Manual

Traffic and Road Use Management
Volume 4 – Intelligent Transport Systems and Electrical Technology

Part 1: Traffic Signal Maintenance

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Queensland Government

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1 Introduction

Queensland Department of Transport and Main Roads is responsible for the provision, maintenance and management of the major arterial and linking roads and road transport infrastructure throughout Queensland. As part of this infrastructure, Transport and Main Roads owns and maintains traffic signals installations. These are an essential component of road safety infrastructure.

2 Scope

This document contains the minimum requirements for maintenance practices applicable to traffic signals that will allow these installations to continue operating safely, reliably, efficiently and effectively for the duration of their economic service life.

The traffic signal maintenance regime includes electrical, operational, structural and environmental aspects, covering both scheduled and unscheduled work.

Maintenance practices for the electronic control aspects of traffic management (for example phasing, timing, sequencing, and the logic rack and electronic equipment) are also not addressed in this document.

3 Abbreviations

Abbreviation	Full title
AS/NZS	Australia & New Zealand Standard
ESO	Electrical Safety Office
EWP	Elevated Work Platform
GPS	Global Positioning System
IER	Immediate Electrical Risk
KDU/HHT	Keyboard Display Unit/Hand Held Terminal
LGAQ	Local Government Association of Queensland
MRTS	Transport and Main Roads Specifications (available at http://www.tmr.qld.gov.au)
MUTCD	Manual of Uniform Traffic Control Devices (Queensland)
RMPC	Road Maintenance Performance Contract
RSM	Road System Manager (State-wide Planning)

4 Definition of terms

Abbreviation	Full title
the Act	*Electrical Safety Act 2002*, Regulations and Codes of Practice
current (non-electrical)	Current at the time of the maintenance activity
electricity entity	As defined in the Act
electricity works	As defined in the Act
Wiring Rules	AS/NZS 3000 commonly referred to as the Wiring Rules

5 General maintenance requirements

5.1 Maintenance programs

Ownership of the traffic signals installation is to be confirmed before maintenance is undertaken.

The programming of maintenance activities for traffic signals is the responsibility of the Regions/Districts and is generally carried out under the Road Maintenance Performance Contract (RMPC). Refer to Element Management Plan No. 34.

5.2 Applicable standards

Work is to be carried out in accordance with Transport and Main Roads specifications, AS/NZS 3019 *Electrical Installations – Periodic Verification* and the *Electrical Safety Act 2002*, Regulations and Codes of Practice (the Act). All works, processes and procedures used in maintenance activities associated with the electrical works described herein is be in accordance with the Act. Electrical maintenance is not to be carried out live except as permitted under the Act.

5.3 Installation drawings

Installation drawings are required for the safe maintenance of electrical installations. Regions/Districts are to work with the maintenance provider to ensure that electrical installation drawings are current and reflect the actual state of the installation. Where drawings are incorrect and/or non-existent, Regions/Districts are to arrange for accurate drawings to be produced. Drawings are to conform to the requirements of the Transport and Main Roads drafting presentation standards.

Where modifications or alterations are made to the installation as-constructed drawings and records of tests are to be provided in accordance with MRTS93 *Traffic Signals*.

5.4 Maintenance personnel

Personnel undertaking traffic signal maintenance activities (including the Superintendent's Representative) are to have the appropriate qualifications, training and experience necessary to undertake their designated activities in a safe and considered manner. These are to include working in a high speed road environment, formal electrical qualifications and knowledge of MUTCD parts 3 and 14 and MRTS.

The possession of a valid Occupational Health and Safety Construction Induction card (also known as a ‘White Card’ or the previous ‘Blue Card’) and a current adult First Aid Certificate are also prerequisites for all persons working on traffic signal installations.

Appropriate training of personnel is the responsibility of the organisation providing the maintenance service. Regions/Districts are responsible for collecting this information from the service provider and are to undertake random audits to ensure compliance.

5.5 Maintenance plant and equipment

When maintaining mast arm installations, elevated work platform (EWP) vehicles are to be used. Every operator is to possess a valid EWP operator ticket, relevant driver’s licence and is to have an appropriate level of experience in EWP operation. Operators are to have training in safe work procedures and evidence of such training. Regions/Districts are responsible for collecting this information from the service provider and are to undertake random audits to ensure compliance.

Vehicles are to have safety checks and have valid current certification in accordance with the relevant parts of:

AS 1418.10	*Cranes, hoists and winches* – Part 10 Elevated working platforms
AS 2550.10	*Cranes, hoists and winches safe use* – Part 10 Mobile elevated working platforms
AS 4748	*Acoustic emission testing of fibreglass insulated booms on elevated work platforms*

Equipment used for maintenance is to comply with relevant safety legislation and standards and be appropriate for the application. Testing equipment calibration is to be current with calibration evidence included in the maintenance report. Regions/Districts are to undertake random audits to ensure compliance.

