
ROADS & TRAFFIC AUTHORITY, N S W

SPECIFICATION SI/TCS/8
Revision 1

INSTALLATION AND RECONSTRUCTION OF
TRAFFIC LIGHT SIGNALS

RTA QA SPECIFICATION SI/TCS/8 (REVISION 1)
INSTALLATION AND RECONSTRUCTION OF
TRAFFIC LIGHT SIGNAL

NOTICE - RTA SPECIFICATIONS AND GUIDES TO SPECIFICATIONS

RTA Specifications are written specifically as models for adaptation and use on RTA projects and may not be suitable for other purposes. Copies of RTA specifications and guides to specifications supplied to the general public do not require the Revision Register and the following guide notes (if provided) but must include the Notice before the Table of Contents. Paper copies may be purchased under the Freedom of Information Act on payment of the price listed in the document "QALIST".

Electronic copies of specifications are not to be supplied outside the RTA unless loaned, by the appropriate RTA Project Manager, to professional services contractors for preparing RTA tender documents. In which case, the contractors are required to return them to the RTA Project Manager.

Electronic copies of specifications may be provided to other State Road or NSW Government Authorities by Asset Management Branch for use on Government funded projects only.

RTA does not permit the possession or use of electronic copies of specifications or guides to specifications by non-RTA organisations or persons other than as stated above.

REVISION REGISTER

Edition Number	Clause Number	Description of Revision	Authorised By	Date
SI/TCS/8 Revision 1		See Appendix H	GM, TM	Jan 2001
		Includes LED lantern installation See Appendix H	GM, TM	Aug 2003

RTA Specification No. SI/TCS/8 Revision 1
INSTALLATION AND RECONSTRUCTION
OF TRAFFIC LIGHT SIGNALS
Amendment No. 1
(Date: 30/10/2007)

Record of Amendments:

Document Description	Summary	Date	Approved
Amendment No. 1 to Specification No. SI/TCS/8 Revision 1	Minor changes in consultation with stakeholders	Oct. 07	GM, TM

Details of Amendment:

<u>Reference</u>	<u>Description of Changes</u>
<u>Clause 2.2</u> (Page 9)	Add the following paragraph after the first paragraph: “(iv) RTA CADD Manual.”
<u>Clause 2.2</u> (Page 9)	Add the following sentences to the end of the first sentence in the first paragraph: “Copies of the RTA CADD Manual are available at the RTA internet web site.”
<u>Clause 2.2</u> (Page 9)	Replace the third paragraph by: “The following Equipment Specifications, issued by the RTA Traffic Equipment and Standards Section, Engineering Technology Branch, Level 5 Pod H, Octagon Building 110 George Street, Parramatta, are referred to in this Specification:”
<u>Clause 2.2</u> (Page 10)	Delete the Note at the end of this Clause and remove the corresponding asterisk before R3452.
<u>Clause 3.7</u> (Page 12)	Replace the last sentence by: “Particulars of the Prequalification Scheme and application forms are available from the Manager, Contract Strategy, Level 6, 260 Elizabeth Street, SURRY HILLS, NSW 2010.”

<u>Reference</u>	<u>Description of Changes</u>
<u>Clause 5.4.4</u> (Page 19)	<p>Replace the third paragraph from this clause with the following paragraph:</p> <p>"The final work-as-executed drawings shall be in CADD file format on a CD or transmitted electronically using email. The CADD files shall be in accordance with the requirements set out in RTA's CADD Manual.</p>
<u>Clause 6.5</u> (Page 29)	<p>Add the following sentences to the end of the first paragraph:</p> <p>"Concrete footing for the Type 13 short push button post shall comply with Drawing No. VC002-66. Details of the anchor bolt assembly for the type 13 post are shown on Drawing No. VC002-67."</p>
<u>Clause 7.1.6</u> (Page 36)	<p>Delete the last sentence in the first paragraph.</p>
<u>Clause 7.2</u> (Page 37)	<p>Replace the fifth paragraph from this clause with the following paragraph:</p> <p>"Where stipulated on the traffic design plan, push button assemblies shall be mounted on wooden poles; attached to the 65mm NB GI pipe as indicated on Drawing No. VM015-16."</p>
<u>Clause 8</u> (Page 42)	<p>Add the following new paragraphs at the end of the clause:</p> <p>"The Contractor shall abide by the following procedure for return of the equipment to the Authority's depot:</p> <ol style="list-style-type: none"> 1. The Contractor shall complete a Field Advice Form in Appendix I to identify which items to be returned to the Authority. This form should be completed based on the site inventory before the commencement of the reconstruction. The Contractor shall give a copy to the Authority's representative. 2. The Contractor shall complete another Field Advice Form at the time of returning the items to the Authority, listing items returned. The Contractor shall give a copy to the relevant RTA Maintenance Supervisor and seek a signature. <p>Note: The equipment returned by the Contractor without first arranging delivery times in advance with the relevant RTA Maintenance Supervisor will not be accepted.</p> <ol style="list-style-type: none"> 3. The Contractor shall seek a signature for clearance from the Authority's representative on the second Field Advice Form, which will be given by the Authority's representative after comparing with the first Field Advice Form. <p>Note: The site shall not be taken over until the signature of clearance has been given by the Authority's representative."</p>
<u>Appendix A</u> (Page 47)	<p>Add a new Drawing No. VC002-66.</p> <p>Footing for Type 13 Short Push Button Post.</p>

<u>Reference</u>	<u>Description of Changes</u>
Appendix B (Pages 53 - 54)	Add new Drawing VC002-67 Holding Down Bolt Assembly for type 13 Short Push Button Post. Add new Drawing VM202-20 Type 13 Short Push Button Post (mechanical details). Add new drawing VM202-21 Type 13 Adaptor Plate for Type 2 Footing. Delete drawing VM200-19 Push Button Mounting Bracket for wooden pole.

APPENDIX I

FIELD ADVICE FORM

Items	To be Returned (Total No.)	Returned to RTA Depot (Total No.)	Verified by RTA Maintenance Supervisor
Traffic Signal Controller	<input type="checkbox"/>	<input type="checkbox"/>	
Traffic Signal Lanterns (QH)	<input type="checkbox"/>	<input type="checkbox"/>	
Traffic Signal Lanterns (LED)	<input type="checkbox"/>	<input type="checkbox"/>	
Post-mounted Vehicle Loop Detector	<input type="checkbox"/>	<input type="checkbox"/>	
Push Button Assembly	<input type="checkbox"/>	<input type="checkbox"/>	
Audio-Tactile Unit	<input type="checkbox"/>	<input type="checkbox"/>	
Master Arms of Signal Posts	<input type="checkbox"/>	<input type="checkbox"/>	
Traffic Signal Posts	<input type="checkbox"/>	<input type="checkbox"/>	
Lower Mounting Bracket	<input type="checkbox"/>	<input type="checkbox"/>	
Post Terminal Top Assembly	<input type="checkbox"/>	<input type="checkbox"/>	
Traffic Signs	<input type="checkbox"/>	<input type="checkbox"/>	
Pit Cover & Frames	<input type="checkbox"/>	<input type="checkbox"/>	

Signature of Contractor: _____ Date: _____

Signature of Authority's Representative: _____ Date: _____

NOTICE

"This document is a copy of one of the Authority's QA Specifications.

The QA Specifications are policy documents within the meaning of the Freedom of Information Act 1989 (NSW) ("FOI Act") and this document is accordingly made available to you pursuant to Section 15(1) of the FOI Act.

The QA Specifications were developed by the Authority for use with trafficworks contracts let by the Authority or local councils. The Authority only uses the QA Specifications in conjunction with its other standard form documents and under the supervision of professional engineers who are trained and experienced in trafficworks. The Authority does not use the QA Specifications for any other purpose and does not consider them suitable for use for any other purpose.

Consistent with the FOI Act, the purposes for which this document has been made available for purchase by you are:

- to satisfy the Authority's obligation under Section 15(1) of the FOI Act to make its policy documents available for inspection and purchase by members of the public
- to ensure that you, as a member of the public who may be affected by the operation of this document, have access to the document.

The price, which you have paid for this document, only covers the Authority's costs of printing and handling the document.

If you use this document for any purpose, which is not consistent with the above (including, without limitation, for carrying out any construction, engineering, maintenance or other work), you do so at your own risk.

This document is current as at the date of this notice. However, you should be aware that the Authority regularly reviews and updates its QA Specifications. You will not be notified of any update.

No advisory or support services will be provided by the Authority.

Copyright in this document belongs to the Roads and Traffic Authority of New South Wales."

CONTENTS

	<u>Page No.</u>
1. SCOPE	8
2. REFERENCE TO SPECIFICATIONS	8
2.1 STANDARD SPECIFICATIONS	8
2.2 RTA SPECIFICATIONS AND DRAWINGS	9
3. PRELIMINARIES	10
3.1 GENERAL	10
3.2 COMPLIANCE WITH SPECIFICATIONS	11
3.3 COMPLIANCE WITH OCCUPATIONAL HEALTH, SAFETY AND REHABILITATION REQUIREMENTS	11
3.4 TRAFFIC CONTROL AT WORK SITES	11
3.5 PROTECTION OF THE ENVIRONMENT	11
3.6 QUALITY ASSURANCE	12
3.7 PREQUALIFICATION	12
3.8 DEFINITIONS	12
3.9 ABBREVIATIONS	14
4. PRELIMINARY WORKS.....	14
4.1 PRELIMINARY ROADWORKS	14
4.2 DUCTS INSTALLED BY OTHERS.....	14
4.3 RELOCATION OF EXISTING TRAFFIC FACILITIES AND INCIDENTAL WORKS.....	14
5. GENERAL REQUIREMENTS.....	15
5.1 SITE SIGNING.....	15
5.2 UTILITY SERVICES	15
5.3 CONSULTATION WITH TRANSPORT MANAGEMENT CENTRE AND OTHER AUTHORITIES	15
5.4 DRAWINGS FOR NEW INSTALLATIONS AND MAJOR RECONSTRUCTIONS.....	16
5.4.1 Drawings Supplied to the Contractor.....	16
5.4.2 Drawing Preparation.....	17
5.4.3 Drawings Used for Execution of Works.....	18
5.4.4 Final Drawings	19
5.5 DRAWINGS FOR MINOR RECONSTRUCTIONS	19
5.6 SUPPLY OF EQUIPMENT.....	20
5.6.1 General	20
5.6.2 Equipment Supplied by the Contractor.....	20
5.6.3 Equipment to be Supplied to the Contractor.....	20
5.6.4 LED lanterns and Controller.....	20
5.7 INSPECTIONS	21
5.8 MARKING OUT	21
6. REQUIREMENTS FOR UNDERGROUND WORKS.....	21
6.1 EXCAVATIONS	21
6.2 CONCRETE	22
6.2.1 Grade.....	22
6.2.2 Rod Reinforcement.....	22
6.2.3 Installation.....	23
6.2.4 Concrete Tests	23
6.3 PAVEMENT RESTORATION	23
6.3.1 Temporary Restoration.....	23
6.3.2 Final Restoration	24
6.4 CABLE INSTALLATION.....	24
6.4.1 Types of Cable.....	24

6.4.2	Installation of Ducts	24
6.4.3	Footway Pits	27
6.4.4	Roadway Pits	27
6.4.5	Installation of Cables	27
6.4.6	Cable Joints	28
6.5	POST AND MAST ARM FOOTINGS	29
6.6	CONTROLLER FOOTINGS	30
6.7	ELECTRICITY SUPPLY	30
6.8	VEHICLE DETECTOR LOOPS	31
6.9	TELEPHONE DUCTS	32
6.10	MULTI FUNCTION POLES (MFP'S) BY OTHERS	32
7.	REQUIREMENTS FOR ABOVE-GROUND WORKS.....	32
7.1	SIGNAL POSTS AND LANTERNS	32
7.1.1	General	32
7.1.2	Installation of Posts and Mast Arms	33
7.1.3	Erection of Special STOP Signs	33
7.1.4	Cable Terminations	33
7.1.5	Lantern Attachments.....	34
7.1.6	Attachments to Wooden Poles.....	35
7.1.7	Target Boards	36
7.1.8	Installation of Mast Arms or Posts through Awnings	36
7.1.9	Covering of Lanterns	36
7.1.10	Retrofitting of LED optical assembly.....	37
7.2	PEDESTRIAN PUSH-BUTTON ASSEMBLIES	37
7.3	AUDIO-TACTILE FACILITIES.....	38
7.4	VEHICLE (LOOP) DETECTORS	38
7.5	CONTROLLER	38
7.6	ELECTRICITY SUPPLY CONNECTION	39
7.7	SPECIAL FACILITIES	39
7.8	SURFACE TREATMENT	40
7.8.1	General	40
7.8.2	Reflectorised Bands.....	40
7.9	TRAFFIC SIGNS ON SIGNAL POSTS.....	40
8.	SPECIAL REQUIREMENTS FOR RECONSTRUCTION OF EXISTING TRAFFIC LIGHT SIGNAL LOCATIONS.....	40
9.	FINAL TESTS	42
9.1	CONTRACTOR'S TESTS	42
9.2	TESTS FOR PRACTICAL COMPLETION	43
10.	PROGRAMME OF WORKS	43
APPENDIX A	LIST OF STANDARD DRAWINGS	45
APPENDIX B	APPLICABLE RTA EQUIPMENT SPECIFICATIONS AND DRAWINGS	51
APPENDIX C	REQUIREMENTS FOR PREPARATION OF CABLE CONNECTION CHARTS.....	57
1.	GENERAL.....	58
2.	LAYOUT OF CHART	58
2.1	Functional Groupings	58
2.2	Numbering of Posts and Cables.....	59
2.3	Controller Housing	59
2.4	Core Allocations for Multicore Power Cable	59
2.5	General Terminal Allocations	59
3.	LOOP DETECTOR CABLE CONNECTIONS	60
APPENDIX D	RECOMMENDED PROCEDURE FOR ASSEMBLY OF TYPE 5 MAST ARMS	63

APPENDIX E	QUALITY SYSTEM REQUIREMENTS.....	65
1.	THE QUALITY SYSTEM	66
2.	QUALITY SYSTEM DOCUMENTS	66
3.	SPECIAL REQUIREMENTS.....	66
4.	INSPECTIONS.....	68
APPENDIX F	CADD REQUIREMENTS FOR ELECTRICAL TCS DRAWINGS.....	69
1.	GENERAL.....	70
1.1	Available Templates.....	70
2.	SPECIFICATION FOR DRAWINGS.....	70
2.1	File Naming Convention.....	70
2.2	Sheet Size.....	71
2.3	Scales.....	71
2.4	Font.....	72
2.5	Symbols (Cells).....	72
2.6	Colour and Line Thickness Definitions.....	72
2.7	Line Types.....	72
2.8	Line Colour and Text Height Allocation.....	73
2.9	Levels (or Layers).....	75
3.	ADDITIONAL REQUIREMENTS.....	80
3.1	Text.....	80
3.2	Hatching versus Solid Fill.....	80
3.3	Polylines.....	80
3.4	Shapes.....	80
3.5	Viewports.....	80
3.6	Two Dimensions.....	80
APPENDIX G	LIST OF SPECIFICATION CLAUSES CONTAINING A REQUIREMENT FOR REPORTING.....	82
APPENDIX H	SUMMARY OF CHANGES FROM SPECIFICATION SI/TCS/8.....	90

Blank page

SPECIFICATION SI/TCS/8

INSTALLATION AND RECONSTRUCTION OF TRAFFIC LIGHT SIGNALS

1. SCOPE

This Specification covers the requirements for installation and reconstruction of traffic light signals under contract in the State of New South Wales, including supply of equipment and materials. This Specification also covers the requirements in respect of preparation of drawings, negotiations with other Authorities and protection to the public and the environment.

This Specification does not apply to portable traffic light signals.

NOTE: This Specification supersedes Specification SI/TCS/8, which was issued in January 2001. Refer to Appendix H for changes from the previous specification.

2. REFERENCE TO SPECIFICATIONS

2.1 Standard Specifications

The following National Standards are referred to in this Specification:

AS 1012	Methods of testing concrete
AS 1074	Steel tubes and tubulars for ordinary service
AS 1100	Technical drawing
AS 1100.401	Engineering survey and engineering survey design drawing
AS 1302	Steel reinforcing bars for concrete
AS 1303	Steel reinforcing wire for concrete
AS 1348	Road and traffic engineering - Glossary of terms
AS 1379	Specification and supply of concrete
AS/NZS 1906	Retroreflective materials and devices for road traffic control purposes
AS/NZS 1906.1	- Retroreflective materials
AS/NZS 2053	Conduits and fittings for electrical installations
AS 2144	Traffic signal lanterns

AS 2276	Cables for traffic signal installations
AS 2276.1	- Multicore power cables
AS 2276.2	- Feeder cable for vehicle detectors
AS 2276.3	- Loop cable for vehicle detectors
AS 2339	Traffic signal posts and attachments
AS 2648	Underground marking tape
AS 2648.1	- Non-detectable tape
AS/NZS 3000	Electrical installations (known as the Australian/New Zealand Wiring Rules)
AS/NZS 3100	Approval and test specification - General requirements for electrical equipment
AS/NZS 3808	Insulating and sheathing materials for electric cables
AS/NZS 3750.9	Organic zinc-rich primer
AS/NZS ISO 9001:2000	Quality management systems - Requirements
SAA HB77	Australian Bridge Design Code
SAA HB77.2	Design loads

In all cases the issue of the Standard that is current seven (7) days prior to the close of tenders shall apply, including such amendments and addenda as are relevant.

