TCS 057 – 2019

Specification for

The Supply and Installation
of
Active Advanced Warning System
for
Railway Level Crossings

January 2019
Rev A

keeping victorians connected

TCS 057 – 2019

Foreword

This specification has been developed by VicRoads. It is one of a number of technical specifications, and associated standard drawings, which set out the requirements for roadside ITS devices, traffic signal equipment and other electrical equipment and associated devices and control systems.

This specification is intended for use in all relevant works undertaken by or on behalf of VicRoads.

VicRoads Standard Drawings, Specifications and Guidelines are available for downloading from VicRoads website at the following link: https://www.vicroads.vic.gov.au/business-and-industry/technical-publications/electrical-and-intelligent-transport-systems

Specification updates. VicRoads specifications and associated standard drawings are subject to periodic review. To keep the specifications up to date, amendments or new editions are issued as necessary. It is therefore important for users of VicRoads specifications to ensure that they have the latest version and associated amendments.

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PREFACE

A. TELECOMMUNICATIONS EQUIPMENT

A.1 All telecommunications equipment shall comply with relevant requirements of the Australian Communications and Media Authority (ACMA). Such equipment shall be labelled with a Regulatory Compliance Mark.

B. CHANGES TO THIS SPECIFICATION

B.1 The main changes to this specification from the previous version are listed below:

- Addition of AAWS/Ice Warning Stations modified slip base pole
- Changes to communication from dial up to TCP/IP
- STREAMS monitoring incorporated

C. REVISION HISTORY

C.1 The following table details versions to this specification:

Revision	Date	Revision Owner	Description
Original	August 2007	VicRoads SJS	First release
A	November 2007	VicRoads SJS	Specification revised
A	January 2019	VicRoads SJS	Specification revised and reformatted.

Contents

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

1.1.1 This document covers the requirements for the manufacture, supply and installation of Active Advanced Warning Signs (AAWS) for 'at grade' railway level crossings for use within the State of Victoria.

1.2 GENERAL

1.2.1 Railway level crossing Active Advanced Warning Signs are used to provide motorists approaching a level crossing with advanced warning of an approaching train.

1.2.2 They are typically installed in remote, rural roads with high approach speeds.

1.2.3 The Active Advance Warning Sign system consists of static warning signs enhanced with flashing yellow signal aspects and a sign controller.