5.6 Maintenance waste disposal

Disposal of waste and unserviceable equipment after it is removed from service must be undertaken in a safe and environmentally friendly manner.

5.7 Replacement parts

Replacement parts are to comply with current Transport and Main Roads specifications.

The current rating and characteristics of electrical circuit protection devices are to be no greater than those specified on the Standard Drawings or manufacturer's documentation. Installations that do not comply with the requirements of the Act are to be rectified.

The photometrics, electrical and ingress protection characteristics of replacement aspects are to be such that the lighting and electrical integrity of the installation are not compromised.

5.8 Traffic management

Safety and traffic control plans where required are to be approved by the Region/District before maintenance work is conducted.

All signage used during traffic signal maintenance is to be in accordance with the *Manual of Uniform Traffic Control Devices* (MUTCD).

5.9 Reporting requirements

The progress of any maintenance regime being undertaken is to be tracked and reported. Regular maintenance meetings are to be scheduled between the maintenance service provider and the Region/District.

The meetings are to cover as a minimum the following items:

- review of performance of the traffic signal hardware
- review of performance of the traffic signal service provider
- reporting of current progress against expected – for example staffing levels/changes, budgeting/expenditure, and
- discussion of issues/problems and how they are being addressed.

Regions/Districts are to inform the Director (ITS and Electrical Technology) about any systemic issues.

5.10 Recording keeping

All traffic signals verification activities are to be logged to monitor performance and to trend failure and outage rates. Data to be collected are defined in Appendix A and Appendix B.

Minimum details required to be logged and reported include:

- intersection/site number
- name of road and/or road number
- region/district number
- date installation commissioned or date controller cabinet manufactured
- type of maintenance service – damage/fault, lamp/aspect replacement, routine spot, etc.
- item maintained – post, mast arm, pit, switchboard, lamp, lantern, etc.
- lamp/aspect replacement date
- verification process carried out
- name of maintenance service provider (Contractor company name and maintenance personnel)
- date maintained.

Where applicable, the Transport and Main Roads ITS and Electrical Asset Maintenance System is to be used.

6 Preventative maintenance

6.1 Electrical

Periodic inspections and tests are required on the electrical installation to ensure compliance with the Act. Full inspections and tests are to be carried out at a maximum of five yearly intervals. Where the risk of degradation of the installation due to environmental or other factors is considered high, more frequent inspections are to be carried out. Spot check audits on parts of high risk installations are to be carried out at a maximum of 12 month intervals. Typical high risk factors may include: corrosive environments, susceptibility to flood/submergence, devices nearing end of life, vermin habitats and high pedestrian activity.

Periodic verification of electrical installations is to be carried out in accordance with Appendix C.

Immediate electrical risks (including exposed live conductors, unearthed equipment and incorrect polarity) must be made safe and rectified when discovered and the ESO and Region/District Management notified.

Electrical tests are to be carried out and documented in accordance with the Wiring Rules and AS/NZS 3019 Electrical Installations – Periodic Verification.

6.1.1 Point of supply maintenance

The traffic signal installation is supplied from the electricity entity's network. Supply can typically be from:

- overhead pole mounted transformer with fuse
- underground pit with fuse

- pillar box with fuse from an underground supply.

Verification is to include a visual inspection of the point of supply for signs of degradation. Where there is any concern about the integrity of the point of supply or the upstream network, the electricity entity is to be advised.

Work is not to be carried out on electricity entity infrastructure without the express written permission of the electricity entity.

6.1.2 Electrical switchboard maintenance

Maintenance is to be carried out to ensure the electrical integrity of the switchboard. As the switchboard is the point where the traffic signal controller is connected to the supply, it is important that all the components are in good condition.

Inspection is to include but not be limited to:

- ingress of water and vermin
- deterioration of weatherproof seals and other components
- damage by vermin
- detection of poor connections and joints
- correct earthing
- protection against direct and indirect contact with LV terminals/surfaces
- correct internal labelling of components
- correct labelling of field cables.

6.1.3 Cable and connection maintenance

Electrical cabling and connections are to be maintained to ensure a low impedance path for the electricity supply. While traffic signal cable is expected to last in excess of 25 years under standard operating conditions, a number of factors (such as those previously mentioned) can reduce service life. Consequently, visual observations and electrical tests are required regularly.

Where cable temperatures are significantly raised due to poor electrical connections, insulation damage can occur, which may ultimately result in fire. Clean cable termination surfaces, correct fixing tightness and the application of protecting grease to terminations can assist in maintaining the integrity of the termination. Thermal imaging equipment can be used where practical and cost effective to aid early detection of high resistance joints.