2.2 RTA Specifications and Drawings

The following RTA documents are referred to in this Specification:

- (i) "Traffic Control at Work Sites" manual;
- (ii) RTA QA Specification G10 "Control of Traffic";
- (iii) RTA QA Specification G21 "Occupational Health and Safety (Minor Works)".

Copies of the *Traffic Control at Work Sites* manual are available from the RTA Traffic Management Branch, Level 2, Centennial Plaza, 260 Elizabeth Street, Surry Hills. Copies of the other documents are available from the Superintendent.

The following Equipment Specifications, issued by the RTA Traffic Equipment and Standards Office, Asset Management Branch, Level 1, 85 Flushcombe Road, Blacktown, are referred to in this Specification:

ATS/4	Audio-tactile Traffic Signal Equipment
C/12	Cables for Traffic Signal Installations
ILD/1	Controller-specific Vehicle Detector Equipment

LD/7	Vehicle Loop Detector Equipment (rack-mounted)
LSS/2	Slot Sealant for Vehicle Detector Loops
MA/1	Traffic Signal Mast Arms
P/6	Traffic Signal Posts
PB/6	Pedestrian Push-Button Assemblies
PCF/2	Pit Covers and Frames
PL/9	Pedestrian Signal Lanterns
QHL/2	10V Traffic Signal Lamps
TSC/4	Control Equipment for Road Traffic Signals
UGS/5	Underground Mains Fuse
VL/11	Vehicle Traffic Signal Lanterns
*R3452	LED Traffic Signal Lanterns

It is to be noted that any RTA document, specification or drawing referred to in this Specification shall be the issue which is current seven (7) days prior to the close of tenders, including such errata, amendments and addenda as may be issued from time to time. It shall be the responsibility of the Tenderer to obtain the relevant issues of such documents, specifications and drawings referred to in this Specification from the tender-issuing office and relevant RTA Offices.

*Note: The Specification R3452 was under preparation at the time of revision of SI/TCS/8. It is expected that the Specification R3452 will be issued in due course when finalised.

3. PRELIMINARIES

3.1 General

The Contractor shall be responsible for the installation and/or reconstruction of traffic light signals in accordance with this Specification at the site(s) nominated in the tender documents.

The Contractor shall supply all equipment and material for the Works unless otherwise stated in the tender documents.

Details of work to be carried out will be shown on the traffic design plans, the Schedule of Requirements or other tender documents.

Notwithstanding whether it has been explicitly included in the traffic design plans, the Schedule of Requirements or other tender documents, the provision of cable ducts and associated pits to connect the controller housing(s) to network connection point(s) (NCP) of the Telstra telephone network shall be deemed to have been included in the Contract unless

explicitly stated otherwise in the tender documents, or unless, in the case of reconstruction works, such ducts and pits already exist and the controller housing(s) is(are) not relocated.

The Tenderer shall carry out all such preliminary investigations as are necessary to familiarise himself/herself with each site and shall be deemed to be fully informed on the conditions at each site and to have allowed for these conditions at the time of tendering.

3.2 Compliance with Specifications

It is to be noted that all drawings referred to, and as listed in Appendix A and Appendix B to this Specification, are an integral part of this Specification.

All works and all equipment and material supplied shall comply with this Specification and other applicable RTA equipment specifications and drawings in the Tender or referred to in the tender documents. Where such specifications and drawings do not exist, the equipment and material shall comply with all relevant Australian Standards or, in their absence, with the appropriate ISO or IEC standards. Appendix B lists the applicable RTA specifications and drawings for certain items of equipment.

In addition to the requirements of this Specification, the installation shall comply with the requirements of the Australian/New Zealand Wiring Rules AS/NZS 3000 and AS/NZS 3100 except as amended by this Specification.

All designs and works submitted by the Contractor shall be deemed to be in full compliance with all relevant requirements of applicable specifications and standards. Any approval given to designs or works by the Superintendent shall not absolve the Contractor from his/her obligations under the Contract to provide and design the works in accordance with the requirements of the Contract, unless any deviation from requirements has been specifically and explicitly drawn to the attention of the Superintendent at the time of submission for approval.

3.3 Compliance with Occupational Health, Safety and Rehabilitation Requirements

The Contractor shall comply with the relevant provisions of RTA QA Specification G21 "Occupational Health and Safety (Minor Works)", the NSW Occupational Health and Safety Act, and other statutory occupational health, safety and rehabilitation requirements.

3.4 Traffic Control at Work Sites

The Contractor shall comply with RTA QA Specification G10 "Control of Traffic" and the RTA *Traffic Control at Work Sites* manual for the control of traffic at work sites.

The Contractor shall provide, maintain and display all safety and warning equipment to the satisfaction of the Superintendent. The cost of providing, maintaining and displaying such equipment shall be borne by the Contractor.

3.5 Protection of the Environment

The Contractor shall comply with all statutory requirements on environmental protection.

3.6 Quality Assurance

The Contractor shall operate a fully documented quality system to a level not below AS/NZS ISO 9001:2000.

The Contractor shall comply with the requirements in Appendix E.

The Contractor shall afford reasonable access to the Superintendent and the Authority for the purpose of conducting quality audits on the Contractor's quality system.

3.7 Prequalification

The contractor directly undertaking the traffic signal works shall be a prequalified contractor under the RTA's Contractors Prequalification Scheme for Installation and Reconstruction of Traffic Light Signals. Particulars of the Prequalification Scheme and application forms are available from the Manager, Traffic Asset Services, Level 1, 85 Flushcombe Road, Blacktown, NSW 2148.

3.8 Definitions

The following definitions are used in this Specification:

"Hold Point" -	means a point, as specified in this Specification, beyond which an activity must not proceed without the explicit approval of the Authority.
"Minor Reconstruction" -	when the reconstruction work is carried out under an RTA Works Order or an RTA Schedule of Rate Contract.
"Major Reconstruction" -	when the reconstruction work is not a Minor Reconstruction.
"primary lantern" -	means a traffic signal lantern that faces an approach and is located to the left, right or overhead of the stop line for that approach.
"the Authority" -	means the Roads and Traffic Authority of New South Wales.

If the work is carried out under a contract or Works Order let by the RTA, any communication with the Authority in regard to the requirements under this Specification shall be made via the Superintendent.

If the work is carried out under a contract let by another party (such as a developer), any communication with the Authority in regard to

the requirements under this Specification shall be directed to the RTA regional project manager.

"the Contract" -

means the documents, which constitute or evidence the final and concluded agreement between the Principal and the Contractor concerning the execution of the work under the Contract.

"the Contractor" -

means the company, which as party to the Contract, is bound to execute the work under the Contract in accordance with the Contract. The Contractor must be a company, which holds a current and valid prequalification approval under the RTA's *Contractors Prequalification Scheme for Installation and Reconstruction of Traffic Light Signals*.

"the Principal" -

means the person or organisation, which as party to the Contract, employs the Contractor to execute the work under the Contract in accordance with the Contract.

[Note: The term "Principal" is used in RTA contracts. In contracts let by other parties, such as a developer, a different term, or no dedicated term, may have been used.]

"the RTA" -

means the Roads and Traffic Authority of New South Wales.

"the Superintendent" -

means the person appointed by the Principal (which may or may not be the RTA) to carry responsibility on behalf of the Principal for the execution of the Contract.

[Note: The term "Superintendent" is used in RTA contracts. In contracts let by other parties, such as a developer, a different term, or no dedicated term, may have been used.]

"the Works" -

means the whole of the work to be executed in accordance with the Contract, including all variations provided for by the Contract.

3.9 Abbreviations

The following abbreviations are used in this Specification:

a.c.	-	Alternating current	
AS	-	Australian Standard	
ELV	-	Extra Low Voltage (as defined in AS/NZS 3000)	
GI	-	Galvanised Iron	
IEC	-	International Electrotechnical Commission	
ISO	-	International Standards Organization	
LV	-	Low Voltage (as defined in AS/NZS 3000)	
NATA	-	National Association of Testing Authorities	(Australia)
NB	-	Nominal Bore (internal diameter)	
RTA	-	Roads & Traffic Authority, NSW	
TCS	-	Traffic control signals	

4. PRELIMINARY WORKS

4.1 Preliminary Roadworks

At some locations, installation and/or reconstruction of traffic light signals is dependent upon prior completion of alterations to existing kerbs and islands or roadway sealing. Details of these adjustments will be shown on the relevant traffic design plans or on a separate plan showing details of the proposed channelisation.

It shall be the responsibility of the Contractor to coordinate its activities with those of the RTA, local Councils, contractors and other relevant bodies where necessary to ensure a smooth flow of work.

4.2 Ducts Installed by Others

At some locations, cable ducts or conduits have been or are proposed to be installed by or on behalf of the RTA or the Principal in the course of building or reconstructing the roadway. Bends are generally not included in such ducts. Details of the extent and location of such ducts will be made known by the Superintendent before commencement of the works.

4.3 Relocation of Existing Traffic Facilities and Incidental Works

The Superintendent will arrange for the relocation of any existing traffic facilities such as bus stops, taxi-cab stands, and also for incidental works such as removal or trimming of trees and the construction of kerbing, guttering and road shoulder sealing made necessary by the installation of signals.

Any traffic signs, which are in the way of the traffic light signal installation, shall be removed or re-installed by the Contractor in accordance with the directions of the Superintendent, who will seek approval from the appropriate authority (such as the local Council or the RTA).

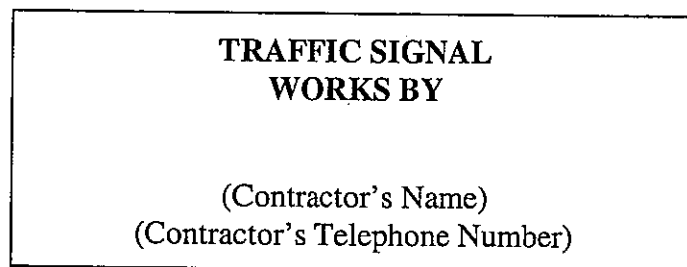
5. GENERAL REQUIREMENTS

5.1 Site Signing

The Contractor shall ensure that high visibility warning devices to alert road users to the presence of works are displayed at the site for the duration of the work.

The Contractor shall also display in either one of the following ways the Contractor's Name and the Contractor's 24-hour contact telephone number:

- (a) On at least one sign with the legend "TRAFFIC SIGNAL WORKS BY" and a layout as shown below in a prominent position at the site for the duration of the work. This sign shall have minimum 75 mm high letters and numbers in black on a white background;



- (b) On both sides of at least five (5) barrier boards at the site for the duration of the work. The letters and numbers shall be yellow and minimum 15 mm high, and shall be located on a black coloured stripe in the middle of the barrier board.

5.2 Utility Services

Before commencing work at any site, the Contractor shall make all such enquiries and inspections as may be necessary to make himself/herself fully conversant with the type and location of surface, underground and overhead utility services. The Contractor shall, during the progress of any work at the site, take all precautions necessary to avoid damage to any such service. In the event that the Contractor damages a service, the Contractor shall be responsible for arranging repairs to be effected as soon as practicable. The Contractor shall bear the full cost of such repairs, including the cost of restoration of the surrounding area. If the Contractor is of the opinion that the proposed installation cannot be carried out due to the location of services, the Contractor shall immediately seek direction from the Superintendent in relation to any alterations, which may be required for the installation.

The Contractor shall be deemed to be conversant with the Sydney Streets Opening Agreement and the proposed work shall take due account of the requirements of this Code. Where necessary, the Contractor shall confer and reach agreement with the service Utilities on whose space allocation the installation will encroach to ensure that the proposed underground work will not constitute an obstruction to existing services.

5.3 Consultation with Transport Management Centre and Other Authorities

Before commencement of work at any site, the Contractor shall consult with the local Traffic Police and local Council Representatives concerning the proposed method of installation, and

the hours of work. Specific approval shall be obtained by the Contractor in respect of the times for partial or complete road occupancies and positioning and storage of large items of equipment such as compressors, caravans and front-end loaders, or sand and tarred metal dumps on any public road or space. If the Contractor proposes to store equipment or material on private property, he/she shall obtain the approval from the owner(s) before commencement of the work.

Note: "Road occupancy" is defined by the RTA Transport Management Centre as any activity involving the closure of traffic lanes or movement of slow or over-dimensioned vehicles, which is not associated with road development. Examples are utility maintenance, special events, and building construction activities.

The Contractor shall be responsible for his/her own arrangements in respect of use of water and electricity at the site of the work.

The Contractor shall give the Superintendent at least 48 hours' notice of any work outside normal working hours. Normal working hours shall be as defined in the associated **CONDITIONS OF CONTRACT**.

Storage of equipment and materials on footways shall not obstruct driveways and shall permit free passage of pedestrian traffic, subject to approval from the local Traffic Police and the appropriate local Council.

In all cases the Contractor shall obtain approval for any road occupancy from the RTA Transport Management Centre and a "Road Opening Permit" from the local Municipal or Shire Council or RTA Asset Management concerned before commencing any excavation. The Contractor shall pay the fees associated with the issue of the Permit, except that the Superintendent will arrange to meet the full cost of final restoration (refer to Clause 6.3.2).

NOTE: The RTA Transport Management Centre requires ten (10) working days for assessment of any road occupancy application.

Where excavation on or attachments to any bridge structure are necessary, the Contractor shall furnish full details of the proposed work, supported by dimensioned diagrams to enable the Superintendent to check structural aspects or obtain the necessary approvals from the relevant Government Bodies (such as the State Rail Authority). Under no circumstances must the Contractor carry out any work on or make attachments to the bridge structure until he/she has been formally notified by the Superintendent of the receipt of clearance from the authority responsible for the bridge structure to the proposed work together with details of special conditions (if any) attached to such approval.

Submission of information on the proposed work on bridge structures shall constitute a **HOLD POINT**.

5.4 Drawings for New Installations and Major Reconstructions

5.4.1 Drawings Supplied to the Contractor

The Authority will supply the Contractor with 3 copies of the traffic design plan. A typical design plan for a signalised intersection is shown in Drawing No. VD002-22, and a typical plan for a mid-block crossing is shown in Drawing No. VD002-20. The special symbols and abbreviations commonly used on traffic design plans are explained on Drawing No. VD003-6. The positions of new components indicated on traffic design plans are nominal only. In the event of services conflicting with the positions shown, it shall be the responsibility of the

Contractor to relocate any component so concerned to the satisfaction of the Authority (see Clause 5.8).

Where relevant, the Authority will supply the Contractor with two copies of drawings showing requirements for preliminary roadworks (refer to Clause 4.1) and details of any existing cable ducts installed previously (refer to Clause 4.2).

In the case of reconstructions, the Authority will also supply the Contractor with two copies of the traffic design plan, cable installation plan and the cable connection chart for the existing signal installation.

The drawing issue relevant to any contract shall be the issue that is defined as the current issue in Clause 2.2, and it shall be the responsibility of the Tenderer to obtain the relevant issues of any drawings referred to in this Specification by arrangement with the Authority. If any drawing issues are changed during the course of the Contract, the Contractor will be advised in writing of such changes to enable appropriate adjustments to the Contract to be negotiated. Where copies of any of the drawings referred to in this Specification, tender form or associated documents, are not already provided, the Tenderer shall obtain the necessary copies of any drawings he/she requires by arrangement with the tender-issuing office. A list of the drawings referred to in this Specification can be found in Appendix A and Appendix B.

5.4.2 Drawing Preparation

The Authority will supply the Contractor with a base outline of the location which consists of views 1 and 2 of the CADD parameters for the cable installation plan, as a transparency and in CADD file format on high density 3.5 inch floppy diskettes. The Contractor shall show the position and size of all cables, conduits, pits, signal posts, detectors, control equipment (i.e. the traffic signal controller, or controller), electricity supply points and associated components as installed and true to scale. All relevant dimensions shall be given to enable the position of all items to be clearly and unambiguously determined. All such dimensions shall be related to property and kerb alignments. Typical examples of installation drawings are shown on Drawing No. VD002-21 and VD002-23.

The Contractor shall complete a cable connection chart for each site. Such a cable connection chart shall include a cable layout and phasing diagram and shall give full details of connections of all cables to control equipment, post top terminals, vehicle detectors and pedestrian push-button assemblies. The Authority will supply the Contractor with a copy of a blank cable connection chart in the standard A1, A2 or A3 sheet size. A typical example of such a cable connection chart is shown on plan No. VD002-37. The requirements for the preparation of cable connection charts for traffic signals is contained in Appendix C.

The connection of cables at mid-block pedestrian actuated traffic signal locations shall be in accordance with Drawing No. VD006-18.

Where it is necessary to connect cables in a manner different to that shown on Drawing No. VD006-18, a separate drawing, giving full details of cables as installed and connected, shall be provided by the Contractor.

In cases where standard methods of installation cannot be used, the Contractor shall prepare drawings of any special construction, such as post footings including details of modifications

to posts (if any) and access pits. Where details of the special requirements can be determined in advance, especially on bridges, a preliminary drawing shall be prepared for prior approval (refer also to Clauses 5.3 and 6.5).

