)		yellow or as modified by the local RCA's amendments to this Specification.

3.14 Special Tools and Keys

The Contractor shall supply to the Engineer one set of any special tools necessary to efficiently adjust and operate the equipment. This equipment will not be required if previously supplied to the Road Controlling Authority. The controller Key type will be as specified in the local RCA's amendments to this Specification..

3.15 Acceptance and Testing

On completion of the work, the equipment is to be left clean, free from dirt, dust, paint blemishes, etc. All services, equipment and fittings shall be in proper working order and in good condition in accordance with this Specification.

Pre Commissioning Tests

When the Contractor has satisfied all of the requirements of the Power Supply Authority and considers that any particular part of the Contract is ready for commissioning, the pre-commissioning checks as set out in the Site Acceptance Sheet in Appendix G shall be performed in the presence of the Engineer or his representative.

The Contractor shall also provide an Electrical Certificate of Compliance to the Engineer prior to the pre-commissioning check.

3.15.2 Earthing and Earth Impedance Test

The contractor to undertake an earth impendence test to AS/NZS3000:2007 (6.3.2 and 6.3.3) and submit results in a report as part of their pre-commissioning checks. The tests shall include the following:

- Earth resistance test-continuity of main earth conductor
- Insulation resistance test for insulation
- Earth resistance test for other earthed and equipotential bonded parts.
- Consumer's main test – polarity and connections
- Final sub-circuit test – polarity and connections
- Earth fault loop impedance test
- Verification of residual current devices (if fitted)

3.15.3 Software (Personality) Controller Bench Test

The contractor shall be required to confirm for themselves that the controller software (Personality) has been programmed to operate in a safe manner and to the requirements of the Design Drawings and Controller Information Sheet. If the contractor is of the opinion that the software is not operating correctly or safely, or there are discrepancies between the design drawings and the CIS, then they shall immediately inform the Engineer.

The Traffic Signal Contractor shall complete a FULL bench testing of the controller software (Personality) AT LEAST ONE WEEK prior to the proposed commissioning date of the signal installation or intersection upgrade.

All bench testing shall be based on the operation as specified in the latest revision of the Controller Information Sheet (CIS), Signal Design Drawing and controller software (SFT) file.

The bench testing shall be undertaken using a similar controller operating under the same version of the background (TRAFF) software as will be installed in the controller on site.

The bench testing shall include but not be limited to:

- Confirmation that all detectors call and extend the relevant phases.
- Confirmation that the correct signal displays / output groups are activated in the relevant phases.
- Confirmation that each signal group output has been configured as either a Major, Minor or Pedestrian output in accordance with the CIS.
- Confirmation that all conflicting signal group outputs (both pedestrian and vehicle) cause the controller to go into fault mode by physically inducing conflicting outputs. The Contractor shall be required to confirm that the Conflict Matrix detailed in the CIS is correct and that the conflict matrix programmed into the controller personality is the same as that shown in the CIS.
- Confirmation that all time settings are consistent between the software and the CIS
- Confirmation that the controller will operate under Flexilink mode of control
- Confirmation that any Special Logic requirements work as specified
- Confirmation that any Special Facility Flags (e.g. Z- , Z+ and any XSF bits) operate as specified

The contractor installing the software shall submit completed and signed forms five working days prior to commissioning the site verifying that the Traffic Signal Controller Personality has been FULLY bench tested. A copy of the Controller Bench testing Form is included in Appendix H.

The contractor shall notify the Engineer at least 24 hours prior to the bench testing being undertaken so that the Engineer may be present when the testing is being completed.

3.15.4 Commissioning

When the Engineer or his representative is satisfied that the signals are installed and operating in accordance with the Specification, he will direct and supervise the commissioning of the signals.

The Contractor shall notify the Engineer 48 hour prior to commissioning the installation. Commissioning must occur outside of the peak traffic periods at a time specified by the Engineer. No commissioning shall take place on a Friday or the day before a public holiday.

Unless approved by the Engineer, commissioning will not be allowed until the controller has been installed on site, and has had continuous SCATS communications for at least 48 hours.

An example of a commissioning check sheet for a new installation is included in Appendix I.

3.16 As Built Documentation to be provided

The contractor shall also supply in both electronic and hardcopy the following within 4 weeks of commissioning -

a) As built plan showing the final locations of all poles, access chambers, KJB, loops, lantern displays and cabinets if they are different from the construction drawing.

b) A completed Cable Termination Chart (in excel format). A Typical layout is shown in Appendix F.

c) A completed Traffic Signal Asset Collection Form (Refer Appendix J) for RAMM .

d) Results of all earth loop impedance testing carried out on all traffic signal poles and cabinets shall be supplied to the RCA's Engineer prior to commissioning. The results shall be signed by the technician who carried out the testing.

e) A log book. The log book shall be completed every time the technician enters the cabinet and shall detail the reason for entering the cabinet and a brief description of the work carried out. Each entry shall be dated and signed.

f) A copy of the electrical Certificate of Compliance.

At the time of commissioning a copy of Items a) and b) shall be provided within the controller cabinet along with a log book and a copy of the Controller Information Sheet (CIS). Within 2 weeks of commissioning, a laminated copy of a), b), and the CIS sheet must be inserted into the document pocket inside the controller cabinet.

3.17 Procedure for Turning Off Signals

Where it is necessary to switch a controller either off or to flashing yellow or to take the site off-line or to switch the signal displays off, notice must be given to the appropriate Road Controlling Authority. The RCA staff must be notified immediately prior to such action being taken and immediately after the controller and communications are fully operational again. The fact that the signals were turned off must be recorded in the control cabinet log book.

When a signalised intersection is planned to be turned off or switched to flashing yellow for more than ten minutes, the Contractor must ensure that the RCA's Engineer is informed so that arrangements for alternative

control of the intersection can be made as they consider necessary. Once the Engineer has been notified, the Contractor can proceed with turning off the signals unless specifically requested to wait for further assistance.

When a signalised intersection is **planned** to be turned off (not flashing yellow) for more than ten minutes, the Contractor shall adhere to an approved traffic management plan (TMP).

At no time during planned works shall an intersection be left unattended with the signals off unless an approved TMP is in place. Also, at no time shall any warning signs or shrouds that indicate that the signals are not in operation be in place on street when the signals **are** working.

When there is an **unplanned** outage of a signalised intersection (e.g. as the result of a controller fault or accident), the Contractor must immediately assess the problem and where necessary make the site electrically safe. If the signals can then be repaired and made operational (either fully or at least flashing yellow) within one hour, and can be done so safely and without the need to work in a live lane, then the Contractor is to proceed immediately with the repairs using a previously approved TMP that relates to the particular type and location of the work. Refer to the Regional Special Conditions to the National Signal Specification if operational repairs will take longer than one hour, or where work needs to occur within a live lane.

It should always be the intention of the Contractor to arrange the work so that the signals will be switched off or set to flashing yellow for the shortest possible time. This will mean that wherever possible, work on the signals is to be continuous until they are switched back to normal control. If a site is under approved temporary traffic management (as set out in an approved traffic management plan), then it will normally be acceptable to turn the signals back on with a reduced number of signal displays. Assuming good visibility of lanterns, the minimum number of displays on any approach can be:

- Primary or dual primary plus secondary, or
- Primary or dual primary plus tertiary.

The intention to operate the signals with reduced displays must be highlighted in the TMP, which should detail each approach where displays will be reduced. The Regional Special Conditions to the National Signal Specification may set out additional RCA requirements.