1.2.4 A typical layout plan for an (AAWS) system is shown in Figure 1.

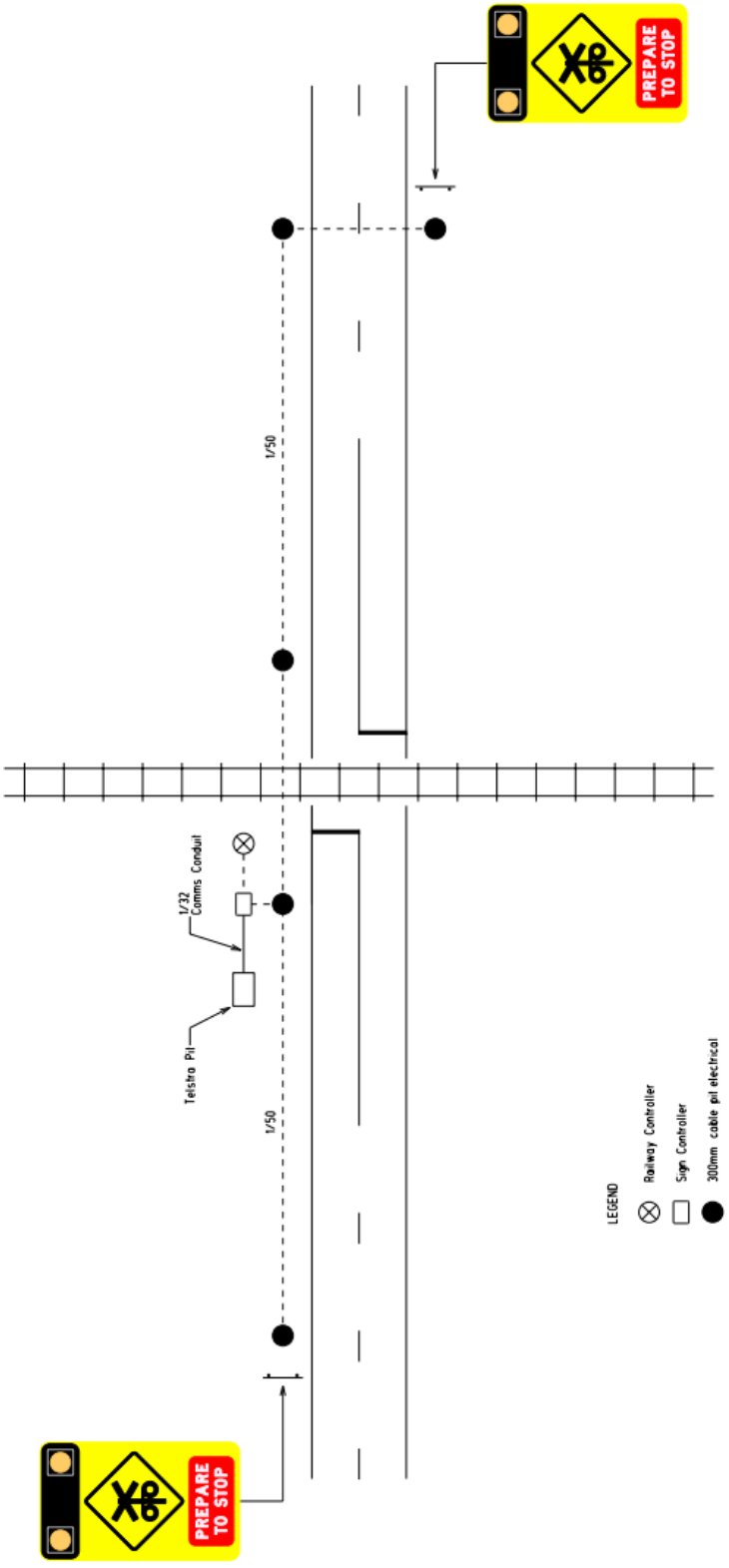

Figure 1
Typical Layout Plan of AAWS System

1.3 SYSTEM OVERVIEW

1.3.1 The Active Advance Warning Signs controller shall activate the flashing yellow signal aspects upon receipt of an appropriate input signal from the Railway Level Crossing protection system.

1.3.2 The flashing yellow signals shall be de-activated upon receipt of an appropriate input from the Railway Level Crossing control system.

1.3.3 Details of the operation of the system and the various inputs and outputs between the Railway Level Crossing Protection System and the AAWS controller are specified in Section 5.

1.3.4 The AAWS controller shall monitor the system and automatically report faults as detailed in Section 5.3.

1.3.5 Figure 2 shows a schematic layout of the system operation.

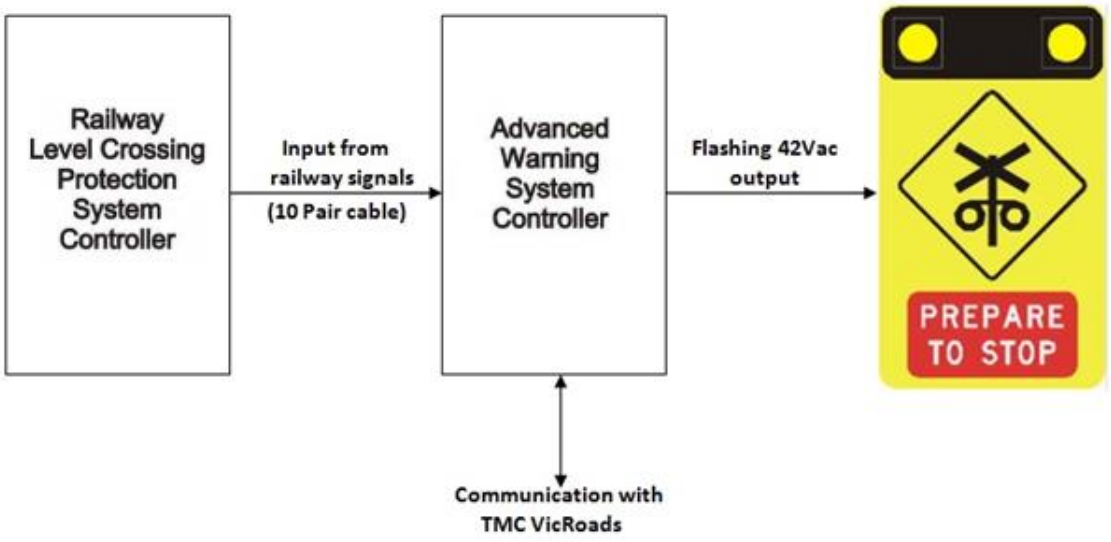

Figure 2
Schematic Layout of Typical AAWS Operation

1.4 INTELLECTUAL PROPERTY

1.4.1 In relation to all Intellectual Property used in/or to operate the system, the contractor grants to VicRoads non exclusive licence to “use, modify and/or sell” or do anything else that without the licence, could be breach of the licensors Intellectual Property.