All drawings prepared by the Contractor shall carry the Authority's title block.

Unless otherwise indicated, drawings generally shall comply with the requirements of AS 1100. Traffic signal symbols shall comply with AS 1100.401. Some of the more common symbols and abbreviations used on traffic signal drawings are shown on Drawing No. VD003-6 (sheets 1-7).

5.4.3 Drawings Used for Execution of Works

The Contractor shall, not less than 5 working days prior to the scheduled date of commencement of work at any location, submit to the Authority 6 sets of the drawings or diagrams of the proposed installation including a cable connection chart for such locations.

The Authority will return 3 sets of drawings to the Contractor, such copies being duly stamped and signed by the Authority. If the proposed installation is not acceptable, the Contractor will be notified and the drawings will be returned with the appropriate comments. The Contractor shall carry out works in accordance only with such drawings or diagrams as are approved by the Authority for this purpose.

No work shall be commenced at the site until the provisional drawings have been approved, and at least one copy of the approved cable drawings shall be kept at the site at all times during the progress of the work. For the purposes of staging the site works, the civil work may commence as soon as the Contractor's proposed cable installation plan has been approved. However, the actual wiring of the cables shall not commence until the proposed cable connection chart has been approved.

Receipt of approved drawings shall constitute a **HOLD POINT**.

Details of "work-as-executed" variations shall be promptly and clearly marked on copies of the above-mentioned approved provisional drawings as works proceed. These copies shall be made available for inspection by the Authority or the Superintendent on request. All variations recorded during the progress of the site works shall be transferred to the final drawings before these are handed over to the Authority in accordance with the requirements of Clause 5.4.4.

The Contractor shall show the Authority and the Superintendent, or their representatives, at the time of the tests for practical completion (see Clause 9.2) that all "work-as-executed" information has been accurately and legibly recorded. A copy of the cable connection chart and traffic design plan, marked up with such information where relevant, shall be stored in the controller housing in the document holder on the door by the Contractor.

5.4.4 Final Drawings

Within 30 days from the date of the completion of tests in accordance with Clause 9.2, the Contractor shall furnish the Authority with all the drawings used in the contract. Such drawings shall include:

- a) the cable installation plan;
- b) the cable connection chart; and
- c) drawings of any special or non-standard construction.

All the above-mentioned drawings shall be fully adjusted and amended by the Contractor to show details of site works actually carried out, and as recorded on copies of the provisional drawings (refer to Clause 5.4.3 above). The work-as-executed drawings shall also indicate the actual cover over the ducts, and the location of protective steel plates (if used - refer to Clause 6.4.2) and cable joints (if used - refer to Clause 6.4.6).

The final work-as-executed drawings shall be submitted in CADD file format on a high-density 3.5 inch floppy diskette or transmitted electronically using e-mail facilities. The CADD files shall be in accordance with the requirements set out in Appendix F and must be compatible for loading into the Authority's CADD program Microstation SE.

Diskettes shall be free of read-write errors and be protected against corruption in transit. Any CADD files which do not comply with the requirements of this specification or which are incorrect or incomplete in respect of work-as-executed information will not be accepted from the Contractor.

For all signal sites in the Sydney area, including developer funded sites, the Authority will supply the Contractor with a current traffic signal site design layout plan (that is, traffic design plan) in CADD file format. The Contractor shall fully adjust and amend this design layout plan to show details of site works actually carried out and shall include work-as-executed linemarking and any minor adjustments to channelisation. Any major channelisation changes from the original design layout may require a new base outline to be issued to the Contractor by the Superintendent. The revision of the design layout will be the responsibility of the Authority or the Developer in this circumstance.

5.5 Drawings for Minor Reconstructions

Where necessary for the execution of the works, the Superintendent will issue the Contractor with three copies of the drawings for the existing and proposed installations. These drawings will comprise the traffic design plan, cable installation plan and cable connection chart.

If the drawings issued for the proposed installation are at variance with the actual work performed or the actual site conditions, details shall be clearly and legibly marked in red on all copies of the drawings by the Contractor. One set shall be handed to the Superintendent at the completion of the work. This set of drawings shall be regarded as the "work as executed" drawings for minor traffic light signal reconstruction works. The second set of drawings shall be stored in the controller housing. The third set of drawings is to be retained by the Contractor.

5.6 Supply of Equipment

5.6.1 General

All equipment and material required for the Works shall be supplied by the Contractor and deemed to have been covered by the Contract sum and rates unless expressly stated otherwise in the Contract.

5.6.2 Equipment Supplied by the Contractor

All equipment and material supplied by the Contractor shall be brand new.

Note: A list of applicable RTA equipment specifications and drawings for some of the major items of equipment can be found in Appendix B.

Where type approval is a requirement in the dedicated RTA equipment specification, the Contractor must supply equipment that has current RTA type approval. Information on type approval and a list of current type-approved equipment may be obtained by arrangement with the Quality Manager, Traffic Equipment and Standards Office, RTA Asset Management Branch, 1/85 Flushcombe Rd, Blacktown.

It shall be the responsibility of the Tenderer to obtain up-to-date issues of any applicable RTA equipment specifications (including any revisions and amendments) and drawings by arrangement with the project work office, which issued the tender documents.

5.6.3 Equipment to be supplied to the Contractor

Where items of equipment are to be supplied by the Principal, the Contractor shall collect the equipment from the locations nominated by the Superintendent.

The Contractor shall give the Superintendent at least two working days' notice of collection of the required equipment from the Principal's store, as nominated by the Superintendent.

The Contractor shall be fully responsible for the safe keeping of such equipment until the relevant signal installation has passed all tests for practical completion including the requirements for "work as executed" drawings (refer to Clauses 9.2 and 5.5). The Contractor shall make good any damage to or loss of equipment in his/her charge and shall be deemed to have accepted all equipment in good order and condition at the time such equipment was picked up by him/her at the point of issue.

5.6.4 LED lanterns and Controller

Where LED lanterns are to be installed the Contractor shall ensure that the traffic signal controller is of a RTA type approved version that is capable of measuring power consumption and monitoring the operating status of the LED lanterns.

It shall be the responsibility of the Contractor to ensure that the compatibility requirement in this clause is met notwithstanding whether any equipment involved is supplied by the Principal or the Contractor.

5.7 Inspections

The Contractor shall give at least 24 hours' notice to the Superintendent in respect of the following matters, which are subject to inspection by the Superintendent:

- (a) Ducts (including bores) after installation, before backfilling (refer to Clause 6.4.2);
- (b) All types of mast arm and Type 6 and other special post footings immediately prior to pouring of concrete (refer to Clause 6.5);
- (c) Controller footing immediately prior to pouring of concrete (refer to Clause 6.6).

5.8 Marking Out

It shall be the responsibility of the Contractor to mark out the position of all signal components in accordance with the traffic design plan (refer to Clause 5.4.1) and the approved provisional drawings (refer to Clause 5.4.3).

The position of components indicated on traffic design plans is nominal only. In the event of local obstructions or conflicting dimensions, the Contractor shall contact the Superintendent and seek a direction.

The need to relocate a traffic signal post or a controller shall constitute a **HOLD POINT**.

The Contractor shall exercise his/her good judgment to ensure that no equipment is installed where it will cause an obstruction, is impractical to maintain or replace, or will be subject to excessive risk of damage. If necessary, a direction in this regard must be sought from the Authority.

General details of positioning of signal components are shown on Drawing Nos. VD001-5 and VD001-6.

6. REQUIREMENTS FOR UNDERGROUND WORKS

6.1 Excavations

Before commencing any excavation work, the Contractor shall obtain approval for any road occupancy and a "Road Opening Permit" as set out in Clause 5.3. All excavations shall be kept to a minimum and as far as practicable in accordance with Drawing No. VC001-8 and VC001-9. Where the area of any excavation exceeds by more than 10 percent those laid down in Drawing No. VC001-8 and Drawing No. VC001-9, the Superintendent shall be notified and he/she will make a joint inspection with the Contractor to determine responsibility for the larger excavation. Where the excavated area is excessive or if pavement damage is unwarranted, the Superintendent may assess the additional restoration cost involved, and deduct this amount from payments due to the Contractor. In normal circumstances, the width of trenches for conduits shall not exceed 0.4 m.

All excavations shall be carried out in such a manner that the effect on vehicle and pedestrian movement is kept to a minimum. In this regard, any requirements of the RTA Transport Management Centre and the local Traffic Police shall be adhered to in every instance. Each excavation shall be kept open for the minimum time, and the Contractor shall be responsible for safety of the public with respect to such excavations at all times until final restoration is made. Road pavement excavations shall be avoided wherever practicable. In cases where

under-road boring appears impracticable, the Superintendent shall be consulted before any excavations are undertaken across such road, or before any exploratory openings are cut to investigate the boring obstruction.

Consultation with the Superintendent prior to opening any roadway pavement shall constitute a **HOLD POINT**.

Before any pavement excavation is commenced, the limits of the trench shall be pre-cut with a concrete saw to a depth of not less than 50 mm. However, no sawcutting shall be carried out until the practicability of the proposed excavation has been established beyond reasonable doubt by a detailed survey of existing services and, where necessary, exploratory excavation.

Where excavation of reinforced concrete areas is carried out, care shall be taken not to damage the steel reinforcing rods or mesh, which shall be cut through only at the centre of the trench. In the course of excavation the steel reinforcing may be bent aside, but should be replaced in its original position when the trench is backfilled.

Excess spoil shall be removed before the end of each day's work. Proper environmental precaution shall be taken to prevent spoil from being washed down nearby drains.

The method of backfilling and compaction shall be subject to the conditions and requirements of the Road Opening Permit referred to under Clause 5.3. If spoil is used to backfill footway trenches, it shall be free from rocks, stones, and sections of pavement material or organic matter. Unless otherwise specified by the local authority, roadway excavations shall be backfilled with a 14:1 sand/cement mixture which shall be well compacted before temporary restoration is applied.

The Contractor shall be responsible for safety to the public and comply with the requirements in RTA QA Specification G10 "Control of Traffic" and the "Traffic Control at Work Sites" manual. Drawing No. VC001-7 indicates typical provisions for traffic signal installation work. Refer to Clause 8 concerning special requirements for public safety at existing signal sites to be reconstructed.

The Contractor shall take suitable precautions to ensure that no signal components are installed such as to cause obstruction to water mains, as set out on Drawing No. VC001-4, and that no damage is caused to adjoining constructions.

6.2 Concrete

6.2.1 Grade

Concrete shall be grade N25E7 in accordance with AS 1379 with a maximum aggregate size of 20 mm. The slump shall be 80 mm nominal.

6.2.2 Rod Reinforcement

Reinforcement shall conform to AS 1302 and AS 1303, free from rust or any coating and securely tied in position with 2 mm diameter annealed iron wire. The reinforcement is to be kept the correct distance from the ground or bottom of form-work by reinforcement chairs.

6.2.3 Installation

All boxing and formwork for concrete shall be of sound construction capable of retaining the concrete in place without change of form until it is set, and so erected as to permit its easy removal without jarring the concrete.

All rubbish shall be removed from boxing. The concrete shall be conveyed to the work immediately on being mixed and at once placed in position, well tamped and brought up to the required level. Care shall be taken to ensure that the concrete is not over-worked causing segregation of aggregates in the surface layer.

Exposed concrete surfaces shall be properly cured by covering after the initial set has taken place. The special curing provisions shall be maintained for at least 36 hours after placement.

6.2.4 Concrete Tests

If the supplier of the concrete has third-party quality system certification under AS/NZS ISO 9001:2000, and if each load of premixed concrete is covered by a certified statement of quality, then tests are not required.

If the concrete is mixed on site, or if the supplier of the premixed concrete does not have third-party certification under AS/NZS ISO 9001:2000, then the Superintendent will from time to time (and in all cases of mast arm and Type 6 and other special post footings) request the Contractor to take four concrete test samples.

Each test sample shall comprise an identical test cylinder (150 mm diameter, 300 mm long each) prepared in accordance with the procedure set down in AS 1012 (Part 8). Each sample shall be numbered consecutively, and shall also be marked with the date the sample was taken, the post identification and the location. The Contractor shall supply the cylinder moulds and baseplates, and the necessary labour and concrete to enable samples to be prepared and maintained in accordance with the provisions of AS 1012 (Part 8).

The Contractor shall arrange for two of the four samples to be tested after seven days by a NATA-certified laboratory. If the first two samples fail the 7-day laboratory test, the Contractor shall not stand the mast arm or Type 6 or other special post on the footing(s), but shall arrange for the remaining two samples to be tested at 28 days. If the last two samples fail the 28-day test, the Contractor shall remove the concrete footing(s) concerned, and pour fresh footings at no cost to the Principal.

The cost of testing the concrete samples shall be borne by the Contractor. The Contractor shall furnish a copy of all certified test reports to the Superintendent.

6.3 Pavement Restoration

6.3.1 Temporary Restoration

As soon as practicable after backfilling and compacting of excavations, the Contractor shall seal the surface with an approved asphaltic material, or in grassed areas, with turf on 50 mm of top soil. This restoration shall be maintained in a safe condition by the Contractor until the final restoration is made by the responsible Agency. The depth of compacted temporary surfacing shall not be less than 50 mm on footways and 100 mm on roadways.

In footways paved with paving blocks, no asphaltic material shall be used, but the Contractor shall replace the paving blocks on compacted and levelled sand unless otherwise directed by the Superintendent.

The Contractor shall be responsible for the restoration and maintenance of excavated areas as set out in the conditions and requirements of the Road Opening Permit referred to in Clause 5.3 and until final restoration is carried out by the responsible agency.

6.3.2 Final Restoration

The Superintendent will arrange for final restoration when the installation work has been completed and will make arrangements to meet the full cost of the necessary restoration. Refer to Clause 6.1 concerning recovery of costs for restoration resulting from excessive excavation.

6.4 Cable Installation

6.4.1 Types of Cable

The cabling between the controller and signal posts shall be in 29-core cable, complying with RTA Specification C/12 and AS 2276 Part 1.

The Contractor shall hold and retain documentary evidence to prove that the cable has been tested in accordance with the requirements of RTA Specification C/12 and complies with all specified requirements.

For all 29-core cables used in LV circuits, at least three spare cores shall be provided. Cabling to posts used solely for provision of pedestrian push-button facilities may be carried out using standard sheathed cable complying with AS/NZS 3808, having four insulated cores of 7/0.50 gauge in addition to an earthing conductor. Cabling to a single lantern mounted on a wooden pole may be carried out using standard PVC sheathed cable complying with AS/NZS 3808, having four insulated cores of 7/0.50 gauge in addition to an earthing conductor, and using a weatherproof connection box as shown in Drawing No. VM015-23. In this application, no other cables shall be terminated at the wooden pole, and the five-core cable shall be run directly to the nearest signal post or the controller.

Cables between loop detector junction points and the associated electronic equipment (known as detector feeder cable) shall be two-core screened cable complying with AS 2276 Part 2. Loop cable shall comply with AS 2276 Part 3.

Cables carrying the incoming supply shall be 7/1.04 gauge single double-insulated or twin double-insulated 250 V a.c. grade cable, or such cable as may be required by the local Electricity Supply Authority or otherwise specified in the Contract.

6.4.2 Installation of Ducts

As far as practicable, all cable ducts shall be installed with cover as follows:

roadways - minimum 0.75 m over ducts;

footways - 0.5 m over ducts.

All cables shall be installed in protective ducts. Ducts under roadways shall be installed by boring methods wherever practicable. Where boring is not considered to be practical, the Contractor shall contact the Superintendent and seek approval for open trenching (refer to Clause 6.1 for nominated **HOLD POINT**).

Where ducts are installed across an excavated roadway, or across a roadway by open trenching, a minimum of two 80 mm NB ducts shall be installed.

All ducts shall be provided in accordance with TABLE 6.4.2, except for ducts to Telstra's network connection points (refer to Clause 6.9). All roadway ducts shall be 80 mm NB, except in the case of mid-block pedestrian signal installations when 50 mm NB ducts are permitted. Where local obstructions make it impractical to install an 80 mm NB duct by under-road boring, the Contractor shall confer with the Superintendent concerning the substitution of smaller bore ducts. The Superintendent will seek a direction from the Authority before giving a direction to the Contractor.

All footway ducts shall be 80 mm NB, except where otherwise permitted in TABLE 6.4.2.

TABLE 6.4.2: MINIMUM PERMISSIBLE CABLE DUCTS

Nominal Bore (NB) in mm	Galvanised Waterpipe Medium Grade to AS 1074	Orange Rigid Plastic Heavy Duty Grade to AS/NZS 2053	Permitted Use
20	20 NB (26.8/2.7)	Not Permitted	Underground supply derived from overhead mains
25	25 NB (33.7/3.3)	Not Permitted	To a single lantern on a wooden pole
25	Not Permitted	Size 32 (31.8/2.8)	Underground supply, or underground section of overhead supply
50	Not Permitted	Size 63 (62.8/4.2)	In roadways (bore pipe)
50	50 NB (60.4/3.7)	Not permitted	In median on top of old road surface
80	Not Permitted	Size 80 (88.9/5.0)	In footways and roadways

NOTE: Figures in parentheses indicate average outside diameter and wall thickness respectively. For minimum and maximum limits refer to the relevant Australian Standard.