SECTION 4

Section 4 - CABLING AND CIVIL WORKS

4.1 Scope

This Section of the Specification covers the supply and installation of all cabling including multicore cable, loop feeder cable, ducting, trenching and backfilling. It also covers the installation of kerbside junction boxes, poles and controller base.

4.2 Cable Diagram

Cable sizes and approximate duct positions can be found on the schematic cable diagram on the Signal Drawing but the Contractor should satisfy himself that the cabling and ducting shown is adequate for the signals equipment depicted on the same drawing.

4.3 Trenching

All trenching and restoration work shall be in accordance with the Road Controlling Authority's specification. Detailed traffic management plans must be approved before work commences.

Open cut trenching across carriageways shall only be carried out between the hours approved by the Engineer.

4.4 Cabling, Ducting and Signal Duct Access Chambers

4.4.1 Ducting

Ducting shall be installed from the controller to all signal duct access chambers, between chambers and from the chamber to the signal pole in the locations indicated on the drawings.

The preferred method of installing the duct lines is by underground thrusting.

In open cut trenching, ducting for all multi-core cables shall use 100 mm diameter orange PVC Class D pipe and shall be continuous between access chambers and from access chamber to **within 300mm** of the base of each pole. The ducts shall be placed no less than 600 mm and no more than 1000 mm below finished ground level.

All thrusted ducting shall be continuous without any joints and must comply with the NZ Electrical regulations.

The minimum number of ducts from the controller and between access chambers is two (2).

All ducting is to be installed complete with draw wires to facilitate pulling through of cables. The draw wire should remain in place on completion of cabling for future use and always replaced when used.

Ducting for loop feeder cables shall be a minimum 32 mm orange PVC Class D pipe laid to a depth of not less than 300 mm and where provided directly behind the kerb. It shall be continuous between the Kerbside Junction Box and the closest access chamber.

Where ducting pipes need to be joined they shall be jointed with an approved PVC cement.

Communications ducting should comply with the local RCA's requirements.

4.4.1.1 Pole Access Ducting

Access from the ducting to the signal pole shall be as shown in Appendix D – Pole Access Duct Details.

4.4.2 Signal Duct Access Chambers

Signal Duct Access Chambers are to be provided at all 230V cable duct intersection points and at either end of sub-carriageway ducting as shown on the Signal Drawing. Where possible, chambers are to be at least 2 meters clear of the carriageway and clear of all pedestrian paths. A chamber is also to be provided immediately adjacent to the controller base.

Chambers are not to be located along pedestrian desire lines.

All duct access chambers shall be concrete and manufactured in accordance with NZS3109:1997 (precast units) and AS/NZS4058:2007, surface finishes to NZS3114:1987 and class B cover as defined in AS3996 2006. Where contractors have chambers manufactured from alternative materials they shall seek prior written approval from the Engineer before tender/installation.

All ducting shall be cut back to the chamber wall and shall be sealed by applying a sand cement mortar.

Where the chamber is installed in a grassed berm, the lid of the chamber shall be encased by a concrete surround a minimum of 300mm wide by 100mm deep and using 25Mpa concrete

4.4.3 Power Cable

All cable shall be installed in the appropriate ducting as specified in Section 4.4

The multicore cable shall be a purpose designed traffic signal cable externally insulated with orange sheathing with the internal individual core insulation being PVC coloured as described below. The external sheathing shall be marked to indicate its use in the installation of traffic signals. The cable shall comply with AS/NZS 2276.1 "Cables for Traffic Signal Installations, Part 1 – Multicore Power Cables" except as amended in Section 4.4.3.1 below.

The cable shall be in a continuous length from the controller to the pole and from pole to pole. Joints between poles will not be accepted in new works. A minimum of 1.0 metre of cable slack shall be left at the controller base and in the chambers on all cable runs.

Existing Installations - Where cable is to be replaced at existing installations similar cabling and cores as are already installed may be used.

Cabling shall not be installed into the ducting until backfilling of trenches has been completed.

4.4.3.1 Amendments to AS/NZS 2276.1

(i) Remove requirement for external sheathing to be PVC. The sheathing used must be suitable to be used in submerged conditions.

(ii) Cable Cores Requirements and Colours

- 27 1.5mm^2 cores coloured white and consecutively numbered from 1 to 27 for signal group displays.
- 4 1.5mm^2 cores coloured violet, labelled "ELV ONLY" and consecutively numbered p1,p2,p3,p4.
- 1 2.5mm^2 core coloured black .
- 1 4mm^2 core coloured green/yellow for earth.
- 1 red 1.5 mm^2 core as a general 230v phase (eg for audio tactile, illuminated signs, cameras etc)
- 1 grey 1.5mm^2 core detector return for push buttons
- 1 orange 1.5mm^2 core used for street lighting feed

4.4.4 Loop Feeder Cable

The feeder cable shall be a twisted pair and be terminated on the appropriate field terminals.

The maximum number of pairs per cable is four (4). If multi pair cable used then each pair should be labelled with factory indelible numbering on the cores, or colour coded as detailed below:-

Pair 1 – Blue & White/ Blue
Pair 2 - Orange & White/Orange
Pair 3 - Green & White/Green
Pair 4 - Black & White/Black

All spare pairs are to be separated away from active pairs and all shield braids shall be connected to a common protective earth point.

The unshielded section of the feeder cable pairs must remain twisted from the point they leave the cable shield to where they enter into the field terminals with the length of unshielded cable being as short as possible. All shields shall be connected to a single common functional earth point at the controller.

The feeder cable must comply with AS/NZS2276.2: - 1998 "Cables For Traffic Signal Installations, Part 2 - Feeder Cable for Vehicle Detectors" with respect to the electrical and waterproofing characteristics.

At least 1.8 meters of cable slack shall be left at the controller base with at least 0.5 meters curled up inside the kerb side junction box.

Loop Feeder Cable Testing

All feeder cables shall be tested by measuring the insulation to ground (earth) and the results recorded on the commissioning sheet. The test shall be taken at 250v conductors to earth and a result of not less than 50M (megohms) will be acceptable. the resistance of the feeder cable and connected loop, when measured at the controller, no more than 10 ohms.

4.4.5 Mains Power Supply

The Contractor shall be the responsible for negotiating with the local electricity network provider for the supply of a mains power cable into the signal control cabinet.

4.4.6 Earthing

The earth pin and wiring connection shall be located in a protected enclosure not readily accessible to the public.

4.5 Installation of Signal Poles and Mastarm / JUMA / JUSP Poles

Signal poles shall be erected as detailed in Appendix A. Each pole is to be plumbed vertically to a tolerance of 10 mm per 5.0-metre length.

For poles up to 5 meters all concrete footings shall have a 28 day compressive strength of at least 20 MPa. Footings for all other poles shall be as per the manufacturers pole foundation design requirements

Signal poles shall be in locations shown on the signal plan. These locations are only indicative and final locations will need to be marked out and agreed to with the Engineer. The Engineer must approve any changes to the designed pole positions.

For traffic signal installations on heavy haulage routes, any signal poles in central islands, or poles that restrict the width to below the heavy haulage route requirements, shall be fold down in as detailed in Drawing TS 381 in Appendix A.

The contractor shall confirm on site that the location of all poles meets the clearance requirements to existing electrical supply services (both underground and overhead) as set out in "NZECP 34:2001 New Zealand Code of Practice for Electrical Safe Distances".

4.6 Controller Base

The controller base shall be constructed to provide a solid non-rocking platform on which the controller may be placed.