1.4.1 Intellectual Property shall include, but not be limited to, the following:

- Software.
- Source code(s).
- Schematic diagrams.
- Circuit diagrams.
- Wiring diagrams.
- Listings of components and sub-components.
- Any and all operational and maintenance documentation.

SECTION 2 RELATED SPECIFICATION AND DRAWINGS

2.1 GENERAL

2.1.1 The fabrication and supply of all components shall conform to all relevant Australian Standards.

2.1.2 All installation works shall conform to the relevant VicRoads specifications and related specifications and standards as indicated throughout this document.

2.1.3 The following related Australian Standards are referenced:

AS 1742.2	Manual of Uniform traffic Control Devices, Part 2, Traffic Control Devices for General use
AS 1742.7	Part 7: Railways Crossings
AS 1743	Road signs - Specifications
AS 2053	Conduits for Electrical Purposes
AS 2144	Traffic Signal Lanterns
AS/NZS 3000	Wiring Rules
AS/NZS 4509.2	Stand-alone power systems - System design
AS 4086.1	Secondary batteries for use with stand-alone power systems - General requirements
AS 4086.2	Secondary batteries for use with stand-alone power systems - Installation and maintenance
AS 60529	Degrees of protection provided by enclosures (IP code).
AS/NZS 61558	Safety of power transformers, power supply units and similar
AS/NZS 61000.6.2	General Standards – Immunity for residential, commercial and light industrial environments
AS/NZS 61000.6.3	General Standards – Emission standard for residential, commercial and light industrial environments

2.1.4 The following VicRoads documents are referenced:

Drawing No TC-1065	Slip Base Pole Assembly - Ground Set Mounted
Drawing No TC-1127	Visor Types and Dimensions
Drawing No TC-2100	Standard Cabinet Label
Drawing No TC-1203	1203 Traffic Signal Controller Foundation Details
Standard Section 714	For the Erection of Road Signs
Standard Section 733	Conduits and Pits of Underground Wiring and Cabling
Standard Section 840	Manufacture of Roads Signs
ITS Device Protocol	Ancillary ITS Device Protocol
Supplement to AS 1742.2	VicRoads Supplement to AS 1742.2:2009 (October 2015)
Supplement to AS 1743	VicRoads Supplement to AS 1743:2001 (August 2017)

2.1.5 The following additional documents are referenced:

SIR's	Service and Installation Rules
VESI	Victorian Electricity Supply Industry

2.1.6 The individual requirements of the Victorian Electricity Supply Industry (VESI) and the local electricity distribution business shall apply for matters relating to the provision of mains power, distribution of power cables and street lighting.

2.1.7 The relevant requirements of the Australian Communications and Media Authority (ACMA) shall apply to the provision and distribution of all communications facilities.

SECTION 3 ACRONYMS

3.1 ACRONYMS

The acronyms used in this document shall be interpreted as follows:

AAWS	Active Advanced Warning System
ACMA	Australian Communications and Media Authority
AS	Australian Standard
CLI	Command Line Interface
ELV	Extra Low Voltage
EMC	Electromagnetic Compatibility
FP	Field Processor as used with STREAMS
HTTP	Hypertext Transfer Protocol
HTTPS	Hypertext Transfer Protocol Secure
ICMP	Internet Control Message Protocol
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IP	Internet Protocol
ITS	Intelligent Transport Systems
LED	Light Emitting Diode
NTP	Network Time Protocol
NZ	New Zealand Standard
PE Cell	Photo Electric Cell
RCD	Residual Current Device
SIR's	Service and Installation Rules
SSH	Secure Shell
SSL	Secure Sockets Layer
STREAMS	STREAMS is an integrated control system which operates ITS Freeway Management Devices and other traffic management devices.
TCP/IP	Transmission Control Protocol/Internet Protocol
TLS	Transport Layer Security
UPS	Uninterrupted Power Supply
VESI	Victorian Electricity Supply Industry

SECTION 4 ACTIVE ADVANCED WARNING SIGNS

4.1 STATIC SIGN

4.1.1 The static sign shall comply with VicRoads Supplement to AS 1743:2001 – Drawing Number 541681.

4.1.2 Manufacture of the sign shall be in accordance with VicRoads Contract Standard Section 860 “Manufacture of Road Signs”.