No more than two 80 mm NB ducts shall be laid side-by-side in one trench in footways. If more than two ducts are to be provided, the additional ducts shall be stacked vertically.

Where concrete-paved medians, islands or blisters are installed on the original road surface, cables may be installed in galvanised iron water-pipe laid directly upon such road surface providing that there is a minimum of 75 mm concrete cover above the pipe. The size used in this application is 50 mm NB. In all cases where galvanised iron water-pipe is laid directly upon an old road surface, the Contractor shall install a minimum of two 50 mm NB pipes to

each post footing. Where the pipes are installed between two pits, the Contractor shall include a spare pipe alongside those that are necessary for the cables.

The size of ducts shall be selected so as to give adequate clearance for pulling of cables without risk of damage during installation, but in any case, the space factor shall not exceed 0.5^{NOTE*}. Drawing No. VR007-6 indicates the number of cables, which can be accommodated in various sized ducts.

The end of the duct shall terminate in a pavement junction pit or footing. Not more than two 90° bends shall be installed between any two junction pits and/or post footings. Ducts crossing carriageways shall always terminate in pavement junction pits.

Where two or more ducts cross a roadway, only one duct shall be interrupted at the pavement junction pit in the median or island. Where this is not practical in special circumstances, the Contractor shall first consult with the Superintendent to confirm the need for additional conduits to be interrupted. The Superintendent will seek a direction from the Authority on the matter before giving a direction to the Contractor.

All screwed connections of galvanised iron pipe shall be thoroughly cleaned and liberally coated with a zinc-rich paint complying with AS/NZS 3750.9 before assembly. Except where fully encased in concrete, couplings and bends used for PVC pipe shall be of sufficient length to allow the pipe to be inserted with a penetration equivalent to the nominal bore of the pipe. Couplings shall have a moulded stop in the centre to ensure equal engagement of pipes from both ends. Bends shall have a minimum internal radius of 230 mm and no sharp internal ridges. Before insertion, the interior of the fitting and the end of the pipe shall be thoroughly cleaned and coated with an approved bonding agent.

Typical installation details are shown on Drawing Nos. VC001-8 and VC001-9. In all footways, except where cable is laid in galvanised iron waterpipe, orange polymeric cable cover strip (minimum 3mm thick) shall be laid approximately 60 mm above the pipe. All non-ferrous pipes shall be surrounded with clean sand, and the polymeric cable cover strip shall be covered with at least 50 mm of clean sand. All galvanised iron pipes shall be covered by orange marker tape to AS 2648.1.

Where ducts cannot be installed except with less than the specified minimum cover, minimum 12 mm thick galvanised steel plates (0.3 x 0.6 m) shall be laid under the polymeric cable cover strip for additional protection.

Steel plates shall be provided in the following situations:

roadways: where cover over ducts installed by open trenching is less than 0.5 m;

footways: where cover over duct is less than 0.3 m.

Details of the position of steel plates shall be recorded by the Contractor and shown on the final drawings referred to in Clause 5.4.4.

^{NOTE*} Space factor is defined as the ratio of the sum of the cross-sectional areas of the installed cables to the internal cross-sectional area of the duct.

6.4.3 Footway Pits

Pavement junction boxes in accordance with Drawing No. VC007-4 shall be used in footways to protect and give access to vehicle detector cable joints; earth electrodes (where these cannot be installed in the controller footing); at a sudden change of direction of ducts (especially in medians at the change from normal cover to galvanised iron water pipes laid directly on the old road surface); and where underground mains fuses are required (refer to Clause 6.7). No duct shall enter any pit less than 150 mm from the bottom of the pit. Where the cover (in the footway) of the entering duct exceeds 820 mm, the pit entry shall be via a bend, which shall be extended as necessary with a vertical length of duct to ensure that the opening is not less than 150 mm above the bottom of the pit. Depending on problems met on site, the Superintendent may direct that a larger pit be constructed in conformance with Drawing No. VC007-5. The interpretation of these requirements is that any cable shall be able to be removed and replaced without the need for excavation.

A footpath cable junction pit in accordance with Drawing No. VC007-5 shall be provided for the following situation:

- (i) the small pit shall be used where a maximum of four 29-core cables pass through a pit or where a maximum of five ducts enter a pit;
- (ii) the large pit shall be used where five or more 29-core cables pass through a pit or where six or more ducts enter a pit.

No Pits shall be installed in kerb ramps unless otherwise directed by the Superintendent with the approval of the Authority.

6.4.4 Roadway Pits

The use of pits in roadways is not permitted unless approved by the Authority. Where it is necessary to use a pit in the roadway, this shall be provided with a heavy-duty cover and frame complying with RTA Specification No. PCF/2 (as amended). The bottom of the pit shall be approximately 450 mm below the bottom of the lowest duct.

Roadway pits shall be constructed to withstand a wheel loading of 80 kN with a dynamic load allowance of 0.4 and a load factor of 2 applied to the wheel loading plus dynamic load allowance. The loading shall be applied as a patch load conforming to size given in SAA HB77.2 "Australian Bridge Design Code - Design Loads" for the wheel loading.

The design of all roadway pits shall have the prior approval of the Authority. In all cases, the shape of the roadway pits shall be such that the duct-lines enter them at right-angles, viewed in a horizontal plane.

The Contractor may be requested in specified instances and depending on conditions met on site, to provide drainage of pits into stormwater drains. Connection to the subsurface drainage system is not permitted.

6.4.5 Installation of Cables

Before any cables are installed, the Contractor shall retain and submit as requested to the Superintendent documentary proof that the cable has been tested and fully meets the requirements of RTA Specification C/12 (as amended).

The maximum number of cables, which can be installed in underground ducts, shall be such that the space factor of 0.5 (refer to Clause 6.4.2) is not exceeded, except where the ducts

were pre-existing. Where the underground ducts were pre-existing, the maximum number of cables allowable shall be such as will permit the installation of the cables without damage. The most common combinations of cables and ducts are shown on Drawing No. VR007-6.

At least 1 m of spare cable shall be coiled within the footing for each signal post, mast arm and controller, and in each pavement junction box or access pit.

No more than three multicore cables (to AS 2276.1) shall be installed in any signal post or mast arm.

Each cable shall only have a single circuit back to the controller; i.e., ring circuits or overlapping circuits are not permitted. Termination of spare cores is not permitted unless otherwise agreed to by the Authority.

Where a post is located on a median less than 2.1 m wide, only a single cable shall be permitted into it. For a reconstruction site, the requirement does not apply where the road-crossing duct capacity restricts the installation of extra cable.

All loop feeder cables shall be taken back to the controller via ducts and pits; i.e., loop feeder cables are not to pass through the post footings.

The Contractor shall take all precautions to ensure that the cables are not damaged when these are pulled through the ducts, viz

- (a) cables must be pulled by hand only, without the use of ratchets, levers, winches or other mechanical devices of any kind;
- (b) whilst cables are being pulled through any duct, manual assistance shall be provided to feed the cable into the duct;
- (c) no cable shall, while being fed into a duct or being pulled out of a duct, be allowed to bear on any sharp edge of a pit or concrete footing;
- (d) cables shall be pulled only through one duct section at a time. For the purposes of this Specification, one duct section is the duct between two successive access points along a given cable route; and
- (e) precautions shall be taken to ensure that the cable is not twisted or kinked as it is being fed into the duct.

Every cable in a pit shall be so positioned that it presents a minimum obstruction to other cables already installed and duct entries into the pit.

6.4.6 Cable Joints

No joints shall be allowed in cables laid in a duct system. For a reconstruction site where cables are directly buried, joints shall be avoided as far as practicable in such cables, and no more than one joint shall be made in any such cable run.

Except where cable joints are shown on the approved installation drawings (Clause 5.4.3), no cables shall be jointed without the prior approval of the Authority.

Cable joints shall be carried out by the method described on Drawing No. VM417-3 or an equivalent approved method. No joint shall be made under conditions of rain or when any

traces of moisture are present on the cable to be jointed. In no case shall cable joints be drawn into a duct.

Except where the joint is made immediately after installation of the cable, the ends of the cable shall be sealed to prevent entry of moisture into the interstices of the cable.

6.5 Post and Mast Arm Footings

Concrete footings for Type 2 posts shall comply with Drawing No. VC002-51. Concrete footings for Type 5 and Type 9 mast arms and Type 6 posts shall comply with Drawing No. VC002-52. Concrete footings for Type 10 and Type 11 mast arms shall comply with Drawing No. VC002-65. Concrete footings for other post types shall comply with the relevant drawings approved by the Authority. Details of the anchor bolts for the Type 2 post are shown on Drawing Nos. VC002-27 and VC002-50. Details of the anchor bolt assembly for the Type 5 and Type 9 mast arms and the Type 6 post are shown on Drawing No. VC002-38.

The complete footing must be cast in one single concrete-pouring operation.

Concrete footings for all types of mast arm and Type 6 and other special posts shall be installed only in previously undisturbed and stable soil, and in excavations specially made for these footings. Excavations that were made for other purposes (for example, under-road boring) shall not be used for the construction of mast arm or Type 6 or other special post footings. No formwork shall be used for the footing.

In locations where a Type 2 post footing cannot be installed due to proximity of underground services, the Authority may permit the installation of a Type 1 post, installed in accordance with Drawing No. VC002-44. At least 1 m of spare cable shall be coiled at the post footing and installed in such a manner that it will not be damaged in the course of placement or subsequent removal of the post.

The edge of the pavement about the post footing excavation shall be neatly and squarely trimmed, and shall be restored as specified on the abovementioned drawings. Where formwork is used, it shall be removed on completion of the work.

The preferred position of all signal posts and mast arms is 1.0 m in from the kerb alignment, but owing to services this may not always be practicable. Mast arms, Type 6 posts and other special posts on an island shall be located a minimum of 2.0 m from every edge of the island and barrier type kerb used. Unless specifically noted on the relevant traffic design plan, no post or mast arm on a footpath shall be installed closer than 0.6 m in from the face of the kerb. The position and shape of the footings may be varied subject to the approval of the Superintendent where the underground services or the overhead awning prevent it from being placed in the nominated position. Where necessary, the arrangement shown on Drawing No. VC002-40 may be applied to off-set a Type 2 post on a standard footing (e.g. in the case of reconstruction of existing signals). Mast arms, Type 6 posts and other special posts shall not be erected on a footing until at least seven days have elapsed after pouring of the concrete, subject to a satisfactory 7-day test (refer to Clause 6.2.4).

Where a post cannot be installed in the normal manner, such as on a railway overbridge, and if construction details are not provided with tender documents, the Contractor shall submit details of the modified footing to the Superintendent for approval before installation is commenced. An example of a drawing providing details of a shallow-cover post installation is shown on Drawing No. VC002-45. In this respect, the requirements of Clause 5.3 shall also be taken into account. The Contractor shall ascertain if any additional approvals should be sought and arrange to obtain such approvals before commencing work on the bridge structure. It should be noted that the approval process in some cases may involve considerable delays, and aboveground work shall not be started before all approvals have been obtained.

Submission of information on the proposed work on bridge structures shall constitute a **HOLD POINT**.

Where a mast arm, Type 6 or other special post footing is required to be installed within 3 m of the edge of an embankment, a trench or a drain, or in soft unstable or previously disturbed soil, the Contractor shall consult with the Superintendent. The Superintendent will assess the conditions and provide the Contractor with details of a modified footing with increased excavation and improved anchorage for installation.

No post or mast arm footing shall be installed above a joint, stopcock or similar device located in any service mains running below the footings. Where other services run below the footing, the construction of the footing shall be modified to bridge the services in such a manner that they can be removed or repaired at any time without damage to either the footing or the services.

6.6 Controller Footings

Some types of simple controllers are accommodated in weatherproof housings fastened to one of the signal posts, in accordance with details shown on the relevant traffic design plan and Drawing Nos. VC002-43 and VM625-17. In all other cases, the traffic signal controller shall be mounted on a concrete footing installed in accordance with Drawing No. VC002-24. The details of anchoring bolts for the controller footing are shown on Drawing No. VC002-25.

Unless otherwise indicated on the traffic design plan, each controller footing shall incorporate a telephone line conduit and precast pit, installed in the manner shown on Drawing No. VC002-24 or VC002-43.

The controller holding-down bolt centres are critical for the correct location of the frangible plates supplied with the controller housing. A template shall be used in the installation of the controller footing to ensure that the bolt centres are correct. Any variation from the manufacturer's installation procedure for the housing shall be subject to the prior agreement of the Authority.

As an alternative to a fully cast-in-situ footing, Contractors may use a pre-cast controller footing, as shown on Drawing No. VC002-55. The Contractor shall take account of the fact that this will require a different holding-down bolt assembly (Drawing No. VC002-56).

Where a ground-mounted controller footing is connected only to a single pit, a minimum of two 80 mm NB ducts shall be installed between the controller footing and the pit.

6.7 Electricity Supply

The Authority will arrange to apply for the supply of electricity for the traffic light signal installation. As soon as a reply is received from the relevant Supply Authority, details will be forwarded to the Contractor. Until such confirmatory details are received by the Contractor, the Contractor shall not commence any work on excavation for installation of supply cables. In this connection, it should be noted that the point or method of connection of the electricity supply shown on the Authority's traffic design plan is subject to confirmation, since that plan may have been drawn before the reply from the relevant Supply Authority is received.

In most areas, the supply for the traffic light signals is obtained from overhead mains in accordance with details shown on Drawing No. VE500-1. Where supply mains are underground, the method of connection and the point of attachment shall be ascertained by

the Contractor. The underground mains shall be brought into the controller through an underground fuse installed in a standard pavement junction box (Drawing No. VC007-4). The underground fuse assembly shall comply with RTA Specification No. UGS/5 and the method of installation are shown on Drawing No. VE500-11. The pit containing the underground fuse shall be installed as near as possible to the point of connection to the Supply Authority's mains.

The electricity supply cable must not pass through post footing cavities. The supply cable may be installed in a common duct with signal cables under the following circumstances:

- (a) the duct has been installed by boring (under a road or driveway); or
- (b) the duct was pre-existing.

Where the supply cable passes through an access pit or pavement junction box, it shall be sleeved with (flexible) conduit and clearly and durably labelled "DANGER: SUPPLY CABLE".

Outside the Sydney-Newcastle-Wollongong Metropolitan Areas, the installation of the underground fuse in underground mains situations shall be subject to the approval of the relevant Supply Authority. It shall be the Contractor's responsibility to consult with the Supply Authority in that respect.

Full details of mains supply connections and associated work actually carried out shall be recorded by the Contractor and incorporated on the final drawings referred to in Clause 5.4.4.

6.8 Vehicle Detector Loops

Advance (passage) detector loops shall be installed in accordance with the requirements of Drawing No. VC005-18 in the positions indicated on the relevant traffic design plan. Stop-line (presence) detector loops shall be installed in accordance with the requirements of Drawing No. VC005-17 in the positions indicated on the relevant traffic design plan. Drawing No. VC005-19 indicates the correct procedure for wiring the loops in relation to the location of the pavement junction box.

Before the loop cables are jointed and before application of sealant to the saw-slots, the Contractor shall carry out a wiring check. A suggested procedure is set out on Drawing No. VC005-22.

Loop cables shall be jointed to the two-core screened cables referred to in Clause 6.4.1 and run directly back to the controller housing, unless otherwise indicated in the tender documents. It is important that the joint between the two-core screened cable and the loop cables be waterproofed to prevent entry of moisture into the interstices of the two-core screened cable. Drawing No. VM417-4 shows the heat-shrink sleeve method of waterproofing the joint. Adequate precautions shall be taken to prevent entry of moisture into the two-core screened cable before the joint is finally sealed. Saw-slots shall be cleared of debris and moisture before installation of the loop cable. Sealant shall be type-approved under Specification No. LSS/2, and shall be applied strictly in accordance with Manufacturer's instructions.

Stop-line detector loops shall be individually wired back to the controller to enable traffic to be detected in each lane separately. Each 2-loop section of 11 m detectors shall be separately wired back to the controller. General requirements on the installation of detector loops are shown on Drawing No. VC001-9.

Advance detector loops are normally combined (in series) to provide two lanes per sensor.

All detector loops shall be wired with 7/0.50 gauge cable conforming to AS 2276, Part 3.

NOTE: A step-by-step procedure for loop detector installation is contained in the RTA publication PRACTICE MANUAL FOR LOOP DETECTOR INSTALLATION AND MAINTENANCE. Copies of this manual are available for personnel training and to formulate work instructions.

6.9 Telephone Ducts

Cable ducts and associated pits connecting the controller housing to a network connection point (NCP) of the Telstra cable network shall be provided in accordance with the relevant requirements of Telstra. The Authority will arrange to apply for the provision of a telephone line circuit to the controller (where required). The Contractor shall coordinate with Telstra to ascertain the location of the Telstra network connection point for this circuit and install the required cable ducts and associated pits. The installation of such cable ducts and pits shall be carried out by persons accredited by Telstra to perform "pit and pipe" construction work.

The Contractor shall install an insulated draw-wire in the ducts between the Telstra network connection point and the controller footing telephone line pit (refer to Clause 6.6).