Transport and Main Roads Specifications now specify the use of either XLPE/PVC or XLPE/HDPE mains cabling for new installations. PVC/PVC cabling is not designed to be submersed in water for periods of time. The new standard cables are more resilient. Where there is a known water retention problem, the better quality XLPE/HDPE cable should be used to replace PVC/PVC cables that have reached end of life.

The standard PVC/PVC multicore traffic signal cable is not designed to be submersed in water for periods of time.

Rodent and vermin attack as well as poor installation methods can also affect the integrity of the cable sheath. Where damage has occurred, moisture ingress and cable degradation will occur.

Where the rate of insulation resistance degradation reasonably suggests that the cable insulation will not comply at the next regular inspection interval, inspection frequency is to be increased or rectification undertaken.

Inspection items are to include but not be limited to:

- joints, connections and terminations for corrosion
- poor, loose, overheated or unsecured connections
- evidence of moisture ingress to cables and/ or connections
- damaged insulation
- exposed conductors
- general condition of cable
- evidence of rodent/vermin activity
- devices that are not fixed wired are to be tested and tagged
- carbon, soot build-up.

In accordance with the *Wiring Rules*, electrical tests are to be carried out on cables and results documented.

6.1.4 Pits and conduit maintenance

Pits and conduits are to be inspected visually. Once it has been determined that the conduit installation complies with the required depth, this need no longer be checked except where work to the ground surface has been carried out in the vicinity of the conduit.

Pit lids are to be intact, undamaged and properly fitted to the pit. Pits are to be free of damage, with no collapse of ground around the pit, no collapse of the inside of the pit, and with the pit top level with the surrounding surface. Pits are to be free draining.

Maintenance of pits and conduits is to include but not be limited to:

- ensuring adequate drainage
- replacement of broken or chipped pit lids
- rectifying collapsed pit side walls and other damage
- maintaining ground/pit surface level and pit surrounds.

Cement pits and ducts that contain, or are suspected to contain, asbestos materials are to be handled using safe work practices and qualified persons in accordance with workplace health and safety legislation and Transport and Main Roads procedures. All asbestos materials are to be identified and recorded in Region/District registers.

6.1.5 Traffic signal controller maintenance

Prior to accessing the traffic signal controller, test for touch voltage on the cabinet.

Traffic signal controllers are to be inspected visually. The controller is to be clear of vermin, particularly geckos in the control equipment, and ants and spiders in the base. The joint between the concrete base and steel plinth is to be sealed and the incoming conduits are to be filled with sealant.

The electrical integrity of components is to be checked.

Maintenance is to include, but not be limited to:

- ingress of/damage by water and vermin
- deterioration of weatherproof seals and other components
- adequate ventilation
- detection of poor connections and joints
- correct earthing
- protection against direct and indirect contact with LV terminals/surfaces
- correct internal labelling of components
- correct labelling of field cables.

6.1.6 Pushbutton/audio tactile sounder maintenance

Pushbuttons are to be inspected visually for signs of deterioration, damage and vandalism.

The button mechanism is to operate freely and the internal microswitch is to function appropriately. Cables are to be to standard and be terminated correctly.

Inspection is to include but not be limited to:

- vandal damage
- deterioration of weatherproof seals and other components
- correct termination of cables
- correct earthing connections
- checking of all accessible fixings for tightness.

6.1.7 Lantern/aspect maintenance

Periodic verification of the lanterns is required to ensure continuing electrical safety.

Maintenance is to include but not be limited to:

- a visual check of the electrical components and wiring for signs of overheating
- checking of all accessible screws, nuts and fixings for tightness
- correct earthing connections.

6.1.8 Other equipment maintenance

Where other permitted electrical equipment, (for example CCTV camera) is connected to traffic signals installations, it is to be checked for electrical safety and be fused with an HRC fuse no greater than 3A for discrimination.

6.2 Structural

Periodic visual inspections are to be undertaken to ensure at least the following items are examined for compliance with the relevant standards:

- steel poles
- other lantern supports (for example, secured to structures).

Inspections are to be carried out ten years after original installation and then every five years thereafter. Environmental conditions to which the traffic signal installation is subject may require the frequency of inspections to be increased - for example, bridges/overpasses, corrosive environment and areas prone to flooding.

Structural inspections are to be completed in accordance with Structures Section requirements.

6.2.1 Steel pole maintenance

Generally once steel poles have been installed and commissioned, minimal maintenance is required. However, the following aspects are to be inspected as a minimum:

- testing the thickness of galvanic protection at the pole base and other areas in accordance with AS/NZS 4680
- pole vertical alignment tolerance check
- surrounding area assessment.