4.1.3 Erection of signs shall be in accordance with VicRoads Contract Standard Section 714 “Sign Installation”.

4.2 FLASHING YELLOW SIGNAL ASPECTS

4.2.1 Each sign shall include two yellow signal aspects that flash alternately when activated.

4.2.2 The above signal aspects shall be installed within the sign face as indicated in 2017 VicRoads Supplement to AS 1743:2001 (Released in August 2017) – Drawing Number 541681.

4.2.3 The signal aspects shall be VicRoads Type Approved yellow 200mm LED single aspect traffic signal lantern.

4.2.4 Both lanterns shall be fitted with Type 1, ‘open’ visors in accordance with VicRoads Standard Drawing TC-1127.

4.2.5 The flashing yellow signal aspects shall operate at ELV level of 42Vac.

4.3 SIGN SUPPORT POST

4.3.1 The sign support post shall be VicRoads type approved slip base modified pole and installed in accordance with the requirements of VicRoads Supplement to AS 1742.2:2009 (Released in December 2017), Appendix D4.

4.3.2 The sign support structure shall be based on a Slip Base Pole Assembly Ground Set Mounted standard drawing TC-1065 with the following changes:

a) Above ground pole height of 5 meters;
b) Exclusion of spigot;
c) Top of the pole capped;
d) Standard lugs removed;
e) Alternative lugs as per Figure 3 and Figure 4 below:

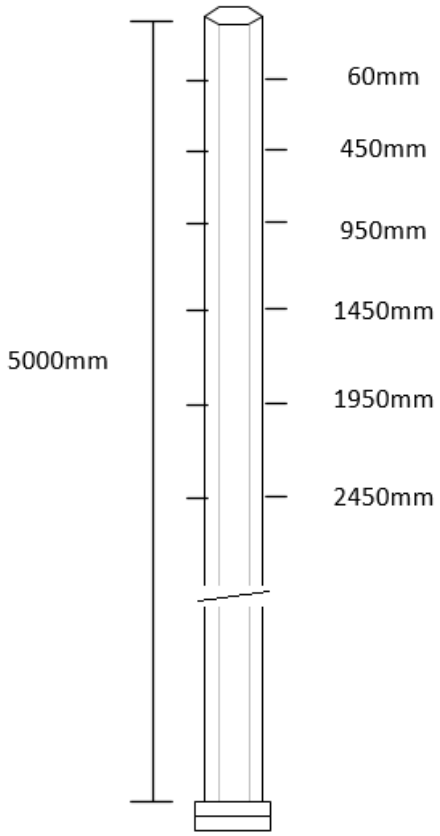

Figure 3
Dimensions and lugs spacing for AAWS and Ice Warning support pole

4.3.3 The dimensions of the lugs of sign support structure shall be as shown in Figure 4.

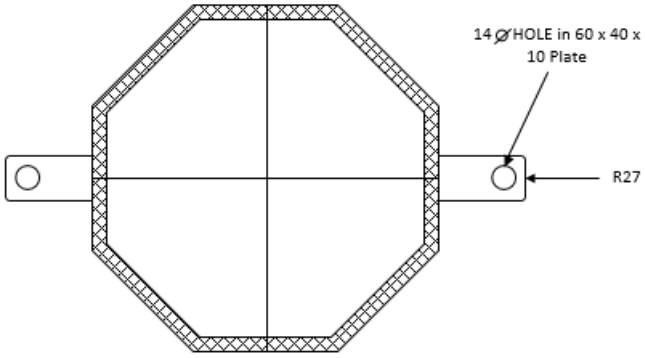

Figure 4
Dimensions of lugs for AAWS and Ice Warning support pole

SECTION 5 CONTROL SYSTEM

5.1 GENERAL

5.1.1 The AAWS Control System shall provide the interface between the Railway Level Crossing System controller and the AAWS flashing yellow signals.

5.1.2 The system shall be designed around modular rack setup.

5.1.3 It is envisaged that the design would include the following separate modules:

- Control Monitoring System module;
- Input/Output/Flasher module; and
- UPS control system module.