The base shall be constructed using reinforced concrete with a 28 day compressive strength of 20 MPa.

The Engineer or his representative will mark the exact position of the base on site.

4.7 Kerb Side Junction Boxes (KJB's)

Kerb side junction boxes shall be constructed from either plastic or cast or sheet aluminium and shall be no smaller than 300 mm long by 200 mm wide by 150mm deep.

The KJB shall be fitted with a firm fitting non-skid lid secured to the base and the lid shall lie flush with the top of the box.

Kerb side junction boxes shall be installed at the locations indicated on the drawing. Where possible they should be located adjacent to the primary signal pole. The kerb side junction boxes shall be as close as possible to the back of the kerb and shall be level with the surrounding ground surface level.

Where there is no concrete kerbing present the junction box shall be located as close as practicable to the carriageway.

KJB's shall be bedded on 100 mm of free draining material and surrounded by 150 mm wide by 150 mm deep concrete haunching and the junction box lid and haunching shall be flush with the surrounding ground level.

The junction box and installation shall be capable of withstanding being run-over by a heavy vehicle.

4.8 Labelling of Cables

All multicore cabling shall be clearly labelled at both ends with the cable run number. The cable shall be numbered such that cable 1 goes to pole 1, cable 2 goes pole 2 etc.. When there are two or more identical cables laid between poles, one cable shall have its label followed by the letter A (i.e. P6A) which shall have terminal numbers starting at 1. The second cable shall be labelled B (i.e. P6B) and start at the next available terminal, etc.

All loop feeder cable shall be labelled at both ends with the appropriate detector loop number.

The approved method for labelling all cables is using a heavy duty PVC marker, white with black moulded or engraved lettering. This marker is to be of the non-split type that completely encircles the cable core. An approved type is the Grafoplast Trasp System.

4.9 Cabling Documentation

All new or modified traffic signal ducting and cabling is required to be recorded for inclusion on the appropriate Road Controlling Authority cable diagram.

Any Contractor installing or modifying traffic signal ducts and/or cables must notify the Engineer a minimum of 24 hours prior to backfilling any trenches in which new or modified ducts/cabling have been installed so that the cables can be independently sighted and recorded. No inspections will be carried out outside of normal working hours except by prior arrangement with the Engineer.

SECTION 5

Section 5 - MAINTENANCE OF NEW WORK

Fault Attendance

All callouts to faults reported during the contracts Defects Liability Period (DLP) or whilst the installation is under maintenance or during the equipment guarantee period shall initially be attended by the local RCA's Maintenance Contractor.

Whilst the installation is in the DLP, or similar periods, the contractor who installed the signals (installation contractor) shall be required to provide the contact details of a suitably qualified technician that is contactable 24hours per day and 7 days per week to assist the RCA's Maintenance contractor to resolve the fault The contact details shall be provided on a laminated sheet inside the controller cabinet.

On attendance of the fault the Maintenance contractor will inform the installation contractor that they are attending a fault on site. The Maintenance contractor will be responsible for getting the signals operational as quickly as possible. The installation contractor shall be required to provide all assistance to ensure that the signals are operational as quickly as possible by either attending the site immediately they are contacted or directing the Maintenance contractor on how the fault may be remedied.

All costs incurred by the Maintenance contractor for faults covered by either the DLP or similar periods will be reimbursed by the signals installation contractor.

At the end of the DLP / guarantee period the equipment shall be handed over in full working order with no defects of any kind. Where defects exist, whether in control equipment, detectors, or signal hardware or in any part of the equipment supplied, these shall be made good at no expense to the Road Controlling Authority.