Traffic signal poles including combination mast arms and joint use poles can suffer damage from both major and minor incidents. They are to be replaced when any of the following damage is evident:

- horizontal cut(s) or tear(s) exist and exceeds 20% of the pole circumference, or
- deformation of pole due to impact exceeds 20% of the pole diameter, or

Where sharp edges are present, but it is not considered necessary to replace the pole, the edges are to be rectified to remove the risk of personal injury. Where hatchway doors and/or fixings are damaged and can be replaced without the need for replacing the pole, the damaged part(s) are to be replaced.

Welding on poles is only to be undertaken at the initial pole fabrication stage. No additional welding of poles is to be undertaken.

6.2.2 Steel post maintenance

Where steel posts are damaged, degraded, or corroded, they are to be replaced.

6.3 Environmental

The maximum interval between inspections is 12 months. Where particularly detrimental environmental conditions require – for example, corrosive environment and areas prone to flooding – more frequent inspections are to be carried out.

6.3.1 Vegetation management

The growth of vegetation near lanterns has the potential to significantly reduce the effectiveness of traffic signal installations. Where vegetation or other obstructions have, or may have an impact on signal performance, they are to be removed or otherwise treated to remove the risk.

Vegetation may increase the likelihood of vermin and/or hinder access to switchgear and electrical pits and is to be managed accordingly. Concrete surrounds should be installed around equipment, particularly switchboards.

6.3.2 Vermin

Evidence of vermin infestation is to be removed, and damage caused by vermin is to be rectified. The installation is to be treated/modified to prevent/minimise the likelihood of reinfestation.

6.3.3 Maintenance access

Where necessary, access to sites is to be remedied to allow safe, all-weather access by maintenance personnel.

6.3.4 General tidy up

Each site is to be cleaned of all waste/rubbish so as to present a clean, tidy area that reflects well on Transport and Main Roads.

6.3.5 Cleaning and painting

The controller, poles, posts, mastarms and associated hardware are to be cleaned and posters and graffiti removed. Where paintwork is damaged or has deteriorated, it is to be repainted.

7 Routine maintenance

Periodic inspections and servicing are required on the traffic signal installation to ensure it is operating safely and efficiently.

Routine signal maintenance is to include, but not be limited to:

- checking lanterns for correct alignment and rectifying as required
- checking lanterns for damage, blown lamps, broken cowls, damaged lenses and rectifying as required
- checking all lamps/aspects are functioning correctly, and replacing as necessary
- when lamps are replaced, cleaning the reflectors and lenses and renewing any defective door gaskets
- checking all pedestrian push buttons, call record indicators and audio tactile driver units are functioning correctly, and repairing as necessary
- check vehicle detectors are functioning correctly
- where installed check all special inputs and outputs are functioning correctly
- where installed, checking all other equipment connected to the controller and rectifying as required
- ensuring site identifier is clearly legible and clean or replace as required
- clearing fault and error log in traffic controller after the above work is complete
- check operation of STREAMS connection.

Maximum response and repair times are to be in accordance with Table 8.1.

8 Response maintenance

8.1 Reported faults and damages

Aspect outages, vehicle detector loops failing to operate, faulty or damaged pedestrian push buttons and damage to traffic signals caused by road crashes, storms, and the like are often notified by the public, electricity entities, emergency services and by departmental staff.

Each Region/District is to have an efficient and effective reporting system in place to cater for reported faults and damages.

Reported faults and damages are to be rectified to make the installation safe for workers, motorists, and pedestrians.

Traffic signal hardware is to be reinstated with the appropriate equipment and identification labels and signs.

Maximum response and repair times are to be in accordance with Table 8.1.

Where immediate rectification is necessary due to immediate electrical risks, details are to be reported in accordance with DEIR Form 3 to the Electrical Safety Office and to Region/District management.

Table 8.1 – Required response to faults/damages

Type of fault/damage	Required response
Safety **Physically Dangerous/Hazardous to the public** – the equipment can cause personal injury. **Operationally Dangerous/Hazardous** – The fault creates a dangerous situation such as conflicting green signals. **Physically Hazardous or Operationally Hazardous** – The fault created a situation where use of the intersection places the user at great risk.	Attendance within four hours Make safe immediately
Inefficiency **Operationally Inefficient** – The failure does not stop the signal operating safely but the performance is inefficient, e.g. Detector failures causing phases to be called and/or extended unnecessarily.	Address operational inefficiency within 24 hours
Degraded **Operationally Degraded** - Signalling or appearance is degraded, e.g. Lamp outages, poor lantern aiming, loss of displays, failed inductive loops.	Rectify within four weeks
Aesthetics and Presentation – Finish, controller obviously out of plumb, pole obviously out of plumb, Tidiness, Cleanliness, etc. Offensive graffiti.	Rectify within three weeks Remove within two working days

Notes:
1. Where temporary works are carried out to address safety or inefficiency issues, the installation is considered to be operationally degraded.
2. Local variations to these required response times are to be documented and approved by the Regional Director prior to implementation.