6.10 Multi Function Poles (MFP's) by others

Where traffic signals are to be installed onto MFP's, the following requirements shall be met:

- (a) The conduit entry into the MFP footing for RTA use shall be 80mm HD PVC Electrical Grade and is to be located as close as possible to the centre of the post to allow for the fitting of an adaptor stool for a standard type 2 traffic signal post if required.
- (b) Each MFP shall have an adjacent pit installed for traffic signal cable storage and access. This pit to be a Min. 450mm x 450mm clear opening in accordance with Specification PCF/2 and Drawing VC007-5.
- (c) An extra 3 metres (4metres total) of each 29 core traffic signal cable to be stored in each pit adjacent to the MFP to allow for the installation of a Type 2 traffic signal post on an adaptor stool in case of an accident or relocation replacement.

7. REQUIREMENTS FOR ABOVE-GROUND WORKS

7.1 Signal Posts and Lanterns

7.1.1 General

Signal posts shall be of the base-plate mounted type.

Unless otherwise indicated on the relevant traffic design plan, the post length shall be 4.1 m. Where local obstructions prevent installation of a Type 2 footing (refer to Clause 6.5), a buried post (Type 1) is necessary. Alternatively, the Superintendent may direct that an offset bracket be supplied.

7.1.2 Installation of Posts and Mast Arms

Unless otherwise directed by the Superintendent, no signal post or mast arm shall be erected unless all other equipment needed for the completion of the traffic light signal installation is available to the Contractor and until the necessary channelisation has advanced to a stage where all components can be installed without creating a traffic hazard and until all of the duct and pit installation is completed.

Confirmation of the availability of equipment and completion of essential channelisation (temporary or permanent) and all of the ducts and pits for the erection of signal posts and mast arms to proceed shall constitute a **HOLD POINT**.

Installation of posts and mast arms shall be on concrete footings referred to in Clause 6.5. Posts and mast arms shall be erected so as to be vertical, and the exposed threads of anchor bolts shall be greased and protected with a suitable cap or sleeve, before installing the surface concrete (refer to Clause 6.2).

Erection of mast arms, Type 6 posts and other special posts is subject to the concrete sample, where required in clause 6.2.4, passing the Laboratory test (refer also to clause 6.5).

Due care shall be taken in the assembly of the mast arms. The Type 5 tapered mast arm shall overlap the joint over at least 360 mm. The recommended procedure for assembly of Type 5 mast arms is given in Appendix D and Drawing No. VM211-10. The Contractor shall take all necessary precautions that the galvanising coating of the mast arm sections is not damaged. The assembly of the Type 5S and 5L mast arms is shown on Drawing No. VM211-26. The assembly of the Type 9 mast arms is shown on Drawing No. VM215-1. The assembly of other post types and mast arms shall be in accordance with the relevant design drawings and assembly instructions.

Note: Drawings for the Types 10, 11 and 12 mast arms may be obtained from the Superintendent.

Safety clearances for mast arms and Type 6 posts in respect of overhead power lines and communications cables are shown on Drawing No. VM211-20. The Contractor shall promptly notify the Superintendent if it appears that these safety clearances will not be achieved in any specific instance.

7.1.3 Erection of Special STOP Signs

The Contractor shall attach special STOP signs (R1-202) to posts located on minor approaches, as shown on the relevant design plan for all new sites. The method of installation of the sign is shown on Drawing No. VM202-12. The signs shall be erected at the same time lanterns are installed. Unless other arrangement is made by the Contractor with the Superintendent, these signs shall be supplied by the Contractor:

The special STOP signs shall be temporarily masked if they conflict with existing traffic signs during the period of construction.

7.1.4 Cable Terminations

All cable termination work shall be carried out by a person authorised to perform electrical work under the requirements of the NSW Home Building Act 1989. For the purposes of this Specification, cable termination work shall include but not be limited to:

- (a) removal of sheathing,
- (b) stripping of conductors,
- (c) fitting of lugs,
- (d) soldering of conductors,
- (e) application of heat-shrink insulation,
- (f) securing of lugs in the terminal block,
- (g) looming and tying of cores, and
- (h) electrical tests.

The cables referred to in Clause 6.4.1 shall be brought up the interior of the signal post or mast arm and terminated on the special terminal assembly. All cables shall be firmly supported in such a manner that the weight of the cable shall not impose mechanical strain on the electrical connections. Each cable shall be clearly tagged with an approved type of permanent marker in accordance with its identification on the approved cable connection chart.

The cable sheath shall be removed for an adequate length, with due precaution 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 connection chart. The cores of different cables at the top of a post shall not be laced together in the same loom. Detector feeder cables shall be sleeved in accordance with the method shown on Drawing No. VM417-4 to prevent water ingress.

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 reserved for future extra facilities (as nominated on the relevant traffic design plan) shall be allocated terminals, and shall be terminated.

In all cases, the conductor shall be terminated by means of an approved type PIDG Lip Blade crimp lug that shall grip the cable insulation as well as the copper strands. Solder type terminations shall not be used, except for the inter-connection of the detector loop cable and the feeder cable within the pavement junction box.

The crimping tools for use with the PIDG Lip Blade crimp lugs shall be of a ratchet type.

Special care shall be taken to insert lip blade crimp lugs correctly in the terminals. The required method is shown in Drawing No. VM417-5.

7.1.5 Lantern Attachments

Every vehicle lantern (except overhead lanterns on mast arms) shall be attached to the post, mast arm or pole so as to enable it to be aimed at a point located at a height of 1.4 m within 150 m of the stop line on the approach to which the signal is directed. In the case of primary lanterns located at the stop line, this point shall be located no less than 15 m from the stop line. All aiming attachments shall be securely locked in position.

Every pedestrian lantern shall be attached to the post, mast arm or pole so as to enable it to be aimed at the centre of the appropriate foot crossing at the opposite side of the roadway, 1.5 m above the kerb. All pedestrian lanterns shall be installed on the pedestrian crossing side of the post, mast arm or pole unless directed otherwise by the Superintendent.

The general arrangement of the signal lanterns on a Type 1 or Type 2 post is shown on Drawing No. VM202-8. The general method of mounting lanterns on a Type 5S (short), 5L (long) and 5XL (extra long) mast arm is shown on Drawing Nos. VM211-6 (sheet 1), VM211-21 and VM211-17. The general method of mounting lanterns on a Type 9 mast arm is shown on Drawing No. VM215-1. The general arrangement of lanterns on a Type 6 post is shown on Drawing Nos. VM212-2 and VM211-17.

Vehicle lanterns on Type 1 or Type 2 posts shall be mounted at the top of such posts unless otherwise indicated on the relevant traffic design plan. Pedestrian lanterns shall be mounted such that the top of such lanterns is approximately 3 m above pavement level. The top of vehicle lanterns on wooden poles shall be approximately 4 m above pavement level.

Lanterns are normally supplied with mounting straps complying with AS 2339, having L = 150 mm for 200 mm signals and L = 250 mm for 300 mm signals. Pedestrian lanterns are supplied with straps L = 250 mm. Where necessary, the Contractor shall supply and fit mounting straps complying with Drawing No. VM012-7 to enable the required number of lanterns to be neatly and compactly accommodated on the post or pole. Particular care shall be taken to mount lanterns and ancillary attachments a maximum distance back from the kerb alignment. In no case shall any part of a lantern, its visors, or target board, be closer to the roadway than the minimum distances shown on Drawing No. VM202-8. In special situations, "Z" brackets may be used to raise the height of a lantern under an awning.

Only one lantern strap shall be installed on each lug screw at the signal post, mast arm or pole.

Lock washers (in pairs) in accordance with Drawing No. VM200-24 shall be used to lock lanterns in position. All lanterns shall be locked in position using lock washers as shown on Drawing No. VM200-28. All dual lanterns shall be installed using the tee-bar method of mounting with lock washers as shown on Drawing No. VM200-27.

Care shall be taken to ensure that mounting straps are spaced to suit the mounting distances of the lanterns so that the lantern bodies are not subject to bending stresses. Such stresses can in the long-term cause cracking of the lanterns and the weatherproofing qualities may be impaired. The Contractor shall supply, where necessary, spacers or offset brackets to satisfy this requirement.

Lantern leads shall be trimmed to form a drop below the entry point (as indicated on Drawing Nos. VM202-8, VM211-21, VM211-17 and VM015-16), and neatly tied to the post or mast arm. No part of any flexible, exposed cable shall be less than 2.5 m above pavement level.

Where local obstructions preclude mounting of lanterns in the stipulated positions, the Contractor shall refer the matter to the Superintendent for a direction from the Authority.

Inability to mount lanterns in the stipulated positions shall constitute a **HOLD POINT**.

7.1.6 Attachments to Wooden Poles

Where lanterns are to be attached to an existing wooden pole, the arrangement shall be as shown on Drawing Nos. VM015-16 and VM015-18.

Details of the special terminal box assembly to be used are shown on Drawing No. VM015-21. Details of the special push-button mounting bracket are shown on Drawing No. VM200-19.

Where a single lantern is mounted on a wooden pole, the arrangement shown on Drawing No. VM015-23 may be used only when called for on the traffic design plan or in the Contract document. In this arrangement a single five-core cable, as described in Clause 6.4.1, shall be run directly through 25 mm NB galvanised waterpipe to the nearest pavement junction box, signal post footing or mast arm footing. If the nearest footing or pavement junction box is more than 3 m from the wooden pole, a pavement junction box shall be provided, as shown on Drawing No. VM015-23, with an 80 mm NB duct between this pavement box and the next point of entry.

7.1.7 Target Boards

All vehicle signal lanterns shall be fitted with target boards in accordance with the requirements of AS 2144. In this regard, specific attention shall be paid to the requirements of Clause 6.8 of AS 2144-1995 as to the gap between the lantern body and the internal edge of the target-board.

A minimum clearance of 2 m below any target board shall apply. Where necessary owing to local obstructions, such as awnings, target boards may be cut away to permit the signal to be located and aimed in the required manner. Where such cutting of the target board would be unduly extensive or impractical, the target board may be omitted.

7.1.8 Installation of Mast Arms or Posts through Awnings

At some locations it is necessary for a mast arm (and in isolated instances a post) to pass through an existing awning. At such locations the Contractor shall carry out the necessary preliminary investigations to ensure that the footing will not be located in such a position that the proposed mast arm would interfere with structural members of the awning.

Before any openings are made in the awning, the Contractor shall contact the Superintendent to ascertain that the necessary approvals have been obtained from the owner(s) of the affected premises and, if applicable, the local Council.

Verification of approvals to cut holes in awnings shall be a **HOLD POINT**.

The Contractor shall be wholly responsible for providing and making good any holes through awnings (which may be necessary for the erection of the mast arm) to the satisfaction of the owner of the property and the Superintendent. A clearance of 25 mm shall be left all round between the mast arm and the awning, which shall be provided with a gutter to prevent rainwater from the awning flowing into the opening. The Contractor shall also comply with any other requirements (such as provision of flashing) specified by the local Council.

7.1.9 Covering of Lanterns

Immediately after erection of signal lanterns at new sites and until the traffic light signals are commissioned, the Contractor shall cover the street-level primary lanterns facing each approach and any lanterns on median/island posts with covers manufactured in accordance with Drawing No. VM418-1. The covers shall be neatly attached and securely tied to ensure that they remain in position under all weather conditions.

For traffic light signals under reconstruction, the Contractor shall similarly cover lanterns if the installation must be left blacked-out for more than two hours or such period determined by the Superintendent.

The Authority will supply the required number of covers to the Contractor. Arrangements for the collection of the covers shall be made through the Superintendent.

NOTE: The colour of the lantern covers used for new installations is yellow (see drawing VM418-1). For reconstruction sites, it is black (drawing VM418-3).

7.1.10 Retrofitting of LED optical assembly

Where new LED optical assemblies and other components to be retrofitted into existing lantern bodies the work shall be carried out in accordance with recommendations of the LED optical assembly and components Supplier. Where the existing lantern installation including cabling and mounting is not of the current installation standard the Contractor shall upgrade the lantern installation to the current installation standard. The cost of the upgrade shall be deemed to have been included in the contract sum.

7.2 Pedestrian Push-Button Assemblies

Pedestrian push-button assemblies shall be attached to posts and mast arms in accordance with the requirements of the relevant traffic design plan.

All wiring between post-top terminals and push-buttons on the same post shall be in 4V-75 sheathed cable, having two cores 7/0.50 gauge in addition to an earthing conductor, complying with AS/NZS 3808. All wiring to push-buttons on short posts (except those on medians) shall be in 4V-75 cable having four cores 7/0.50 gauge in addition to an earthing conductor. The standard colours for the insulated cores shall be allocated in the following manner:

Red	-	Push-button active	
Black	-	Common (ELV) Return	
White	-	Audio-tactile transducer)) (see Clause 7.3)
Blue	-	Audio-tactile transducer)	

The Contractor shall orientate the arrow disc on pedestrian push-button assemblies in the manner shown on Drawing No. VD001-7. In the case of push-button assemblies on median posts, the Contractor shall replace the standard single-headed arrow disc with a two-headed arrow disc, as indicated on Drawing No. VD001-7.

The mounting height and alignment of push-button assemblies shall be as shown on Drawing Nos. VD001-5 and VD001-6.

Where stipulated on the traffic design plan, push-button assemblies shall be mounted on wooden poles; attached to the two 40 mm NB GI pipes using the mounting brackets shown on Drawing No. VM200-19.

7.3 Audio-tactile Facilities

Where indicated on the traffic design plan, the Contractor shall install audio-tactile facilities. The audio-tactile equipment shall comprise an audio-tactile push-button assembly and an electronic driver unit complying with RTA Specification No. ATS/4 (as amended).

On each post or mast arm where an audio-tactile push-button assembly is to be provided, the Contractor shall mount the associated weatherproof housing for the electronic driver at normal pedestrian lantern height and such that convenient access can be obtained to it from a ladder placed on the foot pavement (refer to Drawing Nos. VE530-8 and VM202-8). The two-core cable (twisted white) shall be taken directly inside the signal post or mast arm and connected to the transducer connection terminals in the push-button assembly. The remaining cable cores from the driver unit shall be terminated on the terminal assembly referred to in Clause 7.1.4. For electrical connections refer to Drawing No. VE530-7.

7.4 Vehicle (Loop) Detectors

Five types of inductive loop detectors are currently in use:

- (a) 4.5 m long stop-line detector;
- (b) 11 m long turning-lane detector;
- (c) counting detector;
- (d) advance (passage) detector; and
- (e) red light camera detector.

The detector equipment is normally located in the controller housing, and loop feeder cables are run directly from the loops back to the controller (refer to Clause 6.8).

In special cases, or where an existing installation is reconstructed, detector equipment may have to be accommodated in weatherproof boxes attached to the signal post or mast arm nearest to the loop. Details of such special requirements will be indicated on the traffic design plan, tender form or associated documentation. Attachment of detector equipment to posts mounted on narrow medians or small islands, or wooden poles, shall be avoided as far as practicable. Post-mounted detector equipment shall be mounted in an unobtrusive manner and such that convenient access can be obtained to it from a ladder placed on the foot pavement. Any equipment or attachments below the detector equipment housing shall be located such that the detector monitor lights may be clearly observed by a person standing on the footpath.

7.5 Controller

Where the controller housing is of a type intended to be mounted on the signal post, it shall be positioned so that access to the plug-in modules is from the foot pavement. Installation of the controller shall be generally as indicated on Drawing No. VM625-17. Cables shall enter the post-mounted housing through a support post as shown on Drawing No. VM623-2. An integral concrete slab shall be poured to enclose the posts and the pavement junction box containing the earth electrode (refer to Clause 6.4.3), and the telephone line access pit (as shown on Drawing No. VC002-43).

Ground-mounted controllers shall be installed on the concrete footing referred to in Clause 6.6. Particular care shall be taken to align the 20 mm internal diameter conduits for the

telephone line into the controller, and to ensure the housing and its frangible mounting plates are correctly positioned and installed in accordance with the controller manufacturer's installation instructions. Any variation from the manufacturer's instructions shall be subject to prior agreement by the Authority.

All cables entering the controller housing 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 connection chart. All cables shall be clearly identified by means of approved cable markers or by means of approved, non-fading insulated tags securely tied to the cable in a readily visible position.

Each conductor of the cable shall be terminated with a crimp type PIDG lip blade terminal in accordance with the requirements set out in Clause 7.1.4.

For all controllers, the Contractor shall install an insulated draw-wire in the telephone line conduit between the terminal box on the side of the controller housing, and the telephone line pit.

7.6 Electricity Supply Connection

The electricity supply may be obtained from overhead or underground mains, as set out in Clause 6.7. In the case of an overhead supply, the Contractor shall install a fuse box in accordance with Drawing VM007-2. The method of installation shall be in accordance with Drawing No. VE500-1. In the case of an underground supply, the Contractor shall install an underground fuse assembly (Drawing No. VE500-10) complying with RTA Specification UGS/5.

The installation of an underground fuse box is shown on Drawing No. VE500-11.

In new areas where traffic light signals have not previously been installed, the Contractor may be required to make provision for fitting of a KWH meter. In this respect, the Contractor shall consult with the relevant Supply Authority as to the requirements, and provide an approved type galvanised steel meter box on the supply pole.