END OF SPECIFICATION

Appendix A – Signal Pole Details

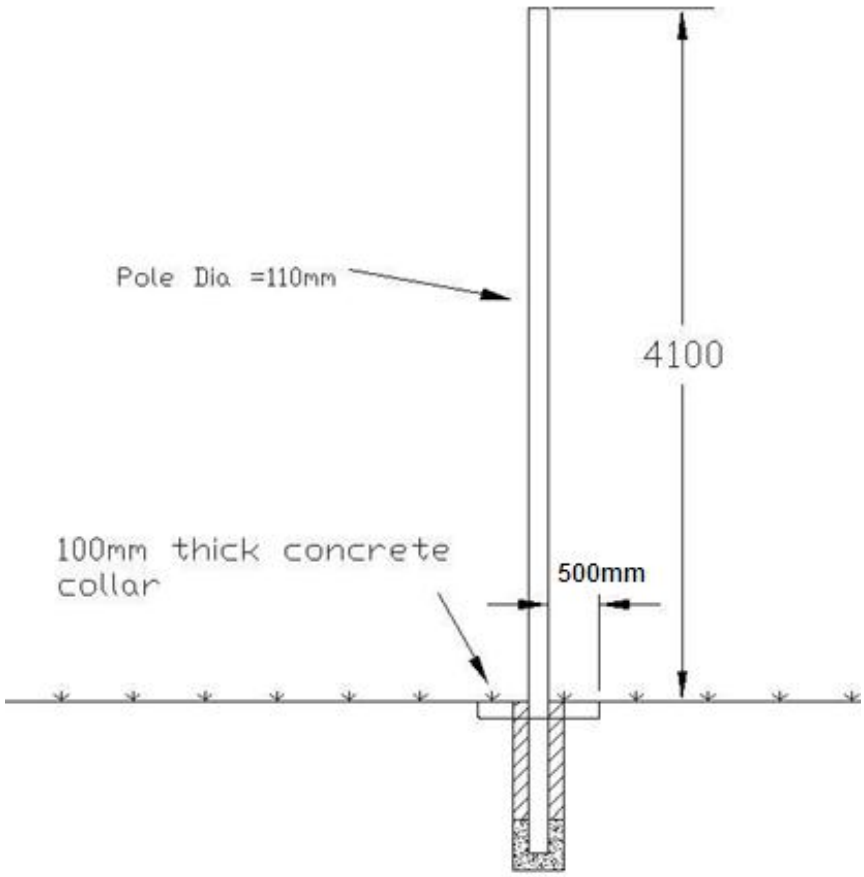


Figure 1- Standard 5 meter Pole

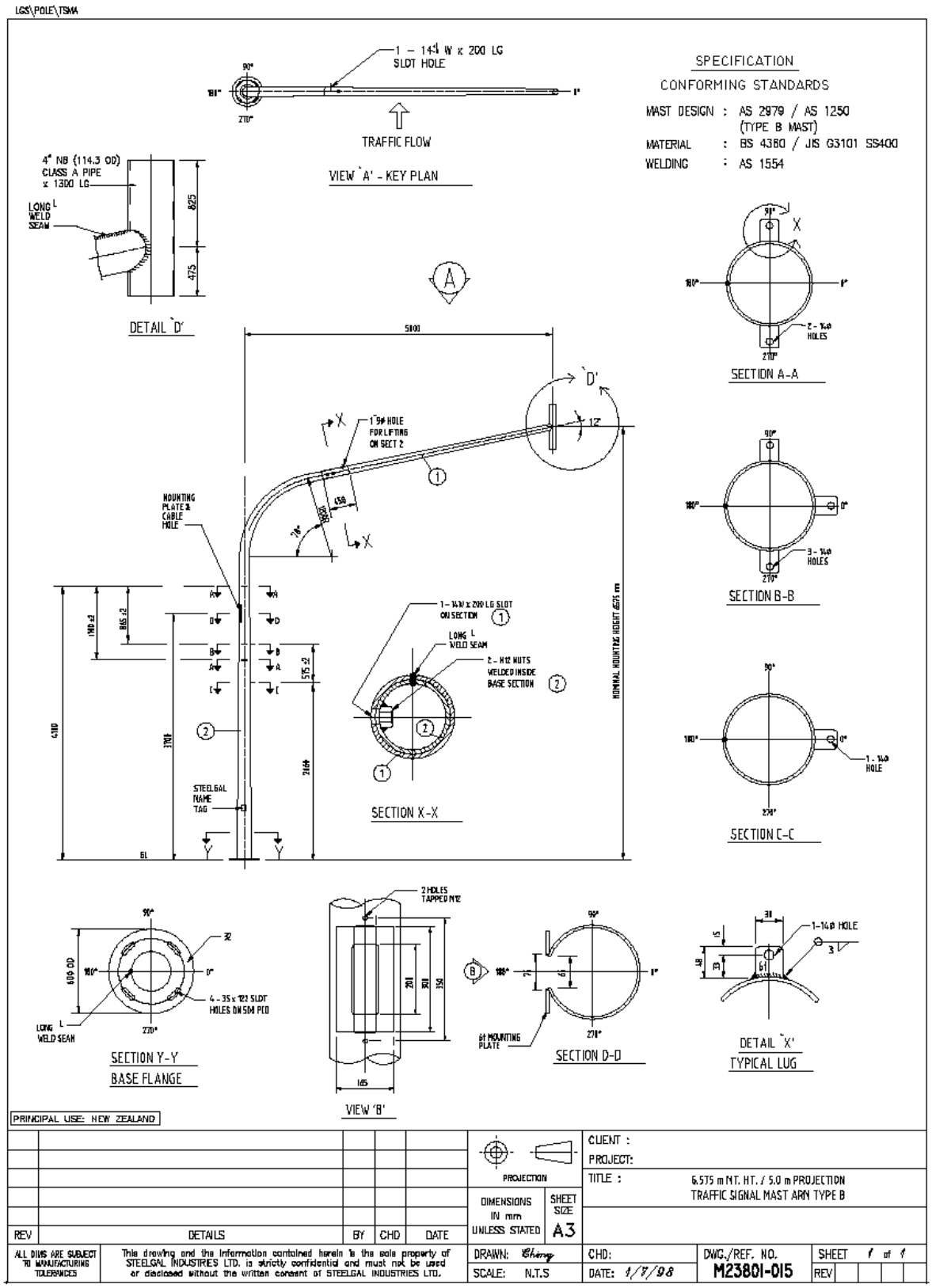


Figure 2- Overhead Mastarm Pole

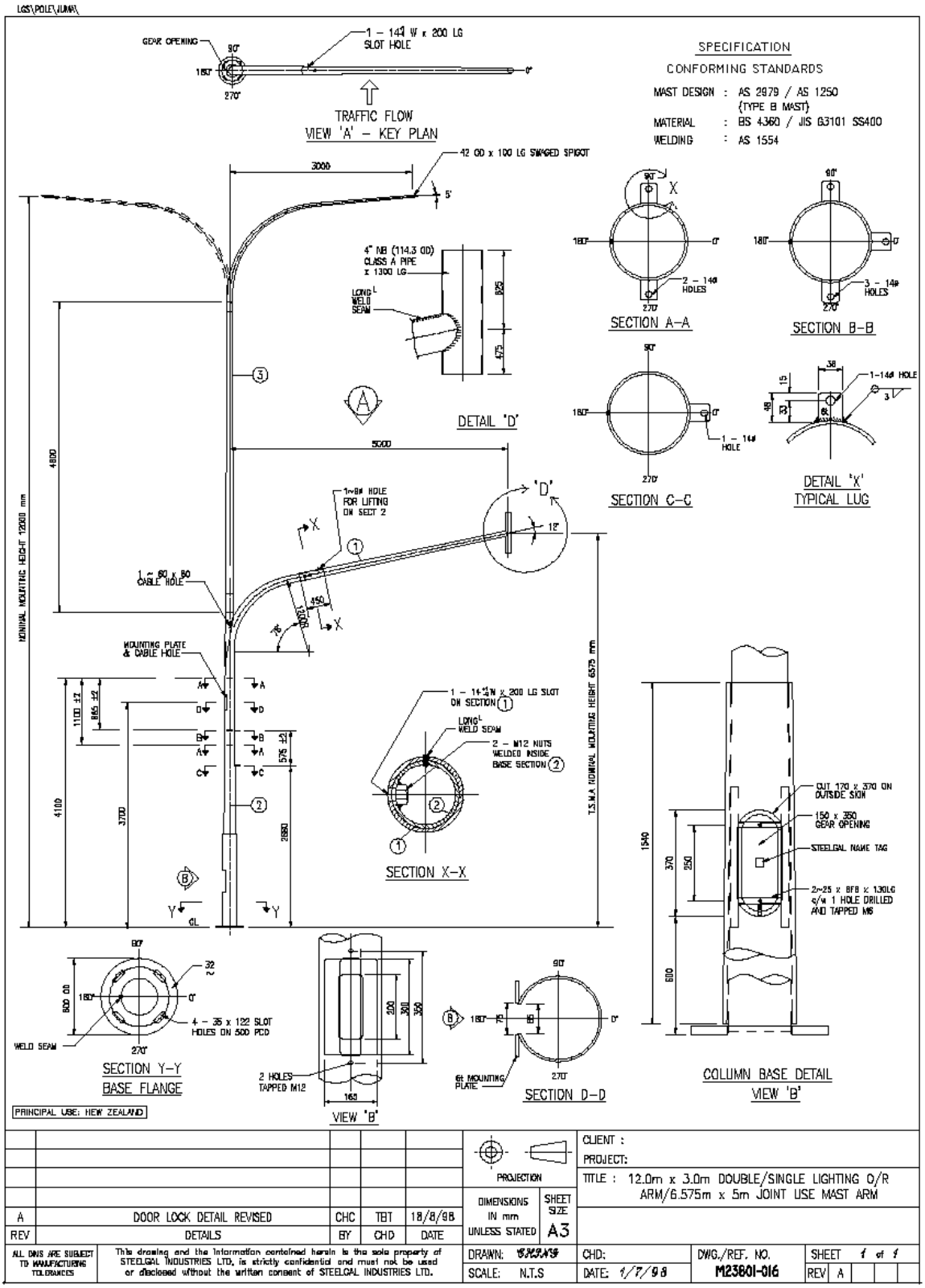