9 References

AS/NZS 3000	*Wiring Rules*
AS/NZS 3017	*Electrical Installations – Verification Guidelines*
AS/NZS 3019	*Electrical Installations – Periodic Verification*
AS/NZS 4360	*Risk Management Specification*
AS/NZS 4680	*Hot-dip galvanized (zinc) coatings on fabricated ferrous articles*
EMP 34	*RSM Element Management Plan 34 Traffic Management*
	Transport and Main Roads Standard Drawings for Traffic Signals
MRTS91	*Conduits and Pits*
MRTS92	*Traffic Signal and Road Lighting Footings*
MRTS93	*Traffic Signals*
MRTS95	*Provision of Switchboards*
MUTCD	*Manual of Uniform Traffic Control Devices*
RMPC Manual	*Road Maintenance Performance Contract Manual*
RPDM	*Road Planning Design Manual*

Appendix A: Traffic signal inventory

The following inventory information is to be maintained.

Inventory on traffic signal controller

Region:					
Intersection/site number:					
Road No.:		**LGA No.:**		**Job No.:**	
Road name:				**Suburb:**	
Latitude:		**Longitude:**			
Plan No.:		**Plan rev.:**		**Rev. date:**	
Point of supply:		**Pole No.:**		**Pillar No.:**	

Inventory

Item	Value					
Install/replace date:	❑ Install			❑ Replace		
Controller type:	❑ PSC1	❑ PSC2	❑ PSC3	❑ Alpha 16	❑ Eclipse	❑ Other
Number of signal groups:	❑ 1-8	❑ 9-16	❑ 17-24	❑ 25-32		
Top-hat section added:	❑ Yes	❑ No				
Additional equipment installed:						
LCB fuse size:	❑ 8A	❑ 5A	❑ Other			
LCB type (PSC only):	❑ Normal	❑ Low power				
Number of cable runs:	❑ 1	❑ 2	❑ 3	❑ 4		
Multicore cable type:	❑ 6	❑ 19	❑ 29	❑ 36		
EFLI modification:						
6A HRC fuse in A2	❑ Yes	❑ No				
10A HRC fuse in flashing yellow cct	❑ Yes	❑ No				
Signal group fuses	❑ Yes	❑ No				
Type of earth:	❑ MEN	❑ Common earth				
Location of MEN point:	❑ Pit	❑ Ground cabinet	❑ Pillar box			
Type of earth electrode:	❑ Earth stake	❑ Earth plate	**Size:**	❑ 12 mm	❑ 16 mm	
Labelling of main earth:	❑ Yes	❑ No				

Current status with respect to the last audit/inspection:	❑ Last audit/inspection outcomes not yet reviewed to determine remedial works ❑ No work required from last audit/inspection ❑ Decommissioned ❑ Design phase ❑ Tender phase ❑ Construction phase ❑ Remedial works certified and completed
Additional comments:	
Inspector name:	
Inspector signature:	
Inspection date:	

Inventory on pits and conduits

Region:					
Intersection/site number:					
Pit ID:					
Description:					
Pit connected to:	❑ Switchboard ❑ Traffic signal post ❑ Road lighting pole ❑ Other				
Road No.:		**LGA No.:**		**Job No.:**	
Road name:				**Suburb:**	
Latitude:		**Longitude:**			
Plan No.:		**Plan rev.:**		**Rev. date:**	

Inventory

Item	Value				
Install/replace date:	❑ Install			❑ Replace	
Pit type:	❑ J1	❑ No. 3	❑ No. 4	❑ No. 7	❑ Round
Pit material:	❑ Plastic	❑ Fibro	❑ Concrete	❑ Fibreglass	❑ Other
Asbestos in pit material:	❑ Yes	❑ No	❑ Possible		
Pit lid material:	❑ Concrete	❑ Plastic	❑ Steel		
Pit lid insulation (steel lid only):	❑ Insulation coating intact			❑ Lid to be replaced	
Asbestos in conduit material:	❑ Yes	❑ No	❑ Not tested		
Asbestos contamination in pit:	❑ Yes	❑ No	❑ Not tested		
Conduit type:	❑ HD	❑ MD	❑ Corrugated	❑ Other	
Number of conduits:			**Size (mm):**	❑ 40 ❑ 80 ❑ 50 ❑ 100	
Conduit colour:	❑ Orange	❑ White	❑ Grey	❑ Black	
Cables in pit:	❑ Lighting	❑ Signal	❑ Detector	❑ Other ITS	
Slack cable in pit (m)L					