5.2 CABINET FOR CONTROL EQUIPEMENT

5.2.1 The AAWS Control System and all associated control equipment shall be housed in a:

- VicRoads Type Approved traffic signal controller cabinet; or
- VicRoads Approved universal roadside cabinet.

5.2.2 The cabinet shall be locked using standard VicRoads traffic signal controller locks.

5.2.3 The foundation for the control equipment cabinet shall comply with VicRoads Standard Drawing TC-1203.

5.3 CONTROL MONITORING SYSTEM

5.3.1 The control monitoring system shall be a processor control system or an industrial computer that is capable of:

- Operating with the VicRoads Ancillary ITS Device Protocol (see Section 5.9);
- Monitoring inputs from the Railway Level Crossing equipment box (see Section 5.3);
- Monitoring the system operation and providing alarms (see Sections 5.14 & 5.15);
- Seamless switching to a battery backup system in the event of a power failure (see Section 6.5);

5.3.2 The control monitoring system shall NOT be used to operate the railway inputs or the flasher unit.

5.3.3 It shall only be used to monitor the operation of the system and for communications with VicRoads ITS Platform.

5.3.4 The control monitoring system hardware shall be able to withstand the temperature, humidity and vibration of the operating environment.

5.3.5 The system shall also be capable of operating satisfactorily from the mains supply voltage variations of the location (see Section 6.2).

5.4 RAILWAY INPUTS

5.4.1 A 10 pair cable shall be provided from the Railway Level Crossing protection system controller to interface with AAWS Control System.

5.4.2 This cable shall provide various inputs and outputs between the two control systems.

5.4.3 The input/output relays shall be housed within the Input/Output/Flasher module.

5.4.4 The Railway Level Crossing controller shall provide ‘dry’, ‘no voltage’ contacts for the ‘cable monitor’ and ‘call’ inputs into the AAWS controller.

5.4.5 The AAWS controller shall provide a ‘dry’, ‘no voltage’ contact for the ‘indicator light’ output into the Railway Level Crossing controller.

5.4.6 Details of the interface inputs and outputs are shown in Table 1 and Figure 5 below.

Table 1
Railway Equipment Cable Interface

RAILWAY SIGNAL CONTROLLER					AAWS CONTROLLER	
Rail Link Function	**Normal Circuit Status**	**Cable Pair Ref.**	**Cable Number**	**Cable Colour**	**Controller Input**	**Operation**
Cable Monitor (Continuity)	Closed	1st	1	White	Common	Permanent signal Indicates integrity of the rail system. Loss of signal indicates a fault and AAWS flashing signal aspects are activated.
			2	Blue	Input	
Pre-Release (FGR)	Closed	2nd	3	White		Not Used
			4	Orange		
Release/ Force (FCR)	Closed	3rd	5	White		Not Used
			6	Green		
Call	Closed	4th	7	White	Common	Signal 'off' (open circuit) when train enters 'control/holding' section. Signal 'on' (closed circuit) when train is clear of crossing and (if fitted) boom barriers are vertical. Upon receipt of the 'call' the AAWS activates the flashing yellow signal aspects.
			8	Brown	Input	
Booms Horizontal	Open	5th	9	White		Not Used
			10	Grey		
Spare	Open	6th	11	Red		Not Used
			12	Blue		
Spare	Open	7th	13	Red		Not Used
			14	Orange		
AWS Off	Open	8th	15	Red	 (NC) RLY	Not Used
			16	Green		
Acknowledge Call (AKN)	Open	9th	17	Red	 (NO) 'A' Relay	Not Used
			18	Brown	(NC) 'B' Relay	
AWS Response (TLR)	Open	10th	19	Red	 (NO) 'A' Relay	Not Used
			20	Grey	(NO) 'B' Relay	

Note: The Contractor must confirm with the rail authority that the cable connections detailed in Table 1 are correct for individual site installations.