Figure 3 - Joint Use Poles

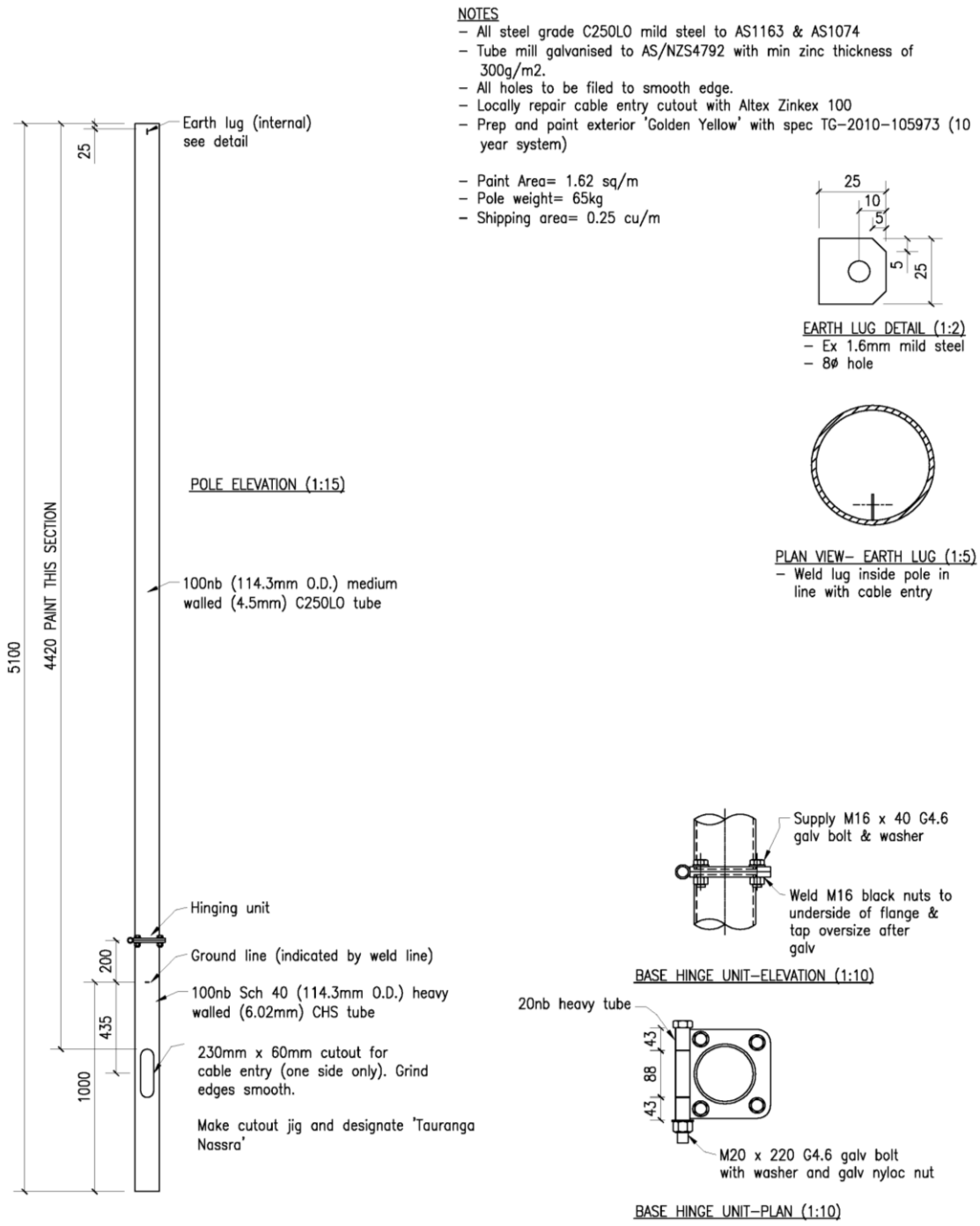


Figure 4 - Standard 5m Fold Down Pole Detail

Appendix B – 5 meter Pole Top Assembly

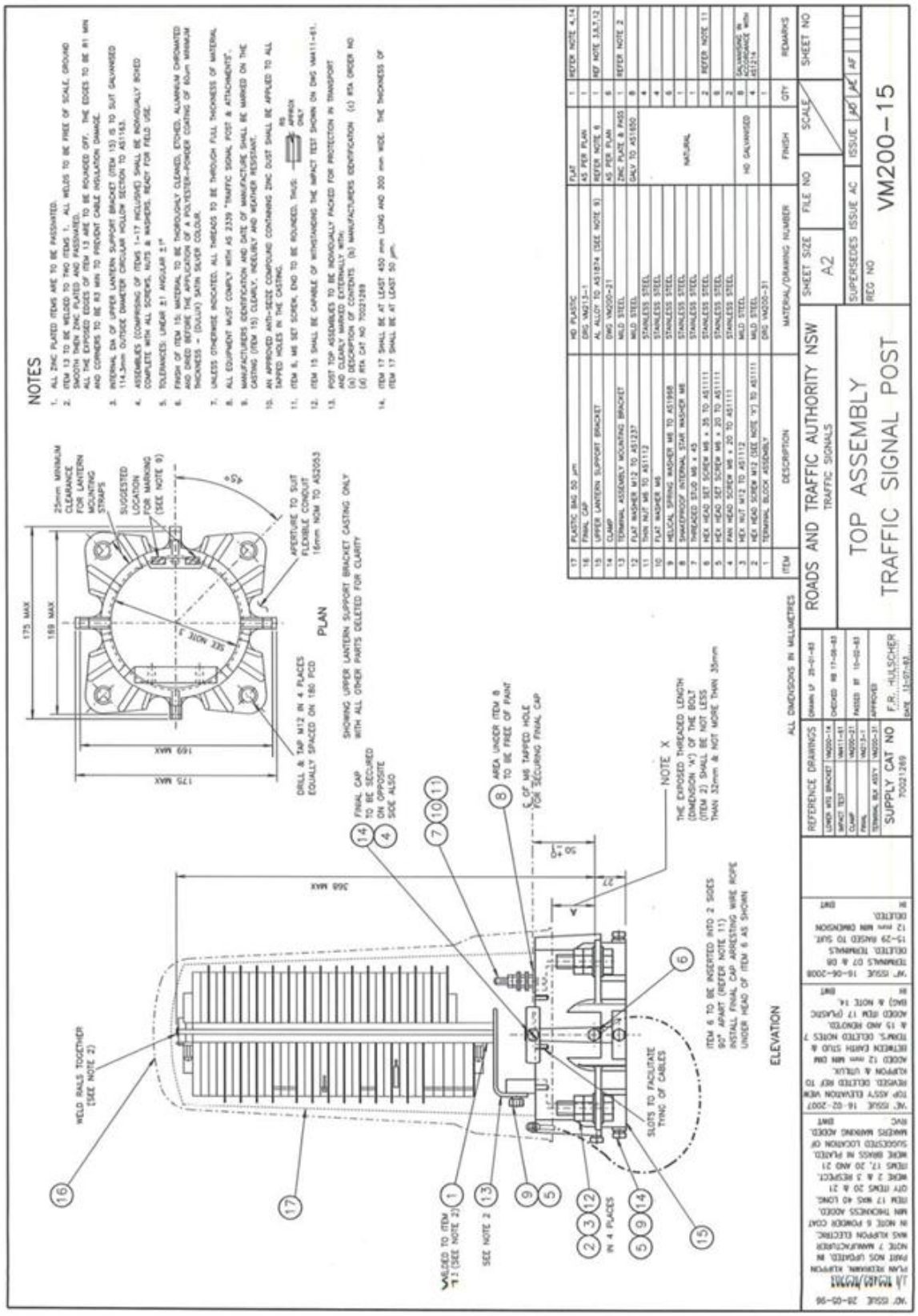


Figure 5 - Pole Top Assembly

Appendix C – Inductive Loop Layout Details