Current status with respect to the last audit/inspection:	❑ Last audit/inspection outcomes not yet reviewed to determine remedial works ❑ No work required from last audit/inspection ❑ Decommissioned ❑ Design phase ❑ Tender phase ❑ Construction phase ❑ Remedial works certified and completed
Additional comments:	
Inspector name:	
Inspector signature:	
Inspection date:	

Inventory on poles/posts

Region:					
Intersection/site number:					
Pole ID:					
Description:					
Road No.:		**LGA No.:**		**Job No.:**	
Road name:				**Suburb:**	
Latitude:		**Longitude:**			
Plan No.:		**Plan rev.:**		**Rev. date:**	

Inventory

Item	Value			
Install/replace date:	❑ Install			❑ Replace
Post height (m):	❑ 1.2	❑ 3.2	❑ 4.1	
Mast arm outreach (m):	❑ 2.5	❑ 5	❑ 6.5	
MA orientation to road (°):				
Foot diameter (mm):				
Combination mast arm outreach (m):	❑ 2.5	❑ 5	❑ 6.5	
CMA outreach orientation to road (°):				
CMA RL mounting height (m):	❑ 9.0	❑ 10.5	❑ 12	
CMA RL transition size (m):	❑ 1.4	❑ 2.9	❑ 4.4	
CMA RL outreach size (m):	❑ 1.5	❑ 3.0	❑ 4.5	
CMA RL outreach type:	❑ Single	❑ Double	❑ None	❑ Other
Rate 3 Label:	❑ Yes	❑ No	❑ Rate 2	
Foot diameter (mm):				
JUP RL mounting height (m):	❑ 9.0	❑ 10.5	❑ 12	
JUP RL outreach size (m):	❑ 1.0	❑ 1.5	❑ 3	
JUP RL outreach type:	❑ Single	❑ Double		
Rate 3 label:	❑ Yes	❑ No	❑ Rate 2	
Foot diameter (mm):				

Current status with respect to the last audit/inspection:	❑ Last audit/inspection outcomes not yet reviewed to determine remedial works ❑ No work required from last audit/inspection ❑ Decommissioned ❑ Design phase ❑ Tender phase ❑ Construction phase ❑ Remedial works certified and completed
Additional comments:	
Inspector name:	
Inspector signature:	
Inspection date:	

Inventory on lanterns/pushbuttons/audio tactile

Region:					
Intersection/site number:					
Pole ID:					
Description:					
Road No.:		**LGA No.:**		**Job No.:**	
Road name:				**Suburb:**	
Latitude:		**Longitude:**			
Plan No.:		**Plan rev.:**		**Rev. date:**	

Inventory

Item	Value			
Install/replace date:	❑ Install			❑ Replace
Lantern manufacturer:	❑ Aldridge	❑ Pannich	❑ Other	
Aspect type:	❑ LED	❑ QH	❑ Incandescent	
Aspect size (mm):	❑ 200	❑ 300		
No. of round aspects:	❑ 1	❑ 2	❑ 3	❑ 4
No. of arrow aspects:	❑ 1	❑ 2	❑ 3	❑ 4
Visor:	❑ Open	❑ Closed	❑ Cutaway left	❑ Cutaway right
Louvres:	❑ Yes	❑ No	❑ Horizontal	❑ Vertical
Target boards:	❑ Yes	❑ No		
Push button manufacturer:	❑ N/A	❑ Aldridge (ATS)	❑ ATS/AEI (pre July 2010)	
	❑ AEI (pre July 2010)	❑ Pannich (BPC)	❑ Safe Roads	❑ Other
Audio tactile installed:	❑ Yes	❑ No		

Current status with respect to the last audit/inspection:	❑ Last audit/inspection outcomes not yet reviewed to determine remedial works ❑ No work required from last audit/inspection ❑ Decommissioned ❑ Design phase ❑ Tender phase ❑ Construction phase ❑ Remedial works certified and completed
Additional comments:	
Inspector name:	
Inspector signature:	
Inspection date:	

Appendix B: Traffic signal maintenance reports

The following inspection reports are to be produced.