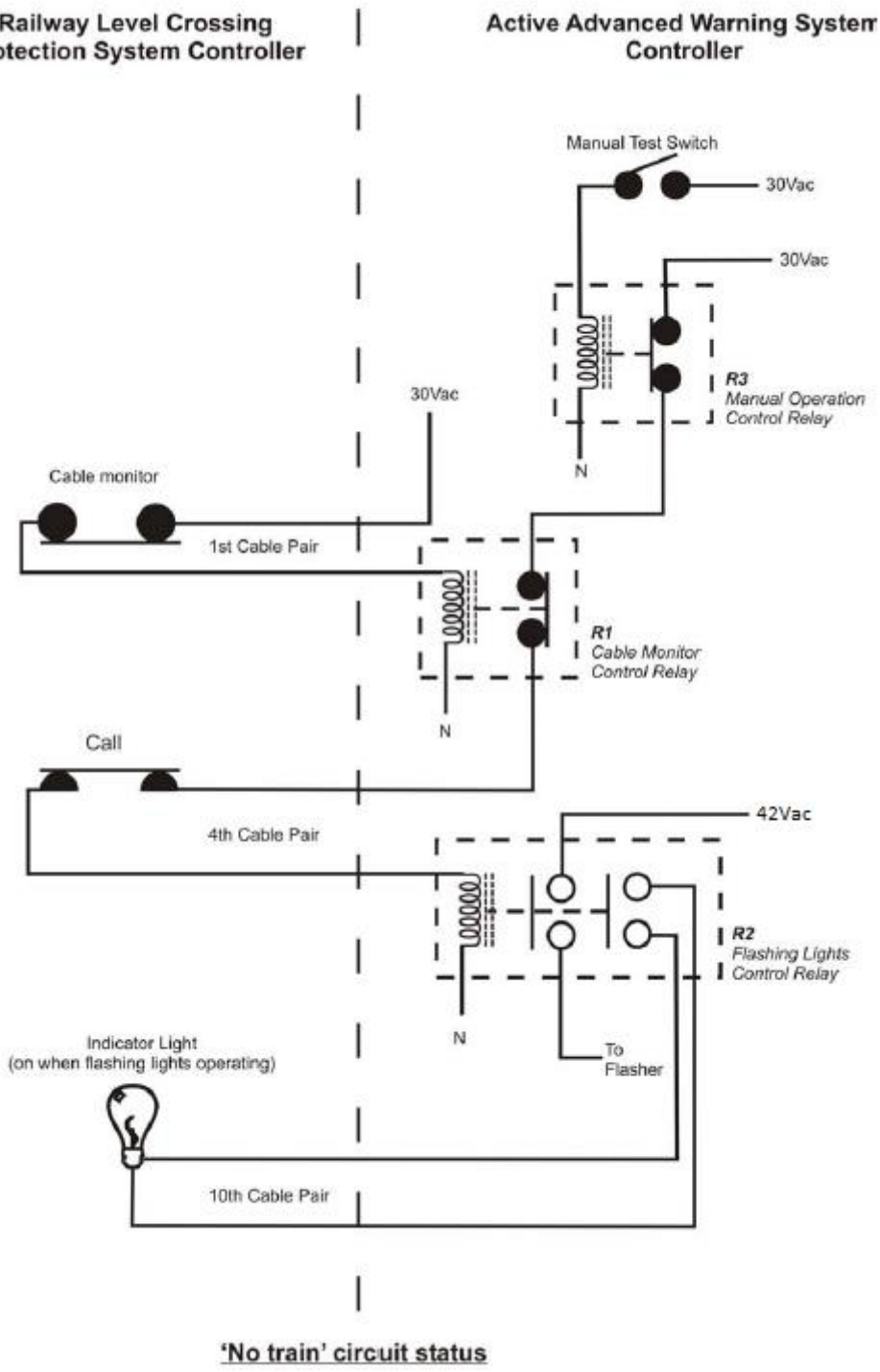

Figure 5
Typical Interface Wiring

5.5 OPERATION OF FLASHING SIGNALS

5.5.1 In the non-activated, ‘no train’ status the flashing signals control relay (R2) is energised which de-activates the flashing signal aspects.

5.5.2 A ‘call’ for a train will open the ‘call’ contact in the Railway Level Crossing protection system and de-energise the flashing signals control relay (R2). This will activate the flashing yellow signals and provide a contact closure that shall be used by the Railway Level Crossing signal controller to provide a visual indication that the flasher is operating.

5.5.3 When the train is clear of the crossing and the boom barriers are vertical (where fitted), the ‘call’ contact shall close and re-energise the flashing signals control relay (R2) to de-activate the flasher unit and the visual indicator circuit.

5.5.4 If the cable monitor contact fails it will de-energise the cable monitor control relay (R1) which will in turn de-energise the flashing signals control relay (R2) and activate the flashing yellow signals.