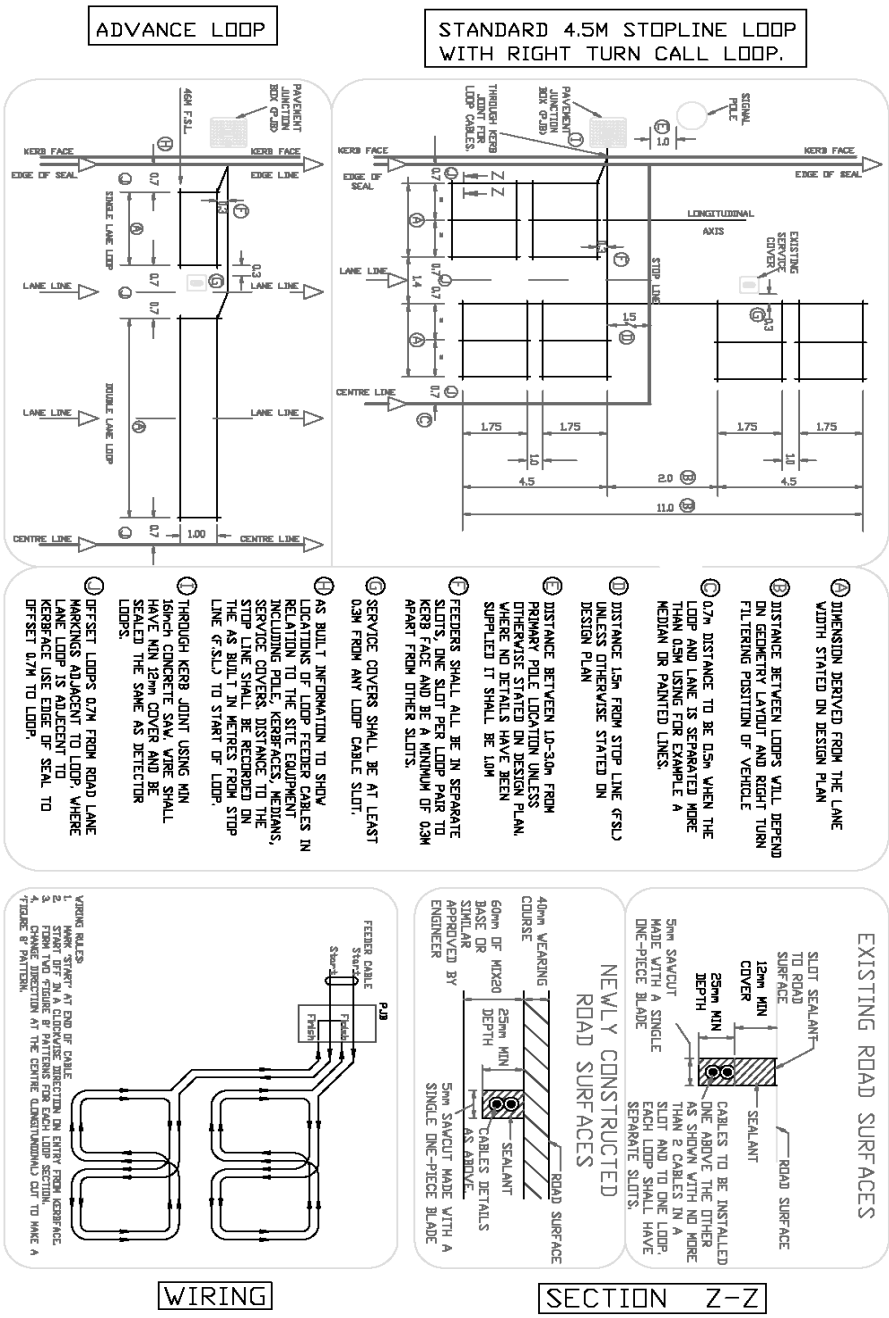
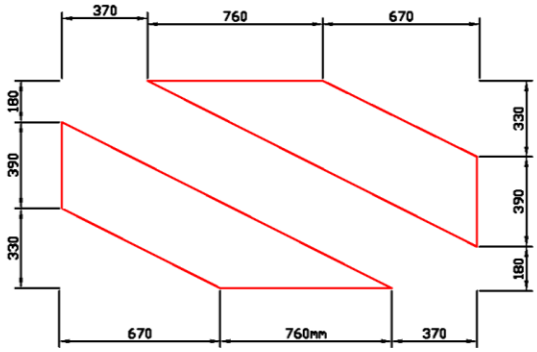
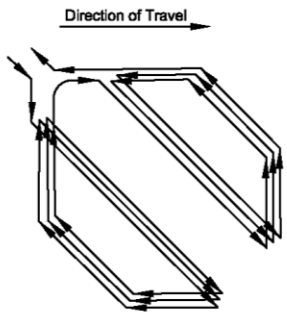


Figure 6 – Vehicle Loop Details



CYCLE LOOP GEOMETRY AND DIMENSIONS



Recommended to have 4-8 turns depending on size of loop.