The Contractor shall arrange for, and carry out all tests required by the Electricity Supply Authority and shall pay all fees connected therewith. After such tests have been completed and the installation passed, the Contractor shall inform the Superintendent that the supply is available (refer to Clause 9.1).

7.7 Special Facilities

Where indicated on the traffic design plan, the Contractor shall provide special facilities, such as auxiliary signals in Fire/Ambulance stations. Drawing No. VE535-1 shows typical connections. All cables to this auxiliary equipment shall be fully ducted.

Particulars of other special requirements, e.g. linking to other signal installations or railway level crossing equipment, will be indicated in the tender documents where applicable.

7.8 Surface Treatment

7.8.1 General

The Contractor shall make good any damage to all equipment and surface treatment occasioned during transport, storage or installation.

Hot-dipped galvanised signal posts and mast arms shall not be painted, but any areas where the protective coating has been damaged during transport, storage or installation shall be touched up with a cold-curing galvanising paint conforming with AS/NZS 3750.9.

7.8.2 Reflectorised Bands

All posts located on medians, and those located in exposed positions on other islands, shall be provided with 1.2 m wide reflectorised bands commencing at 0.75 m above ground level. These reflectorised bands shall be yellow pressure-sensitive Class 1 retro-reflective material in accordance with AS 1906 Part 1 and shall be applied around the entire circumference of the post.

The reflectorised bands shall be applied immediately after the erection of the post on site.

7.9 Traffic Signs on Signal Posts

Where traffic signs are to be installed onto signal posts, the following requirements shall be met:

- (a) Standard mounting brackets in accordance with Drawing Nos. VT006-51, VT006-52, VT006-53, VT006-54, VT006-55, VT006-56, VT006-57, VT006-58 or VT006-61 shall be used for mounting each traffic sign. Lock washers shall be used at each hinged joint (refer to Drawing No. VT006-60).
- (b) Signs shall not be attached to the signal lantern target board or bracket.
- (c) Sign brackets shall not share the same mounting points with signal lanterns or other signal equipment.
- (d) Signs shall not be mounted in such a way that interferes with the ability of drivers and pedestrians to observe the traffic signals, or blocks access to signal lanterns by preventing the full opening of the lantern doors.
- (e) Bands shall not be used for mounting signs permanently. Bands may only be used in a temporary situation for a period of up to one month unless otherwise directed by the Superintendent.

8. SPECIAL REQUIREMENTS FOR RECONSTRUCTION OF EXISTING TRAFFIC LIGHT SIGNAL LOCATIONS

Every day immediately upon arrival at any existing traffic light signal location to carry out work, the Contractor shall notify the RTA Transport Management Centre by telephone of the following details:

- (a) the time the Contractor arrived on site;
- (b) a brief description of the work intended to be carried out on site; and
- (c) if existing equipment is to be altered or removed, details of the equipment affected.

Every day immediately before leaving the site, the Contractor shall notify the RTA Transport Management Centre by telephone of the following details:

- (i) the time the Contractor will be leaving the site; and
- (ii) confirmation of any alterations and removal carried out on the existing equipment.

NOTE: The contact telephone number of the RTA Transport Management Centre is (02) 8396 1686.

The Contractor shall also record the information notified to the RTA Transport Management Centre, including the date of each notification, in a site-work logbook. The logbook shall be made available for inspection by the Superintendent on request. The Contractor shall submit a copy of the log book, duly certified by the Superintendent as an accurate and complete record of the Contractor's presence and works carried out at the site, to the Authority's representative at the time of the tests for practical completion (see clause 9.2).

Where reconstruction of an existing traffic light signal location requires the blacking-out of the site, the Contractor shall obtain the Superintendent's approval as regards the date and time the signal installation may be switched out of service for the purpose of reconstruction.

Permission for the switching-off of existing traffic light signals shall constitute a **HOLD POINT**.

The Contractor shall arrange its work in such a manner that the out-of-service period is kept to an absolute minimum, and whenever practicable, the installation shall be restored to service during peak-hours and overnight.

If the traffic light signals are expected to be out-of-service for more than two hours, the Contractor shall install covers in accordance with Clause 7.1.9.

The Contractor shall comply with the relevant requirements of the *Traffic Control at Work Sites* manual (as amended). The cost of providing, maintaining and displaying all safety and warning equipment shall be borne by the Contractor. The Contractor shall inform the RTA Transport Management Centre and the Police of the details of the blackout and, if necessary, arrange for Police attendance.

Where the reconstruction work is not a Minor Reconstruction (refer to Clause 3.8 for the definition of Minor Reconstruction), the Contractor shall in all cases, unless otherwise stated in the tender documents with the agreement of the Authority, provide a new traffic signal controller in accordance with Clause 5.6 and replace the existing controller.

The Contractor shall replace all existing post-mounted vehicle loop detector facilities, if any, with integral detectors in the controller housing and install new detector feeder cables to connect the existing detector loops to the controller housing, unless otherwise agreed to by the Authority.

Where work is required to be carried out on or to existing post top assemblies containing porcelain type terminal blocks, (e.g. disconnection or termination of cables), the Contractor shall replace such post top assemblies with a new, current RTA-approved type unless otherwise agreed to by the Authority.

The Contractor shall arrange for the existing control equipment and all reclaimable items of the existing traffic light signal installation to be returned to the Authority's Store by arrangement with the Superintendent. For the purposes of this requirement, all items of equipment that are installed aboveground are reclaimable items. Where stipulated in the tender documents, the Contractor shall replace obsolete equipment and repair damaged construction.

NOTE: The Authority may direct the Contractor to dispose of certain items of equipment reclaimed or obsolete equipment instead of returning them to the Authority's Store.

The Contractor shall take due care not to damage the existing control equipment and reclaimable equipment, including any connection cables which form an integral part of the equipment, during removal and in transit. Any damage to such equipment shall be made good by the Contractor, or the cost of repairing the damage shall be borne by the Contractor. Lantern cables and cores must not be cut short in the process.

NOTE: In removing existing items of equipment from an installation, lantern cables should be properly disconnected from post top terminals by loosening the terminal screws and pulling out the conductor wires from the terminals. All mast arms and posts, except Type 1 posts, should be properly disassembled from their footings. Type 1 posts may be sawed or cut off below the footpath or paving level.

If the Contractor, in the course of the reconstruction work, discovers any damage in the existing installation, he/she shall promptly bring this to the attention of the Superintendent in order that the Superintendent can consult with the Authority to determine the appropriate remedial action.

All new underground cable shall be installed in ducts (refer to Clause 6.4.2). Where existing direct-buried cables are disturbed, these shall be reinstalled in ducts as part of the reconstruction. At the point where the ducts terminate and (undisturbed) direct-buried cables continue, the Contractor shall install a footway pit in accordance with the requirements of Clause 6.4.3.

All new underground ducts shall be installed to replace the existing asbestos cement (fibro) pipes where cables are required to be replaced or added, unless otherwise agreed by the Authority.

Where the number of spare cores in an existing multicore cable is less than that stipulated in Clause 6.4.1, there is no requirement to replace such cable provided that there are sufficient cores to perform all the required functions.

All existing wiring of other systems on site shall be reinstated if disturbed. Where the location of the control equipment is to be changed, all existing wiring of other systems that terminate in the existing controller housing shall be extended to the new location and re-terminated.

9. FINAL TESTS

9.1 Contractor's Tests

Before handing over the traffic light signal installation to the Authority, the Contractor shall carry out all such inspections and electrical tests as are necessary to ensure that the installation

complies fully with the requirements of the Contract, including those of the local Electricity Supply Authority.

On completion of the Contractor's own tests and inspection, and following rectification of any deficiencies found, the Contractor shall inform the Superintendent that the supply has been connected (refer to Clause 7.6) and that the installation is ready for tests for practical completion. The Contractor shall supply a copy of its own test records to the Superintendent before the commencement of tests for practical completion.

9.2 Tests for Practical Completion

Upon receipt of advice from the Contractor that the installation is ready for tests for practical completion, the Superintendent will arrange for the Authority to carry out a full inspection and test of the complete installation. The Contractor shall give at least two working days' notice of the site's being ready for such tests.

The Contractor shall also show the Superintendent and the Authority's representative(s) all details of "work-as-executed" variations, marked on the provisional drawings, as required under Clause 5.4.3 or Clause 5.5.

For reconstruction works, the Contractor shall submit a duly certified copy of the site-work logbook referred to in Clause 8 to the Authority's representative before the tests for practical completion commence. Practical completion will only be considered upon the receipt of an acceptable copy of the logbook by the Authority. The Authority will advise the Superintendent and the Contractor whether the installation passed the tests for practical completion.

10. PROGRAMME OF WORKS

The Contractor shall keep the Superintendent fully informed concerning his/her proposed installation programme. Such information shall include the date of commencement of excavations at each traffic light signal site and the date of completion of all electrical works. If the work is proposed to be carried out in several stages, the commencement and completion dates of the several stages shall also be indicated. The Contractor shall take particular care with programming of reconstruction work where existing traffic light signals are to be switched out of service, as referred to in Clause 8.

If there is any change in the proposed programme, through whatever circumstances, the Contractor shall forthwith inform the Superintendent in writing.

The Superintendent will keep the Contractor informed of the anticipated progress of preliminary roadworks (refer to Clause 4.1).

Blank page

APPENDIX A

LIST OF STANDARD DRAWINGS

APPENDIX A

LIST OF STANDARD DRAWINGS

This Appendix and Appendix B together contain a full listing of all of the drawings that have been referenced in this Specification. Drawings, which may be referred to more often on site during installation work, such as those showing typical installation details, are listed in this Appendix. Drawings, which may not be referred to as often on site, such as those showing manufacturing details, are listed in Appendix B.

Note: Appendix B also lists other applicable RTA equipment specifications and drawings.

Note: Drawings and specifications that are applicable but are not listed in either Appendix A or Appendix B will be included in the tender documents or issued by the Superintendent.

Refer to Clauses 2.2 and 5.4.1 regarding drawing issues.

Drawing No.	Description
VC001-4	Precaution against obstruction of water mains
VC001-7	Safety provisions for traffic signal installation work
VC001-8	Typical excavations and installation of components for mid-block locations
VC001-9	Typical intersection excavations and installation of component parts
VC002-24	Footing for ground-mounted controller housing
VC002-40	Mechanical and special installation details of brackets for offsetting a type 2 post
VC002-43	Footing for type 2 post and post-mounted controller
VC002-44	Type 1 post installation details
VC002-45	Installation and mechanical details of special type 2 post with shallow cover

Drawing No.	Description
VC002-51	Footing for type 2 post
VC002-52	Footing for type 5 and type 9 mast arms and type 6 post
VC002-55	Footing for ground-mounted controller housing with pre-cast concrete footing top
VC002-65	Footing for Type 10 and Type 11 mast arms
VC005-17	Method of installation of stop line detectors
VC005-18	Method of installation of advance detectors
VC005-19	Symmetripole loop detector wiring guide
VC005-22	Symmetripole loop detector test procedure
VC007-4	General arrangement of a pavement junction box pit
VC007-5	Large and small footpath cable junction pits
VD001-5	Standard positioning of traffic signal components at intersections
VD001-6	Standard positioning of traffic signal components at mid-block locations
VD001-7	Orientation of pedestrian push-button arrow disc
VD002-20	Typical traffic signal design plan for mid-block location
VD002-21	Typical cable installation plan for mid-block location
VD002-22	Typical traffic signal design plan for intersection location
VD002-23	Typical cable installation plan for intersection location
VD002-25 (4 sheets)	Traffic signal post top assembly-suggested terminal allocations
VD002-37	Typical cable connection chart for intersection location
VD003-6 (7 sheets)	Symbols and abbreviations
VD006-18	Standard cable chart for mid-block pedestrian-actuated signals
VE500-1	General arrangement of consumer mains for overhead supply

Drawing No.	Description
VE500-11	Installation of underground fuse box
VE530-7	Standard connection chart for post-mounted audio-tactile equipment
VE530-8	Method of installation of audio-tactile signal facilities
VE535-1	Connection diagram for Fire/Ambulance station signals
VM015-16	Assembly details of terminal box, lanterns and pedestrian push buttons on wooden poles
VM015-18	General arrangement of traffic signals on wooden poles
VM015-23	General arrangement for a single lantern on a wooden pole
VM200-27	Assembly details for dual lanterns using lock washers
VM200-28	Assembly details of lock washers
VM202-8	Traffic signal lantern and accessories assembly on standard type 2 post
VM202-12	Installation of traffic signal priority sign (R1-202)
VM211-6 Sheet 1	General arrangement of type 5 mast arms
VM211-10	Recommended method of assembly for type 5 mast arm
VM211-17	Lower assembly details of terminal box and lanterns for mast arms and type 6 post
VM211-20	Safety clearances from overhead power lines and communications cables for traffic signals and signs
VM211-21	Assembly details of upper lanterns to type 5 mast arms
VM211-26	Assembly details of type 5L and 5S mast arms
VM212-2	General arrangement of type 6 post
VM215-1	General arrangement of type 9 mast arms
VM417-3	Method of jointing multi-core traffic signal cables
VM417-4	Method of protection for two-core screened detector feeder cables

Drawing No.	Description
VM417-5	Method of inserting lip blade crimp lugs into terminals
VM625-17	Outline and arrangement of post-mounted controller
VR007-6	Maximum allowable cable combination in ducts for traffic signal installation
VT006-60	Assembly details for traffic signs using lock washers

Blank page

APPENDIX B

**APPLICABLE RTA
EQUIPMENT SPECIFICATIONS AND DRAWINGS**

APPENDIX B**APPLICABLE RTA
EQUIPMENT SPECIFICATIONS AND DRAWINGS
(Refer to Clauses 3.2 and 5.6.2)**

The following is a list of applicable RTA equipment specifications and drawings for some of the major items of equipment.

NOTE: Refer to Clauses 2.2, 5.4.1 and 5.6.2 regarding currency of specification and drawing issues.

<u>Applicable RTA Specifications</u>	<u>Equipment Covered</u>
ATS/4	Audio-tactile equipment
C/12	Cables for traffic signal installations
ILD/1	Controller-specific vehicle detector equipment
LD/7	Rack-mounted vehicle detector equipment
LSS/2	Slot sealant for vehicle loops
MA/1	Traffic signal mast arms
P/6	Traffic signal posts
PB/6	Pedestrian push-button assemblies
PL/9	Pedestrian signal lanterns and accessories
PCF/2	Pit covers and frames
QHL/2	10V traffic signal lamps
TSC/4	Controller and housing
UGS/5	Underground mains fuse
VL/11	Vehicular signal lanterns and accessories

<u>Applicable RTA Drawings</u>	<u>Equipment Covered</u>
VC002-25	"L" bolt for controller housing footing
VC002-27	"L" bolt for type 2 post footing
VC002-38	Holding-down bolt assembly for type 5 and type 9 mast arms and type 6 post
VC002-40	Offset mounting bracket for type 2 posts
VC002-49	Reinforcing stirrup for type 2 post footing
VC002-50	Holding down bolt assembly for type 2 post (alternative method)
VC002-56	Holding-down bolt assembly for ground-mounted controller using a pre-cast concrete top
VE500-10	Underground fuse box
VM007-2	Pole mounting fuse box
VM012-7	Lantern mounting straps
VM012-8	Adjustable "Z" bracket for 200 mm lanterns
VM012-12	Fixed "Z" bracket for 200 mm lanterns
VM012-13	Fixed "Z" bracket for 300 mm lanterns
VM012-14	Tee-bar strap for dual 200 mm lanterns
VM012-15	Tee-bar strap for dual 300 mm lanterns
VM015-21	Terminal box for mounting on wooden poles
VM015-22	Terminal box for mast arms and type 6 posts
VM015-24	Terminal box for mounting a single signal lantern on a wooden pole
VM016-10	Pavement junction box casting
VM041-32	Direction arrow/transducer disc for pedestrian push-button assemblies

<u>Applicable RTA Drawings</u>	<u>Equipment Covered</u>
VM052-5	Support cradle and securing bracket for underground fuse box
VM200-10	Lantern mounting bracket for wooden poles
VM200-14	Lower mounting bracket
VM200-15	Post top assembly
VM200-19	Push-button mounting bracket for wooden pole
VM200-24	Lock washer
VM200-29	Special lock washer for T-bar assemblies for dual lanterns
VM201-16	Type 1 post (mechanical details)
VM201-17	Base plate for type 1 post
VM202-1	Type 2 post (mechanical details)
VM202-5	Type 2 push-button post (mechanical details)
VM202-10	Type 2 adaptor plate for type 5 or 6 footing
VM206-13	"L" bracket for target board
VM206-14	Target boards for 200 mm 1-aspect, 3-aspect, "3 + 3"-aspect, and 4-aspect signal lanterns
VM206-21	Target boards for 300 mm 3-aspect and "3 + 3"-aspect signal lanterns
VM208-27	Symbol mask for 200 mm signal lanterns
VM208-29	Type B 200 mm and 200 x 300 mm closed visors
VM208-31	Type A 200 mm open visor
VM208-39	Blanking-out disc for signal lanterns
VM208-42	Symbol mask for 300 mm signal lanterns

<u>Applicable RTA Drawings</u>	<u>Equipment Covered</u>
VM208-43	Type B 300 mm and 300 x 400 mm closed visors
VM208-44	Type A 300 mm open visor
VM208-45	Louvre for 200 mm signal lanterns
VM211-22	Type 5 mast arm: mast column
VM211-23	Type 5 mast arm: outreach 5L
VM211-24	Type 5 mast arm: outreach 5S
VM211-25	Type 5 mast arm: upper lantern support
VM211-27	Type 5 mast arm: upper lantern support to suit 200 mm lanterns
VM211-28	Type 5 mast arm: outreach 5XL
VM212-1	Type 6 post (mechanical details)
VM213-1	Finial cap for post top assemblies
VM213-2	Finial cap (split type) for post top assemblies
VM215-2	Type 9 mast arm: mast column
VM215-3	Type 9 mast arm: outreach arm (various lengths)
VM215-4	Type 9 mast arm: upper lantern support
VM215-5	Type 9 mast arm: identification plate
VM417-3	Cable jointing kits
VM418-1	Traffic signal out-of-service lantern cover (yellow)
VM418-3	Traffic signal out-of-service lantern cover (black)
VM620-19	Engraved plate for emergency signal control switch
VM623-2	Supporting post for post-mounted controller housing
VM626-6	Mounting bracket for audio-tactile housing on mast arms and type 6 posts

**Applicable
RTA Drawings****Equipment Covered**

VM626-7	Mounting bracket for audio-tactile housing on an ELP
VT006-51	Single mounting bracket for small signs
VT006-52	Single mounting bracket for large signs
VT006-53	Double mounting bracket for small signs
VT006-54	Double mounting bracket for medium signs
VT006-55	Double mounting bracket for large signs
VT006-56	Vertical saddle (bracket) for small signs
VT006-57	Vertical saddle (bracket) for large signs
VT006-58	Horizontal saddle (bracket) for various sized signs
VT006-61	Single end mounted bracket for special stop signs

APPENDIX C

**REQUIREMENTS FOR
PREPARATION OF
CABLE CONNECTION CHARTS**

APPENDIX C

REQUIREMENTS FOR PREPARATION OF CABLE CONNECTION CHARTS

The following rules apply to the laying out and drawing up of cable connection charts for traffic light signals.