5.5.5 Relays R1 and R2 will be energised continuously so it is important that they are high quality relays designed for continuous operation.

5.5.6 The operation of the AAWS flashing signals shall be independent of the control monitoring system and shall be capable of continued operation in the event that the control monitoring system processor fails or is removed for maintenance purposes.

5.6 MANUAL TEST OPERATION

5.6.1 Provision shall be made for the manual operation/testing of the system via a manual/auto switch.

5.6.2 In the ‘manual’ position, the switch shall operate the manual operation control relay (R3) de-energising the flashing signals control relay, activating the flashing signal aspects.

5.6.3 In the ‘auto’ position, the switch shall de-energise the manual operation control relay (R3) and place the system in normal operating mode.

5.7 FLASHER UNIT

5.7.1 The flasher unit shall be designed for operation with VicRoads Approved LED traffic signal lanterns.

5.7.2 The flasher unit shall be located within the Input/Output/Flasher module.

5.7.3 The flasher unit shall provide a separate pair of alternating outputs for each approach to the crossing.

5.7.4 The number of cycles per minute shall remain constant and be capable of being adjusted within the specified range (50-60 per minute).

5.7.5 The flash unit shall be capable of generating a duty cycle which is variable between 35% and 65% in increments no greater than 10%.

5.8 VISUAL INDICATORS

5.8.1 The system shall include, as a minimum, the following indicators:

- System operational;
- Flashing signal aspects operating;
- System in manual mode;

SECTION 6 COMMUNICATION

6.1 GENERAL

6.1.1 All AAWS shall be fully compatible with VicRoads ITS Platform (See Appendix A).

6.2 SECURITY

6.2.1 VicRoads communications network must conform to the VicRoads Information Security Policy at all times.

6.2.2 All AAWS shall be fully compliant with VicRoads communications security requirements.

6.3 DATA TRANSMISSION

6.3.1 Communications is required between the AAWS system and VicRoads Network and shall be via a TCP/IP compatible network link, such as cellular wireless connection.

6.4 TIME ACCURACY

6.4.1 AAWS shall be able to synchronise its internal clock with VicRoads provided NTP server via NTP protocol.

6.4.2 All data shall be time stamped in milliseconds.

6.5 CONFIGURATION

6.5.1 Configuration tools shall be provided by the manufacturer.

6.5.2 The configuration tools shall enable configuration of device parameters and detection layout via IP network.

6.5.3 The configuration tools shall operate correctly on VicRoads standard operating environment.

6.6 MONITORING

6.6.1 The control monitoring system shall be capable of providing the following status indications when requested by the host using the communications protocol detailed in Appendices A:

- Cable status – indicate integrity of Railway Level Crossing control system;
- Lamp status – indicate that all lamps are operational;
- Mains supply status - indicate that the mains supply is okay;
- Lamps supply status – indicate that the lamps supply is okay;
- Battery status – indicate that the battery level is acceptable;

- Manual/Auto switch status – indicate that the switch is the ‘manual’ or ‘auto’ mode;
- Door switch – indicate that the door is close;

6.7 ALARMS

6.7.1 The control monitoring system shall be capable of automatically providing the following alarm status indications using the communications protocol detailed in Appendices A:

- Cable monitor alarm – cable monitor faulty;
- Lamp failure alarm – indicate lamps failure for each approach individually;
- Mains supply alarm – indicate failure of mains supply;
- Lamps supply alarm – indicate failure of lamps supply;
- Battery charger alarm – indicate failure of the 240Vac supply to the battery charger;
- Battery low alarm – indicate that the battery charge level is lower than acceptable;
- Battery critical alarm – indicate that the battery charge level is critically low;
- Stuck on alarm – indicate if the system is on without input from railway signals; and
- Door open alarm – indicate that the cabinet door has been opened.

SECTION 7 ELECTRICAL REQUIREMENTS

7.1 GENERAL

7.1.1 All electrical works shall comply with relevant requirements of AS/NZS 3000.

7.1.2 Transformers used within the sign and/or sign control system shall comply with the appropriate parts of AS/NZS 61558.

7.2 MAINS POWER

7.2.1 The mains supply voltage shall be deemed to be 230Vac +10%, -6% in accordance with AS 60038 Section 2. The system and or sub-elements of the system shall be capable of operating satisfactorily from the same within ±15 %.