CYCLE LOOP CABLE DETAIL

Figure 7 – Cycle Loop Details

Appendix D – Pole Duct Access Details

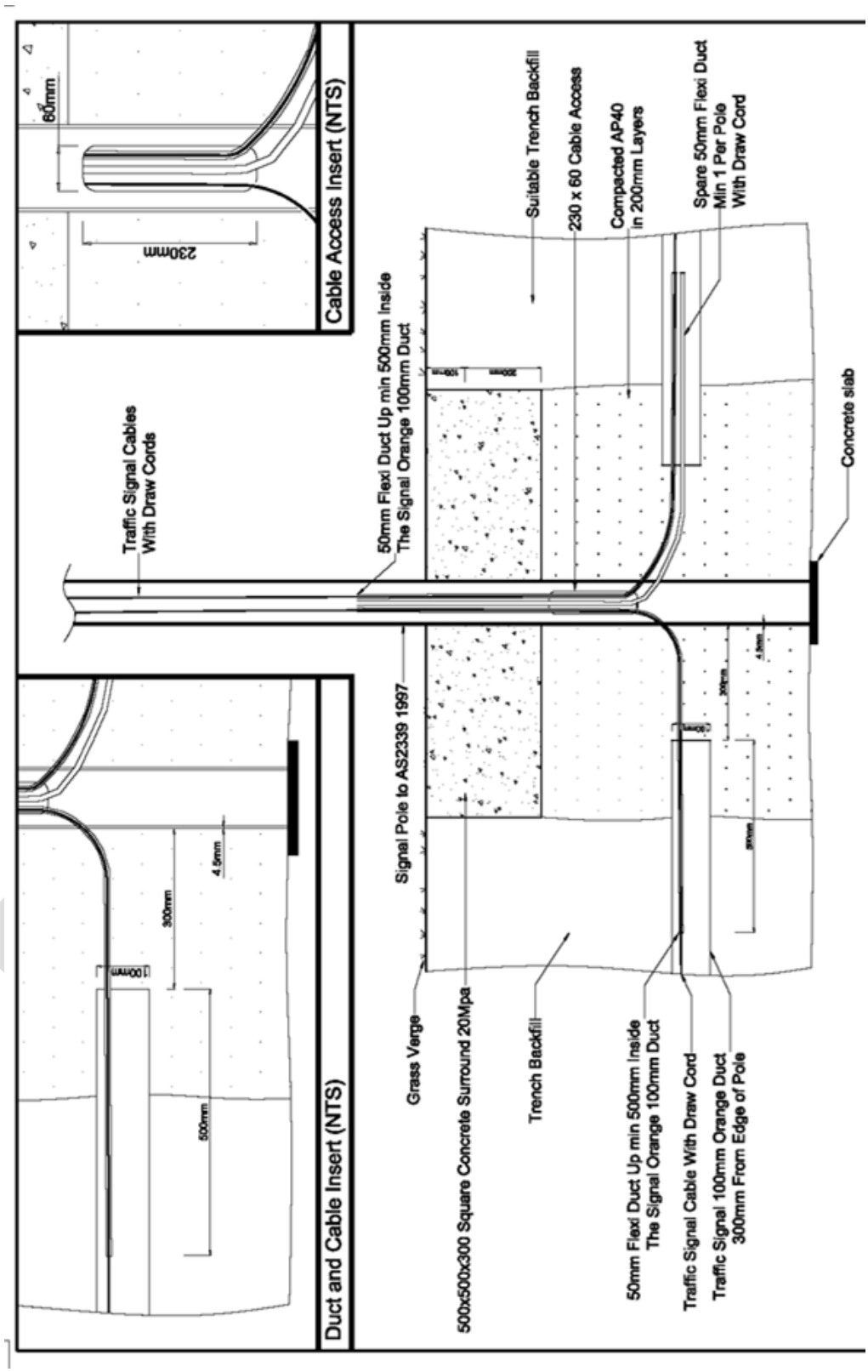


Figure 8 – Duct Access Details

Appendix E – Lantern Shroud Details

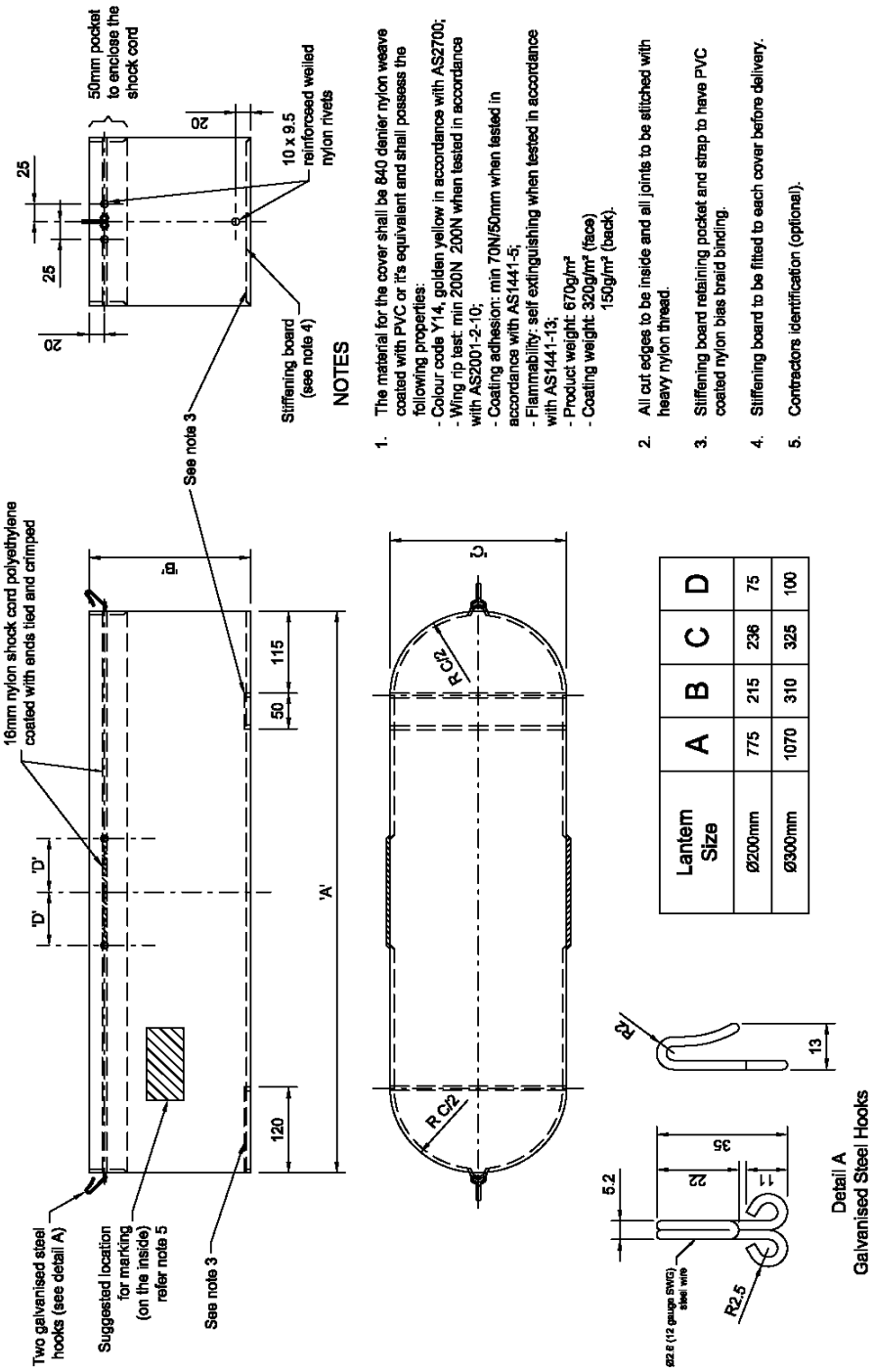


Figure 9 – Vehicle Lantern Shroud

Appendix F – Cable Termination Chart

Cable Termination Chart

				Poles that can be isolated									
LOCATION : North St and South Street			Date :	April 2003									
	INT 4115	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12
Group #													
	Red	1			1	1	1						
1	Amber	2			2	2	2						
GB SB	Green	3			3	3	3						
	Red	4					4			1			1
2	Amber	5					5			2			2
GB NB	Green	6					6			3			3
	Red	7				4	7						
3	Amber	8				5	8						
GB SB RT	Green	9				6	9						
	Red	10					10						4
4	Amber	11					11						5
GB NB RT	Green	12					12						6
	Red		13	7					4				
5	Amber		14	8					5				
TP EB	Green		15	9					6				
	Red			10				13	7				
6	Amber			11				14	8				
TP WB	Green			12				15	9				
	Red			13					10				
7	Amber			14					11				
TP EB RT	Green			15					12				
	Red			16					13				
8	Amber			17					14				
TP WB RT	Green			18					15				
	Red										20	20	7
9	Amber										21	21	8
TP LT	Green										22	22	9
	Cross										23	23	
12	Wait										24	24	
Xing LT	PD										G1	G1	
	Cross	16								16			
13	Wait	17								17			
Xing GB Nth side	PD	G1								G2			
	Cross			19			16						
14	Wait			20			17						
Xing GB Sth side	PD				G1		G1						
	Cross							19	18				
15	Wait							20	19				
Xing TP West side	PD							G2	G3				
	Cross		18	22				19					
16	Wait		19	23				20					
Xing TP East side	PD		G2	G2				G2					
	Return	G4	G4	G4	G4	G4	G4	G4	G4	G4	G4	G4	G4
	Power	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red
	Neutral	Black	Black	Black	Black	Black	Black	Black	Black	Black	Black	Black	Black
	Earth	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
	Cable	31	31	31	31	31	31	31	31	31	31	31	31