1. GENERAL

The Cable Connection Chart shall be divided into the following sections:

- (a) Chart Proper, giving the interrelation between cable numbers, type of cable, cable core identification, post numbers, post terminal numbers, controller terminal numbers and the service function.
- (b) Cable Layout Diagram showing the outline of the location, not to scale, but bearing a good resemblance to the actual site. This diagram shall clearly indicate the North Point, all posts complete with designation, controller, detectors and detector numbers, cable routes complete with designation, street names, vehicle and pedestrian phasing. In all cases, designations shall correspond with those given on associated traffic design plan and cable installation plan.
- (c) Loop Detector Cable Connections showing the housing termination for each of the 2-core screened cables (detector feeder cables).
- (d) Supplementary Information covering references to other drawings, controller information and special notes.

2. LAYOUT OF CHART

The layout of the chart referred to under item 1(a) above shall follow the general standard adopted by the Authority and as shown on a typical cable connection chart Drawing No. VD002-37. A CADD version of these charts is available from the Traffic Equipment and Standards Office, Asset Management Branch, Level 1, 85 Flushcombe Road, Blacktown.

2.1 Functional Groupings

The various functions for which cable cores are allocated, shall be grouped in the following categories:

- (a) Vehicle lanterns;
- (b) Pedestrian lanterns;
- (c) Pedestrian push buttons;
- (d) Common or Miscellaneous;
- (e) Spares.

Within each grouping, functions are to be listed in alphanumerical order from top to bottom.

2.2 Numbering of Posts and Cables

Posts are numbered on the Traffic Design Plan in a "clockwise" sequence starting from the controller. On the cable chart, each post is allocated a separate column, numbered from left to right, starting with post No. 1. Each post column is sub-divided into a number of smaller columns, the first one of which shows the post terminal number. The other small columns shown for each post are first the *primary* cable, followed by other cables terminated on the same post.

The *primary* signal cable for a particular post is defined as the one cable, which carries all the functions from that post towards the controller, and this cable is always numbered the same as the post.

2.3 Controller Housing

At the far left of the chart, there are a number of columns for multicore cables terminated at the controller housing. The housing terminals are allocated during the adaptive engineering stage and will vary somewhat depending on the controller configuration.

2.4 Core Allocations for Multicore Power Cable

As far as practicable, the core numbers shall correspond with the post-terminal numbers for the same function. Note that this convention cannot always be followed where cables with different numbers of cores are joined at a post top.

The black (BK), grey (GY) and green/yellow (G-Y) cores must be terminated at terminals N, C and E (earth stud) respectively.

In all cases, white cores 1 (ONE), 8 (EIGHT) and 11 (ELEVEN) shall be included amongst spare cores.

It is to be noted that post terminal Nos. 27, 28 and 29 do not have correspondingly numbered cable cores; and there are no correspondingly numbered post terminals for white cores 1 (ONE), 8 (EIGHT) and 11 (ELEVEN).

2.5 General Terminal Allocations

The miscellaneous or common functions shall be terminated at all posts, viz.:

- (a) Lamp Active - Terminal 9 using white core 9 (NINE);
- (b) Lamp Return - Terminal N using the black core;
- (c) Push-button Return - Terminal C using the grey core;
- (d) Earth - Earthing stud using the green/yellow core.

The allocation of post terminals shall follow the general guidelines shown in Drawing No. VD002-25, Sheet 1. Sheets 2, 3 and 4 of Drawing No. VD002-25 illustrates the preferred allocation of functions for three common phasing arrangements.

It should be noted that lamp-monitoring equipment introduced in 1989 requires that approaches on the same signal phase must now be electrically separated. This requirement is indicated on Traffic Design Plans by an asterisk.

3. LOOP DETECTOR CABLE CONNECTIONS

Two-core screened cables are run directly from individual detector loops to the controller and each two-core cable is labelled according to the numerical loop designation on the traffic design plan. The connections for these cables are shown in a separate tabulation below the cable layout on the cable connection chart.

The detector numbers are shown in the first column with the detector functions to suit in the second column; and the controller housing terminals are then allocated in accordance with the following rules, in the third column of the table except for post-mounted controllers which follow the detector number, eg C1-1, C2-2 etc in sequence.

Rule 1 Using the Traffic Design Plan, group the adjacent loops of each approach together so that they each use a channel of the same sensor card. Combine approaches to obtain the most economical use of sensors and channels while following the alpha/numerical order where possible.

- Rule 2 Because of the current use of 2- and 4-channel sensor cards, there will often be a spare or unused loop position due to an odd number of loops on some approaches or combination of approaches. The standard adopted is that each card space always provides four loop positions. If a 2-channel sensor card is used, it will always result in two unprovided for loop positions following in that card space. The 2-channel sensor card may therefore also be selected for certain sensor positions on the rack to help maintaining the alpha/numerical order. The 8-channel cards are to be considered always as 2 x 4-channel cards for the purpose of these rules. Similarly, a 16-channel card should be considered as a 4 x 4-channel card.
- Rule 3 Where there are five loops on a 4-lane approach, select the loops adjacent to each other for the same sensor. The loop that is left over (i.e. the departure section of the right turn detector) can then be combined with another group and sensor. This applies to a loop in a single lane approach also.
- Rule 4 Where there are five loops on a 5-lane approach, select the split between each sensor in a non-sensitive location, such as between the first 2 loops in from the kerb. These loops would normally operate the same so the effects of interaction and cross talk between the loops is not as bad as splitting sensors between different operating loops.
- Rule 5 All post-mounted loop detector outputs, fire-call switch and pedestrian push-buttons will still terminate on the "E" block, starting from E5 for the first detector or push-button. The order of detector switch numbers shown on the Traffic Design Plan is to be strictly applied in this case.

Blank page

APPENDIX D

**RECOMMENDED PROCEDURE
FOR ASSEMBLY OF
TYPE 5 MAST ARMS**

APPENDIX D**RECOMMENDED PROCEDURE FOR
ASSEMBLY OF TYPE 5 MAST ARMS**

The outreach, or straight extension section of the mast arm is attached to the column by means of a forced tapered fit, which will have at least the same strength as a one piece steel column. Carrying out the following procedure will achieve an effective joint.

1. Place the column section on wooden bearers.
2. Check that the joint area of both sections is clean, undamaged and deburred.
3. The outside mating surface of the column and the inside mating surface of the outreach should be smoothed and polished with emery tape or a finishing wheel.
4. Apply a coating of oil to the mating surfaces of the joint.
5. Line up the column and the outreach so that the M12 nut welded into the top of the column is in the correct relationship with the 100 mm x 14 mm slot in the outreach section.
6. To achieve the specified overlap, a force of up to 2 tonnes must be applied. During assembly, the joint area should be vibrated by striking it with a mallet, or length of wood.

The amount of overlap must be such as to allow the M12 set screw to be tightened within the range of the slot to prevent accidental rotation at the joint. The recommended method of applying the force is shown on Drawing No. VM211-10.

APPENDIX E

QUALITY SYSTEM REQUIREMENTS

APPENDIX E

QUALITY SYSTEM REQUIREMENTS

1. THE QUALITY SYSTEM

The Contractor shall plan, develop and maintain a Quality System in accordance with the requirements of AS/NZS ISO 9001:2000 and the RTA Prequalification Scheme for Installation and Reconstruction of Traffic Light Signals.

The Contractor shall immediately implement changes to its system if the Quality System:

- (a) does not adequately address Specification requirements; or
- (b) is causing non-conformance; or
- (c) has to be changed as a result of an audit; or
- (d) no longer represents the Contractor's current and/or appropriate practice.

The Contractor shall immediately inform the Superintendent of any change to its Quality System and shall promptly submit amended documentation detailing the change.

2. QUALITY SYSTEM DOCUMENTS

The Quality System documents provided by the Contractor shall be the:

- (a) Quality Manual;
- (b) System Procedures; and
- (c) Technical Procedures.

The Quality System documents shall cover all works under the Contract, both on-site and off-site.

The Quality Manual shall be prepared in accordance with the requirements of AS/NZS ISO 9001:2000.

3. SPECIAL REQUIREMENTS

The following special requirements shall apply.

(a) Quality System Procedures

The Contractor shall develop, maintain and implement procedures in accordance with AS/NZS ISO 9001:2000 as part of the corporate Quality System.

The Quality Manual or Project Quality Plan shall describe or reference the applicable quality system procedures prepared for all system requirements contained in AS/NZS ISO 9001:2000 Section 4. Quality system procedures referenced in the Project Quality Plan shall be readily accessible to project personnel at their work locations.

(b) Process Control

Documented process control procedures shall be prepared, as required by AS/NZS ISO 9001:2000 Clause 4.9(a) and the additional requirements of the Contract to address the planning, process descriptions, process verification and control of work, and identify all relevant factors affecting the quality of the product.

The Contractor shall identify any work processes (including subcontracted work) for which results cannot be fully verified by subsequent inspection and testing. In such cases, process controls shall be documented to indicate operator qualifications, equipment controls and method of continuous monitoring of process parameters.

(c) Inspection and Test Plan(s) and Procedures

The Inspection and Test Plan(s) shall cover all inspection and testing required by the Specification.

Inspection and Test Plans shall be submitted to the Superintendent in sufficient time for acceptance before the commencement of the activities covered by the Inspection and Test Plans.

In addition to the Inspection and Test Plan(s), the Contractor shall prepare Inspection and Test Procedures for all inspection and testing activities covered by the Inspection and Test Plan(s). The Inspection and Test Procedures shall be submitted when requested by the Superintendent.

The Inspection and Test Plan(s) and the supporting Inspection and Test Procedures may be developed as a combined document.

(d) Traceability

Traceability is required for concrete batches, traffic signal cable (multicore, loop and loop-feeder), and loop sealant.

(f) Records

The attention of the Contractor is also drawn to Clause 26.5 of the General Conditions of Contract.

(g) Non-conformance

The Contractor shall promptly notify the Superintendent of any product or service non-conformance, except where conformance is to be achieved by simply reworking with the original process.

A non-conforming product shall not be covered up unless a disposition has been accepted by the Superintendent and implemented by the Contractor.

Where required by the Superintendent, a **HOLD POINT** shall apply prior to covering up rectification work, to allow the Superintendent to inspect the rectification work.

4. INSPECTIONS

The Contractor shall not proceed beyond a **HOLD POINT** until the **HOLD POINT** has been released by the Authority.

The Contractor shall make suitable arrangements to notify the Authority when a **HOLD POINT** will be reached so that the Authority can review and/or witness any work process or test being undertaken by the Contractor and thus expedite the release of that **HOLD POINT**.

APPENDIX F

**CADD REQUIREMENTS FOR
ELECTRICAL TCS DRAWINGS**

APPENDIX F

CADD REQUIREMENTS FOR ELECTRICAL TCS DRAWINGS

1. GENERAL

This Appendix specifies the CADD requirements for the preparation of electrical design drawings for the installation of traffic signals and other traffic control devices. The drawings covered are:

- (a) Cable installation plans;
- (b) Cable connection charts;
- (c) Duct layout plans;
- (d) Manufacturing details of equipment;
- (e) Installation details of equipment; and
- (f) Circuit and connection diagram of equipment.

All drawings shall comply with the relevant requirements in this Appendix.

1.1 Available Templates

For cable installation and duct layout plans, an electronic template of the border and basic outline showing all the information contained in Levels 1 and 2 is available.

For cable connection charts, an electronic template of the A1-, A2- and A3-sized blank grids showing all the information contained in Level 1 is available.

2. SPECIFICATION FOR DRAWINGS

2.1 File Naming Convention

2.1.1 In UNIX Operating System

The following are typical file names:

For design layout:	VV2000_25A.dgn
For cable installation:	VV2000_26A_INS.dgn
For cable chart:	VV2000_27A_CHT.dgn
For duct layout:	VV2000_28A_DCT.dgn

In each file name above, the first two letters (VV) represent the plan series; the next four digits (2000) represent the unique TCS number; the next two digits after the underscore (e.g. (26)) represent the plan sheet number; the next letter (A) represents the drawing issue; the next three letters after the underscore represent the plan type (e.g. INS = Cable Installation; CHT = Cable Chart; DCT = Duct Layout) except in the case of design layout plans (that is, traffic design plans) where these three letters are omitted; and the last three letters after the full stop represent the file type (e.g. dgn, dxf and dwg).

2.1.2 In DOS

In DOS, the file name is restricted to eight digits. The following are typical file names:

For design layout:	D200025A.dxf
For cable installation:	I200026A.dxf
For cable chart:	C200027A.dxf
For duct layout:	P200028A.dxf

In each file name above, the first letter represents the plan type (e.g. D = Design Layout (i.e. traffic design plan); I = Cable Installation; C = Cable Chart; P = Duct Layout); the next four digits (2000) represent the unique TCS number; the next two digits (e.g. (26)) represent the plan sheet number; the next letter (A) represents the drawing issue; and the last three letters after the full stop represent the file type (e.g. dgn, dxf and dwg):

NOTE: Where the sheet number is less than 10, zero shall be inserted before the single digit sheet number.

2.2 Sheet Size

The most common sheet size is A1 but may vary through the range A0, A1, A2, A3, A4 and is to be in accordance with the ISO-A series specified in AS 1100.

2.3 Scales

Cable installation plans and duct layout plans shall be prepared and submitted in Real World Co-ordinates 1:1 using metres as the unit of measurement and plotted at a scale of 1:200.

Plans showing manufacturing details of equipment shall be prepared and submitted in Real World Co-ordinates 1:1 using millimetres as the unit of measurement, and may be plotted at the most practical scale of between 1:1 to 1:10.

Plans showing installation details of equipment shall be prepared and submitted in Real World Co-ordinates 1:1 using metres or millimetres as the unit of measurement and may be plotted at the most practical scale of between 1:2 to 1:20.

Cable connection charts are not to scale, but shall be prepared and submitted in paper size.

Circuit and connection diagrams of equipment are not to scale, but shall be prepared and submitted in paper size.

2.4 Font

Engineering font or Monotxt font with a width factor of 0.8 shall be used.

2.5 Symbols (Cells)

Common symbols for use on cable connection charts and cable installation plans are defined on Drawing No. VD003-9 (2 sheets).

2.6 Colour and Line Thickness Definitions









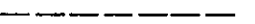



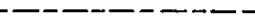
The following colour and line thickness definitions shall be used:

<u>Colour</u>	<u>Line Thickness (mm)</u>
Blue	0.15
White	0.25
Red	0.35
Green	0.50
Cyan	0.70
Yellow	1.00

2.7 Line Types

"Line Types" used must match "Line Types" predefined in RTA CADD program, as shown on TABLE F.2.7.