Inspection on traffic signal controller

Region:					
Intersection/site number:					
Road No.:		**LGA No.:**		**Job No.:**	
Road name:				**Suburb:**	
Latitude:		**Longitude:**			
Plan No.:		**Plan rev.:**		**Rev. date:**	

Inspections

Item	**Pass**	**Fail**			**Corrective Action Required**
		IER	**AS**	**MRTS**	
Safe location	❑	❑	❑	❑	
Safe access (present and future)	❑	❑	❑	❑	
Pole guard	❑	❑	❑	❑	
Seal against vermin	❑	❑	❑	❑	
Conduits sealed	❑	❑	❑	❑	
Protection against direct contact	❑	❑	❑	❑	
Signs of degradation	❑	❑	❑	❑	
Main switch labelled	❑	❑	❑	❑	
Protective devices labelled	❑	❑	❑	❑	
MEN link	❑	❑	❑	❑	
Earth conductor/clamp/stake	❑	❑	❑	❑	
Main earth conductor label	❑	❑	❑	❑	
Neutral link and label	❑	❑	❑	❑	
Drawing/circuit schedule correct	❑	❑	❑	❑	
Consumer mains connection correct	❑	❑	❑	❑	
Exposed conductors	❑	❑	❑	❑	
Suitable IP rating	❑	❑	❑	❑	

Tests on controller

Item	Value	Pass	Fail			Corrective Action Required
			IER	AS	MRTS	
Earth continuity tests		❑	❑	❑	❑	
Polarity		❑	❑	❑	❑	
Earth Fault Loop Impedance (Ohm) (External EFLI into supply)		❑	❑	❑	❑	
RCD on GPO		❑	❑	❑	❑	
Maximum Demand (A)		❑	❑	❑	❑	
Voltage (V)		❑	❑	❑	❑	

Tests on loops

Item		Value		Corrective Action Required
		This test	Last test	
Detector number		*N/A*	*N/A*	
Sensitivity setting	*N/A*			
Frequency (kHz)	*N/A*			
Mode (PA)	*N/A*			
Mode (PR)	*N/A*			
Inductance (µH)	*N/A*			
Q/LER	*N/A*			
Correct loop operation	*N/A*	Yes	No	

Additional comments:	
Inspector name:	
Inspector signature:	
Inspection date:	

Inspections on circuits and cables

Region:					
TSC ID:					
Description:					
Cct ID:					
Description:					
Road No.:		**LGA No.:**		**Job No.:**	
Road name:				**Suburb:**	
Latitude:		**Longitude:**			
Plan No.:		**Plan rev.:**		**Rev. date:**	

Inspections

Item	**Pass**	**Fail**			**Corrective Action Required**
		IER	**AS**	**MRTS**	
Correctly terminated	❑	❑	❑	❑	
Correctly labelled	❑	❑	❑	❑	
Correct colour coding	❑	❑	❑	❑	
Signs of degradation	❑	❑	❑	❑	
Cable protection type/size	❑	❑	❑	❑	
Drawing correct	❑	❑	❑	❑	
Correct circuit connections	❑	❑	❑	❑	

Tests on consumer mains

Item	**Value**	**Pass**	**Fail**			**Corrective Action Required**
			IER	**AS**	**MRTS**	
Earth continuity tests		❑	❑	❑	❑	
Polarity		❑	❑	❑	❑	
Earth leakage testing		❑	❑	❑	❑	
Earth Fault Loop Impedance (Ohm)		❑	❑	❑	❑	

Tests on multicore signal cables

Item	Value	Pass	Fail			Corrective Action Required
			IER	AS	MRTS	
Earth leakage (mA)		❑	❑	❑	❑	
Earth continuity		❑	❑	❑	❑	
Earth fault loop impedance (Ohm)		❑	❑	❑	❑	

Additional comments:	
Inspector name:	
Inspector signature:	
Inspection date:	

Inspections on pits and conduits

Region:					
Intersection/site number:					
Pit ID:					
Description:					
Pit connected to:	❑ Switchboard ❑ Traffic signal pole ❑ Other				
Road No.:		**LGA No.:**		**Job No.:**	
Road name:				**Suburb:**	
Latitude:		**Longitude:**			
Plan No.:		**Plan rev.:**		**Rev. date:**	

Inspections

Item	**Pass**	**Fail**			**Corrective Action Required**
		IER	**AS**	**MRTS**	
Pit surround	❑	❑	❑	❑	
Pit level with surrounding surface	❑	❑	❑	❑	
Earth subsidence round pit	❑	❑	❑	❑	
Pit wall deflection/damage	❑	❑	❑	❑	
Pit lid intact	❑	❑	❑	❑	
Pit marker	❑	❑	❑	❑	
Pit in suitable location	❑	❑	❑	❑	
Water in pit	❑	❑	❑	❑	
Pit clean	❑	❑	❑	❑	
Conduit depth (mm)	❑	❑	❑	❑	
Conduit protruding > 100 mm	❑	❑	❑	❑	
Conduit sealed	❑	❑	❑	❑	
Drawing correct	❑	❑	❑	❑	

Additional comments:	
Inspector name:	
Inspector signature:	
Inspection date:	