Figure 10 – Cable Termination Chart

Appendix G – Site Acceptance Test Chart

INTERSECTION NAME			
NUMBER		DATE	

Contract Name & Number		
Commencement Date		
Signals & Civils Contractor		
PRE-INSPECTIONS	**Y/N / N/A**	**Comments**
Duct Connections to Poles		
Loops Positioned Correctly		
Recorded Loop Positions		
Texiphalte Installed Cleanly		
>12mm Loop Feeder Cover		
OPERATIONS	**Y/N / N/A**	**Comments**
E-Prom Labelled (check sum)		
Lamps Off, Controller Ops		
Copy Ramm to Controller		
Check Fault Log, Clear		
Full Start Up:		
Flash Test Each SG		
Flashing Ambers Working		
Check All Red (SPT=10s)		
Revision On Correct Phases		
All Default Phases Call		
Monitor Operations in HHT		
After Full Start Up:		
Other Phases Call (xsf / flags)		
Ped Protection OK		
Mains off-on, contr ops ok?		
Last Gasp (Scats in Log)		
POLES	**Y/N / N/A**	**Comments**
Correct Location		
Concrete Collar (500mm)		
Painted / Powder Coating		
Fold Down Poles Work		
Pole Numbers Installed		
ALL LANTERNS	**Y/N / N/A**	**Comments**
Attached & Aligned Correctly		
Correct Height (3.2m-4.1m)		
Directional Arrows Aligned		
Louvers Installed Correctly		
Correct Visors Installed		
Ped Lanterns:		
Attached Correctly		
Ped Lantern Height /Align (3m)		
Correct Visors Installed		

Figure 11 – Site Acceptance Sheet 1 of 3

INTERSECTION NAME			
NUMBER		DATE	

PEDESTRIAN CROSSING	**Y/N / N/A**	**Comments**
Push Buttons:		
Install Correct Height (1.1m)		
Sound Levels (High)		
Audio Unit Audible		
Mutable Unit OK (if fitted)		
Arrow Aligned to Crossing		
Tactile Vibration OK		
PB Light Indicator (If Fitted)		
Ped Detectors:		
Pads/Camera Installed OK		
Pad/Camera Activates OK		
Instruction Labels Installed		
CONTROLLER	**Y/N / N//A**	**Comments**
Make, Type and Size		
Signal Group Size / No. of	8 | 12 | 16 | 24 | 32	
Detector Card Size / No. of	8 | 12 | 16 | 24 | 32	
DP Number		
ICP Number		
Det Card Operation Check		
Gland Plate Labels (On top)		
Cable Looms Labels (Under)		
Detector Switches Labelled		
Signal Groups Numbered		
Detector Block Numbered		
Cable Glands Sealed		
Spare Sockets Working		
Wiring Tidy		
Logic Rack Secure		
Door Seals and Locks		
VEHCILE DETECTORS	**Y/N / N/A**	**Comments**
KJB 100mm concrete surround		
KJB 20mm concrete pad		
Loop Joins with Scotchlok 314		
>1.8m Slack in Contr Base		
>0.5m Slack in KJB		
CABLING & EARTHING	**Y/N / N/A**	**Comments**
Telecom Cable Identified		
Impendence Test Reports		
Street Lighting Labelled		
RCD's Labelled		

Figure 12 – Site Acceptance Sheet 2 of 3

INTERSECTION NAME			
NUMBER		DATE	

CABLING & EARTHING	**Y/N / N/A**	**Comments**
Draw Cables Installed / Work		
Controller Cabinet Earthed		
1m Cable Slack in Chambers		
CIVIL WORKS	**Y/N / N/A**	**Comments**
Correct Ducting as per Specs		
Chambers Level with Surface		
Plastered Inside Chamber		
Kerbing Installed Correctly		
KJB Concrete Installed (100mm)		
KJB Drainage Installed (100mm)		
Road Surface Condition		
Footpath Surface Condition		
Pram Ramps Installed		
Direction Pavers Aligned		
Tactile Pavers Aligned		
Road Markings Installed		
Drainage, Esp at Crossings.		
Grass Berms Restored		
Correct Signage Installed		
Temp Advance Warnings		
DOCUMENTATION	**Y/N /N/A**	**Comments**
In Controller (Laminated)		
Controller Information Sheet		
Intersection As-Built Drawing		
Log Book		
OTHER	**Y/N /N/A**	**Comments**

Commissioning / Switch On Date:

TTMU Engineer:

Sign: **Date:**

Signal Contractor:

Sign: **Date:**

HAND OVER TO TTMU FOR OPERATIONS AUTHORISED WHEN SIGNED ABOVE

Figure 12 – Site Acceptance Sheet 3 of 3

Appendix H – Controller Bench Testing Form

Controller Personality Bench Testing

Intersection Name:		
Intersection Identification:	Controlling Authority:	Intersection number:
Personality File Number:		
Date PROM Created:		
Name of PROM Tester:		
Date PROM Bench Tested:		
PROM Bench Test:	Pass	Fail

Test	Result/Comment	Signed
Time Settings – Vehicle		
Time Settings – Pedestrian		
Time Settings – Presence		
Time Settings – Special Purpose		
Flexilink Call Data		
Filter Operation		
Special Logic		
Calling Detectors		
Phase Movements		
Conflict Matrix		
Ram Version		
Functionality		

Figure 13 – Controller Bench Test Form

Appendix I – New Intersection Commissioning Form

New Installation Acceptance (NIA) Check Sheet

Description	Evidence	Check
Traffic Signal Controller	RTA Type Approval - Module	
	RTA Type Approval - Housing	
LED Aluminium Lanterns	RTA Type Approval for each lantern type	
	NATA certified laboratory report	
Poles under 5.2m	Comply with AS 2339 1997	
	SUMB to be an RTA approved UMB	
Poles over 5.2m	Engineers Design and Certificate of Compliance	
Poles (Posts)	*Design Certificate and a Certificate of Compliance from a suitably qualified Engineer*	
RAMM Collection Sheet	Completed T01-08 Spreadsheet	
Test Certificates	Original Electrical Certificate of Compliance	
	Bench Testing Laboratory Statement/Certificate with the Qualified Engineer's Signature	
	Comply with the Electrical Wiring Regulations AS/NZS 3000 and approved by the local power supply authority	
	Delivery dockets of concrete supply from a Certified Readymix Plant	
Supply of Electric Power	The Original of the Certificate of Compliance	
Producer Statements/Hardware Guarantees	Certified copy of products/equipments on a signed and dated paper with company letterhead, as well as a copy of the drawing for the products/equipments being certified	
Documentation	Instruction Manual	
	Both two hardcopies and an electronic copy of Controller Information Sheet and Cable Termination Chart	
	Cabling and Ducting record	
Reflector	Comply with AS/NZS 2144:2002	
Visors and Louvre	Comply with AS/NZS 2144:2002	
Pedestrian Push Button Assemblies	Comply with AS 2353-1999	
	All push buttons units shall be Vic Roads approved	
	Audio tactile driver and housing shall be RTA approved	
Vehicle Loop Detectors	Comply with AS 2703:1987	
Detector Loop Wire	Comply with AS/NZS 2276.3:2002	
Earthing (Bonding)	Comply with AS/NZS 3000:2007/Amdt 1:2009	
Switch/Earth Termination	Comply with IEC 60947-7-1, 60998-1 and 60998-2-1	
As-built drawings	Supplied as hardcopy and in AutoCAD.DWG formats	
C & I	Hardcopy and Excel formats	
Keys	Two full sets	

Figure 14 – New Installation Check Form

Appendix J – RAMM Asset Data Form

Int #: _____ Date: _____ Int. Name: _____

			Road the Pole is on Target Board					Lantern							
Item	Pole #	Pole Mount (G.P., Flange etc)	# of Aspects	Road Name - Material (Plastic or Metal)	Size	Condition Ratings		Level (OH or LL)	Type (Pri,Sec, Tert,Ped)	Manufacturer	Lantern Body (Metal or Plastic)	Display (Thru, LT, RT, Ped, T&RT, T&LT, L&RT	# of Aspects	Lens Size	Lamp Type (QH, LED)

Figure 15 – Asset Information Form

Appendix K – Example Controller Gland Plate