TABLE F.2.7: LINE TYPES USED IN DESIGN OFFICE

<u>LINE TYPE</u>	<u>DESCRIPTION</u>	<u>EXAMPLE</u>	<u>COLOUR</u>
BB (BARRIER LINE)	2 UNBROKEN AND 0.08m APART		RED
BS (BARRIER LINE)	1 UNBROKEN AND 1 AS PER LANE LINE		RED
L1 (LANE LINE)	3.0m PAINT AND 9.0m GAP		RED
C1 (CONTINUITY LINE) LINE)	1.0m PAINT AND 3.0m GAP		CYAN
T1 (TURN LINE)	0.6m PAINT AND 0.6m GAP		CYAN
TB (HOLDING LINE)	0.6m PAINT AND 0.6m GAP		CYAN
1 (MICROSTATION)	DOTTED		WHITE
2 (MICROSTATION)	2.0m STROKE AND 1.0m GAP		WHITE
3 (MICROSTATION)	4.0m STROKE AND 1.0m GAP		WHITE
4 (MICROSTATION)	3.0m STROKE AND 3.0m GAP WITH A DOT IN GAP		WHITE
5 (MICROSTATION)	1.0m STROKE AND 1.0m GAP		WHITE
6 (MICROSTATION)	2.0m STROKE AND 3.0m GAP WITH DOUBLE DOT IN GAP		WHITE
7 (MICROSTATION)	3.0m STROKE AND 0.5m GAP, 1.5m STROKE AND 0.5m GAP		WHITE

2.8 Line Colour and Text Height Allocation

The following lists define the line colours and text heights that shall be used for cable installation plans, duct layout plans and cable connection charts.

- (a) For cable installation plans and duct layout plans:

	<u>Colour</u>
Dimension lines	White
Detectors	Red
Pipe and cable	Green
Unused pipe (Dashed lines)	Red
Cable Layout lines	Red

	<u>Text Height</u> <u>(mm)</u>	<u>Text Colour</u>
Street / Road names	7.0	Cyan
Designations to and from	2.5	White
Grades	2.5	White
Dimensions	2.5	White
Notes	3.0	Red
Labels	3.0	Red
Detector numbering	3.0	Red
Post number in circle	3.0	Red
Notes (Label)	5.0	Green
Cable Layout (Label)	5.0	Green
Registration number	7.0	Cyan
Title	5.0	Green
Issue change	2.5	White
Reference plans	2.5	White

- (b) For cable connection charts:

	<u>Colour</u>
Kerb layout	White
Detectors	White
Detector cables	White
Signal cables	Green
Leader	White
Pedestrian arrow line	Cyan
North Point	White

	Text Height (mm)	Text Colour
Signal and detector facilities	3.0	Red
Terminations	3.0	Red
Number of spares	3.0	Red
Post numbers	5.0	Green
Registration number	7.0	Cyan
Post numbers in layout	2.0	White
Detector numbers in layout	2.0	White
Remainder of text in layout	2.5	White
Title text	4.0/5.0	Green
Issue change	2.5	White
Cable number in circle	3.0	Red
Detector terminations	2.5/3.0	White/Red
Reference plans	2.5	White

2.9 Levels (or Layers)

2.9.1 Cable Installation Plans

Information on each cable installation plan shall be organised into different levels (or layers) as follows:

(a) Level 1 (or Layer 1)

- ◆ Title Block and Border, including the following information:
 - Plan Registration Number and Issue
 - File Number
 - Scale
 - Site Location and Plan type
 - Designed by
 - Checked by
 - Approved by
 - Reference plans
- ◆ Road, island and property outlines including; utilities, street names, North Point, destinations and grades.

(b) Level 2 (or Layer 2)

- ◆ Post types and locations
- ◆ Post number assigned to each post
- ◆ Detector location, width and identifying number
- ◆ Electric supply point
- ◆ Location and type (graphical representation) of Controller

(c) Level 3 (or Layer 3)

- ◆ Cable and duct locations

- ◆ Cable and duct depths
- ◆ Pit types and locations
- ◆ Dimensions
- ◆ Labels and leaders
- ◆ Cable Layout Diagram
- ◆ All notes
- ◆ Job Instruction issue change notes

(d) Level 4 (or Layer 4)

Level 4 is an optional Group. This group shall contain the outline of existing road and island channelisation before any modifications due to roadworks. If the outline is not modified, Level 4 is not required.

2.9.2 Cable Connection Charts

Information on each cable connection chart shall be organised into different levels (or layers) as follows:

(a) Level 1 (or Layer 1)

- ◆ Title Block, Border and Grid, including the following information:
 - Plan Registration Number and Issue
 - Site Location and Plan type
 - Designed by
 - Checked by
 - Approved by
 - Reference plans

(b) Level 2 (or Layer 2)

- ◆ All connection information needed in grid, including the following information:
 - Names of Signal Facilities
 - Housing Terminals
 - Cable labels and size
 - Post numbers
 - Lines to define post width in columns
 - Number of Post Terminals
 - Post Terminals
 - Cable Cores
 - Number of Spares
 - Detector labels and terminations
 - All notes
 - Job Instruction issue change notes

(c) **Level 3 (or Layer 3)**

All information contained in the *Cable Layout Diagram* (Refer to Appendix C).

2.9.3 Duct Layout Plans

Information on each duct layout plan shall be organised into different levels (or layers) as follows:

(a) **Level 1 (or Layer 1)**

- ◆ Title Block and Border, including the following information:
 - Plan Registration Number and Issue
 - File Number
 - Scale
 - Site Location and Plan type
 - Designed by
 - Checked by
 - Approved by
 - Reference plans
- ◆ Road, island and property outlines including utilities, street names, North Point, destinations and grades.

(b) **Level 2 (or Layer 2)**

This is an optional Level. Where required, it shall contain the following information:

- ◆ Post types and locations
- ◆ Post number assigned to each post
- ◆ Electricity supply point
- ◆ Location and type (graphical representation) of controller

(c) **Level 3 (or Layer 3)**

The purpose of this Level is to show any additional information necessary for the "DUCT LAYOUT" which has not been shown in the preceding Levels. Typically it shall contain:

- ◆ Duct size and locations
- ◆ Non standard duct depths
- ◆ Pit types and locations (Optional)
- ◆ Dimensions
- ◆ Labels and leaders
- ◆ All notes
- ◆ Job Instruction issue change notes

(d) Level 4 (or Layer 4)

This is an optional Level. This group shall contain the outline of existing road and island channelisation before any modifications due to roadworks. If the outline is not modified, Level 4 is not required.

2.9.4 Manufacturing Details of Equipment

Information on each plan showing the manufacturing details of equipment shall be organised into different levels (or layers) as follows:

(a) Level 1 (or Layer 1)

- ◆ Title Block and Border, including the following information:
 - Plan Registration Number and Issue
 - File Number
 - Scale
 - Site Location and Plan type
 - Designed by
 - Checked by
 - Approved by
 - Reference plans

(b) Level 2 (or Layer 2)

- ◆ Outlines of actual components

(c) Level 3 (or Layer 3)

- ◆ Hatching
- ◆ Dimensions
- ◆ Labels and leaders
- ◆ All notes
- ◆ Job Instruction issue change notes

2.9.5 Installation Details of Equipment

Information on each plan showing the installation details of equipment shall be organised into different levels (or layers) as follows:

(a) Level 1 (or Layer 1)

- ◆ Title Block and Border, including the following information:
 - Plan Registration Number and Issue
 - File Number
 - Scale
 - Site Location and Plan type

- Designed by
 - Checked by
 - Approved by
 - Reference plans
- (b) **Level 2 (or Layer 2)**
- ◆ Outlines of actual components
- (c) **Level 3 (or Layer 3)**
- ◆ Background details to location of component
 - ◆ Hatching
 - ◆ Dimensions
 - ◆ Labels and leaders
 - ◆ All notes
 - ◆ Job Instruction issue change notes

2.9.6 Circuit and Connection Diagram of Equipment

Information on each circuit and connection diagram shall be organised into different levels (or layers) as follows:

- (a) **Level 1 (or Layer 1)**
- ◆ Title Block and Border, including the following information:
 - Plan Registration Number and Issue
 - File Number
 - Site Location and Plan type
 - Designed by
 - Checked by
 - Approved by
 - Reference plans
- (b) **Level 2 (or Layer 2)**
- ◆ Outlines of actual electrical components including terminators
- (c) **Level 3 (or Layer 3)**
- ◆ Background details to location of components
 - ◆ Wiring and connections
 - ◆ Hatching
 - ◆ Labels and leaders
 - ◆ All notes
 - ◆ Job Instruction issue change notes

3. ADDITIONAL REQUIREMENTS

3.1 Text

Only the standard fonts specified shall be used. No user-defined or other fonts shall be used. No superscripts or subscripts shall be used. The displaced text shall be a separate line of text.

No embedded escape sequences, such as "Tabs", shall be used.

3.2 Hatching versus Solid Fill

All filled-in areas shall be Hatching (solid fill shall not be used).

NOTE: Solid fill is not supported by the CADD program.

3.3 Polylines

Polylines with thickness shall not be used.

NOTE: Polylines are not supported by the CADD program.

3.4 Shapes

Shapes shall not be used.

NOTE: Shapes are not supported by the CADD program.

3.5 Viewports

Viewports shall not be used.

NOTE: Viewports are not supported by the CADD program.

3.6 Two Dimensions

All views on drawings shall be two-dimensional only. No three-dimensional views shall be used.

APPENDIX G

**LIST OF SPECIFICATION CLAUSES
CONTAINING A REQUIREMENT FOR REPORTING**

APPENDIX G**LIST OF SPECIFICATION CLAUSES
CONTAINING A REQUIREMENT FOR REPORTING****(For guidance only)**

This Appendix contains a summary list of the clauses in Specification SI/TCS/8 that include a requirement for reporting. This Appendix is provided for guidance only and must be construed only as such. It does not replace, override, amend or alter any requirements in Specification SI/TCS/8.

NOTE: While care has been taken to ensure accuracy, the summary list in this Appendix may not be complete or error-free. The full text of Specification SI/TCS/8 and other relevant tender or contract documents should always be referred to for any reporting requirement under the Contract.

Clause in Specification SI/TCS/8	Reporting Party	Party to Receive Report	Reporting Event
Clause 4.3	Contractor	Superintendent	Traffic signs in the way of the traffic signal installation.
	Superintendent	Appropriate authority (RTA, local Council, etc.)	Traffic signs in the way of the traffic signal installation.
Clause 5.2	Contractor	Superintendent	Utility services damaged or preventing the proposed installation.

Clause in Specification SI/TCS/8	Reporting Party	Party to Receive Report	Reporting Event
Clause 5.3	Contractor	RTA Transport Management Centre, Local Traffic Police and Council	Road occupancies and use of any public road or space for positioning or storage of equipment or material
	Contractor	Property owner	Use of private properties
	Contractor	Superintendent	Work outside normal working hours
	Contractor	RTA Asset Management, or local Municipal or Shire Council as appropriate	Road Opening Permit
	Contractor	Superintendent	Proposing work on or to any bridge structure
	Superintendent	Relevant Government Bodies	Proposed work on or to any bridge structure
Clause 5.8	Contractor	Superintendent and RTA	Local obstruction to installation position of equipment or conflicting dimensions
	Superintendent	RTA	Local obstruction to installation position of equipment
	Contractor	RTA	Obstruction to equipment maintenance or risk of damage

Clause in Specification SI/TCS/8	Reporting Party	Party to Receive Report	Reporting Event
Clause 6.1	Contractor	RTA Asset Management, or local Municipal or Shire Council as appropriate	Road Opening Permit
	Contractor	Superintendent	Need for a larger excavation
	Contractor	Superintendent	Under-road boring impracticable
Clause 6.4.2	Contractor	Superintendent	Under-road boring impracticable
	Contractor	Superintendent	Use of smaller bore ducts
	Superintendent	RTA	Use of smaller bore ducts
	Contractor	Superintendent	Need for additional conduits to be interrupted
	Superintendent	RTA	Need for additional conduits to be interrupted
Clause 6.4.3	Contractor	Superintendent	Installation of pits in kerb ramp
	Superintendent	RTA	Installation of pits in kerb ramp

Clause in Specification SI/TCS/8	Reporting Party	Party to Receive Report	Reporting Event
Clause 6.5	Contractor	Superintendent	Change to the position or shape of post or mast arm footings
	Contractor	Superintendent	Proposed changes to standard post footing
	Contractor	Superintendent	Proposing work on or to any bridge structure
	Contractor	Superintendent	Mast arm footing location close to an embankment, trench or drain, or in soft unstable or previously disturbed soil
Clause 7.1.2	Contractor	Superintendent	Inadequate safety clearance between mast arms or posts and overhead power lines or communications cables
Clause 7.1.5	Contractor	Superintendent	Local obstructions precluding mounting of lanterns in the stipulated positions
	Superintendent	RTA	Local obstructions precluding mounting of lanterns in the stipulated positions
Clause 7.1.8	Contractor	Superintendent	Before making opening in awnings

Clause in Specification SI/TCS/8	Reporting Party	Party to Receive Report	Reporting Event
Clause 7.6	Contractor	Superintendent	Availability of power supply
Clause 8.	Contractor	RTA Transport Management Centre	Arrival time and details of reconstruction works to be carried out
	Contractor	RTA Transport Management Centre	Departure time and details of reconstruction works done
	Contractor	Superintendent	Blacking out the installation
	Contractor	RTA Transport Management Centre and Police	Blacking out the installation
	Contractor	Superintendent	Return of existing equipment to RTA store
	Superintendent	RTA	Return of existing equipment to RTA store
	Contractor	Superintendent	Damage in existing installation
	Superintendent	RTA	Damage in existing installation
Clause 9.1	Contractor	Superintendent	Availability of power supply
Clause 9.2	Superintendent	RTA	Tests for practical completion
	RTA	Superintendent and Contractor	Results of tests for practical completion

Clause in Specification SI/TCS/8	Reporting Party	Party to Receive Report	Reporting Event
Clause 1, Appendix E	Contractor	Superintendent	Change to the Contractor's Quality System
Clause 3(g), Appendix E	Contractor	Superintendent	Product or service non-conformance
Clause 4, Appendix E	Contractor	Authority	When a HOLD POINT will be reached

Blank page

APPENDIX H

**SUMMARY OF CHANGES
FROM SPECIFICATION SI/TCS/8**

APPENDIX H

SUMMARY OF CHANGES FROM SPECIFICATION SI/TCS/8

This Appendix lists the main changes incorporated in Specification SI/TCS/8 Revision 1, which constitute significant changes from the requirements of Specification SI/TCS/8. Minor editorial changes and spelling corrections have not been included.

The numbering corresponds to the Clause numbers of the new specification. Clauses which were in Specification SI/TCS/8 and which have been deleted from the new specification have been listed separately at the end.

1. Scope

The introduction has been reworded to reflect the "supply-and-install" requirements of the installation/reconstruction work, and also the need for protection of the environment.

2.1 Standard Specifications

This clause now only lists the standard specifications referred to in the Specification. The requirements to comply with these standard specifications have been moved to Clause 3.2

A number of standard specifications have been replaced by new ones. They are: AS 3147 by AS/NZS 3808; AS/NZS ISO 9002:1994 by AS/NZS ISO 9001:2000.

2.2 RTA Specifications and Drawings

Reference to RTA Specification R3452 "Supply of LED lanterns" has been added. The address of RTA Office referred to in this clause has been updated.

3.6 Quality Assurance

The quality system model has been updated from the withdrawn AS/NZS ISO 9002:1994 to AS/NZS ISO 9001:2000.

3.7 Prequalification

The address of the RTA office referred to in this clause has been updated.

3.8 Definitions

Definition of the word "Hold Point" has been altered.

5.4.1 Drawings supplied to the Contractor

The word "Superintendent" has been replaced by the "Authority" in paragraphs one, two and three.

5.4.2 Drawings Preparation

The word "Superintendent" has been replaced by the "Authority" in paragraphs one and two.

5.4.3 Drawings Used for Execution of Works

The word "Superintendent" has been replaced by the "Authority" in paragraphs one and two.

5.4.4 Final Drawings

The word "Superintendent" has been replaced by the "Authority" in paragraphs first and last.

5.6.2 Equipment Supplied by the Contractor

The address of Quality Manager has been updated.

5.6.4 LED lanterns and Controller

This is a new clause with new requirements for LED lanterns installation.

6.5 Post and mast arm footings

Drawing number VC002-65 for the concrete footings for Type 10 and Type 11 mast arms has been added.

6.10 Multi Function Poles (MFP's) by Others

This is a new clause regarding RTA requirements when a MFP is installed by a Contractor.

7.1.2 Installation of Posts and Mast Arms

Requirement of the completion of duct and pit installation before the aboveground work can proceed has been added.

7.1.10 Retrofitting of LED optical assembly

This is a new clause for the requirements when a Contractor is retrofitting LED optical assembly.

7.9 Traffic Signs on Signal Posts

Drawing number VT006-61 for the single end mounted bracket for the special stop sign has been added.

8. Special Requirements for Reconstruction of Existing Traffic Light Signal Locations

A new requirement has been added when a Contractor is disturbing the existing asbestos cement (fibro) pipes by either adding cable or replacing cable.

Appendix A List of Standard Drawings

A new drawing VC002-65 "Footing for type 10 and Type 11 mast arms" has been added.

Appendix B Applicable RTA Equipment Specifications and Drawings

A new drawing VT006-61 "Single end mounted bracket for special stop signs" has been added.

Appendix E Quality System Requirements

The referenced quality system standard has been updated to AS/NZS ISO 9001:2000, in line with the current quality system requirements for Prequalified Contractors. In the Clause 4 "Inspections" the word "Superintendent" has been replaced by the "Authority"