Inspection on poles/posts

Region:					
Intersection/site number:					
Pole ID:					
Description:					
Road No.:		**LGA No.:**		**Job No.:**	
Road name:				**Suburb:**	
Latitude:		**Longitude:**			
Plan No.:		**Plan rev.:**		**Rev. date:**	

Inspections

Item	**Value**	**Pass**	**Fail**			**Corrective Action Required**
			IER	**AS**	**MRTS**	
Distance from HV lines (m)		❑	❑	❑	❑	
Distance from LV lines (m)		❑	❑	❑	❑	
Distance from communication lines (m)		❑	❑	❑	❑	
Proximity to power poles (m)		❑	❑	❑	❑	
Proximity to trees (m)		❑	❑	❑	❑	
Clearance from railway lines (m)		❑	❑	❑	❑	
Clearance from rail OHV (m)		❑	❑	❑	❑	
Clearance from driveway (m)		❑	❑	❑	❑	
Clearance from drainage (m)		❑	❑	❑	❑	
Pole structural integrity		❑	❑	❑	❑	
Door and screw orientation/ condition		❑	❑	❑	❑	
Terminal panel		❑	❑	❑	❑	
Correct conduit installation		❑	❑	❑	❑	
Correct upper mounting assembly connections		❑	❑	❑	❑	
Earth connection		❑	❑	❑	❑	
Drawing correct		❑	❑	❑	❑	

Tests

Item	**Value**	**Pass**	**Fail**			**Corrective Action Required**
			IER	**AS**	**MRTS**	
Earth integrity		❑	❑	❑	❑	

Additional comments:	
Inspector name:	
Inspector signature:	
Inspection date:	

Inspection on lanterns/pushbuttons/audio tactile

Region:					
Intersection/site number:					
Pole ID:					
Description:					
Road No.:		**LGA No.:**		**Job No.:**	
Road Name:				**Suburb:**	
Latitude:		**Longitude:**			
Plan No.:		**Plan rev.:**		**Rev. date:**	

Inspections

Item	Pass	Fail			Corrective Action Required
		IER	AS	MRTS	
Lantern wiring secure	❑	❑	❑	❑	
Lantern correct operation	❑	❑	❑	❑	
Lantern fixings secure	❑	❑	❑	❑	
Pushbutton earthing	❑	❑	❑	❑	
Pushbutton correct operation	❑	❑	❑	❑	
Pushbutton fixings secure	❑	❑	❑	❑	
Audio tactile earthing	❑	❑	❑	❑	
Audio tactile correct operation	❑	❑	❑	❑	
Audio tactile fixings secure	❑	❑	❑	❑	

Additional comments:	
Inspector name:	
Inspector signature:	
Inspection date:	

Appendix C: Periodic verification

Requirements for electrical installations

Comply with the requirements as set out in *AS/NZS 3019.2007 Electrical Installations – Periodic Verification* and as follows.

Clause 1.1 Where other traffic related equipment (for example CCTV or communications equipment) has been connected to the signals installation, the relevant periodic verification clauses apply.

Clause 2.1 Immediate electrical risks (exposed live conductors, unearthed equipment and incorrect polarity) must be rectified when discovered and the ESO notified.

Where other test results of an installation are found not to comply with the requirements of *AS/NZS 3000:2007 Wiring Rules* (for example high leakage current in a multicore cable) consideration must be given to the risk to road users of having signals switched off.

Where signals must be switched off for maintenance, police must be present to direct traffic.

Clause 2.8 For standard installations, the maximum interval between inspections is five years. Where harsh environmental conditions exist, more frequent inspections must be carried out. Once inspections have a documented history, frequencies may be adjusted to suit the specific installation requirements.

Clause 3.2 (c) – not required

Clause 3.2 (h) – not required

Clause 3.2 (j) – not required

Clause 3.2 (l) – not required

Add the following clauses to 3.2

Clause 3.2 (n) Covers/lids are not broken or missing

Clause 3.2 (o) Electricity entity side of the point of supply is not showing signs of deterioration.

Clause 3.2 (p) Electrical components have been replaced with identical units.

Clause 3.2 (q) Switchboards and poles/posts are adequately sealed against vermin.

Clause 4.3 (b) – not required

Clause 4.6 – not required

Clause 4.7 (b) – not required

Clause 4.7.1 (b) For each pole/post, this is verified by carrying out earth fault loop impedance tests at each pole/post between the A2 connection and the pole/post.

Clause 4.7.4 – Leakage current testing is required on the consumers mains and the multicore cable.

Clause 5.2 (a) – not required

Clause 5.3 (b) – not required

Clause 5.4 – not required

Clause 5.5 – Earth fault loop impedance measurements are required at the switchboard for external impedance and at the end of each multicore run for total circuit impedance.

Clause 5.7 – not required

Clause 5.9 – not required