7.2.2 The location of the Point Of Supply (POS) for the installation shall be determined/confirmed at a pre-installation inspection in consultation with VicTrack and the local power distribution company.

7.2.3 Unless otherwise directed, the POS shall be constructed as an unmetered supply as shown in VicRoads Standard Drawing TC-1206 Consumer Mains for Traffic Signals, using an approved mains isolation circuit breaker board.

7.2.4 Where power comes from an underground supply or is specified, an approved pillar connection shall be installed complete with an approved mains isolation circuit breaker or fuse.

7.2.5 The pillar should be installed between 5m and 10m from the controller. A ‘hoop’ type bar shall be installed over the pillar to ensure that it does not present as trip hazard.

7.2.6 The Contractor shall lodge all relevant associated documentation to comply with the requirements of the Energy Safe Victoria and the local Distribution Business for the provision of a 230v 50 hertz single phase power supply for final termination on not less than 32 amp service fuses.

7.2.7 Where the Supply Authority determines that a meter is to be used, the electricity supply meter box and consumer mains shall be housed within approved distribution cabinet (typically a Type 2). The specific requirements for individual installations shall be determined by the Supply Authority.

7.3 ELECTRICAL FACILITIES

7.3.1 The electrical system within the cabinet shall incorporate the following facilities:

- a circuit breaker board comprising appropriately rated mains isolation switch and circuit breaker/s;
- a socket outlet protected by an integral Residual Current Device (RCD) in accordance with the requirements of AS/NZS 3000; and

- provision to manually activate the flashing yellow signal aspects for testing and maintenance purposes. Such provision shall be located inside the controller cabinet to prevent unauthorised operation.

7.4 INTERNAL PROTECTION

7.4.1 All equipment internal to the sign and SC shall be protected against damage resulting from:

- Lightning strikes at or near the sign/controller;
- Electrical transients on power cabling;
- Electrical transients on communications wiring;
- Radio frequency interference;
- Static electrical discharge; and
- Any harmonics arising from the above and any equipment in the cabinet.

7.5 BACKUP BATTERY

7.5.1 A battery back-up, or Uninterrupted Power Supply (UPS), facility shall be provided with the system and housed within the control system cabinet.

7.5.2 The battery back-up or UPS facility shall have the capacity to operate the AAWS system under normal operational conditions for a minimum period of six hours.

7.5.3 Batteries used in the back-up system shall be of a deep discharge, low-maintenance gel type and will be automatically charged from an internal system located within the control equipment cabinet

7.6 ELV LANTERNS (42VAC)

7.6.1 The default operating voltage for the flashing yellow aspects shall deemed to be ELV level (42 volt a.c.) LEDs, unless otherwise specified in individual tender documents.

7.7 SIGNAL LANTERN CABLING

7.7.1 The signal cabling shall be capable to cover the distance between the AAWS controller and the flashing yellow signal aspects.

7.7.2 The cabling shall be suitable to cater for voltage drop.

7.7.3 Where there is Slip Based Pole installed, disconnect terminal shall be used.

7.8 SOLAR POWER

7.8.1 Where specified in individual tender documents, the sign shall be designed for solar operation.

7.8.2 The solar power system shall be designed, constructed and installed in accordance with AS/NZS 4509.2, AS 4086.1 and AS 4086.2.

7.8.3 The supplier shall design a suitable ‘solar system’, when designing the solar system, consideration must be given to the power consumption, the hours of operation, the surrounding environment and the average amount of sunlight available

SECTION 8 ENVIRONMENTAL REQUIREMENTS

8.1 AMBIENT CONDITIONS

8.1.1 The control system shall operate correctly in ambient temperatures in the range -10°C to +50°C, and with up to 90% relative humidity, and with up to 1 kW/m2 insolation applied to the maximum exposed surface.

8.2 EMC COMPLIANCE (EMC)

8.2.1 All equipment covered by this specification shall comply with all relevant requirements of the Australian Communications and Media Authority (ACMA) for EMC and shall be labelled with a conforming RCM compliance label as detailed in Figure 6.

Figure 6 - RCM compliance label

8.2.2 All equipment covered by this specification shall comply with:

- AS/NZS 61000.6.1 for immunity; and
- AS/NZS 61000.6.3 for emissions.

8.2.3 The control system shall meet the requirements of the prescribed tests as detailed in the following standards:

(a) electrostatic discharge (AS/NZS 61000.4.2);
(b) fast transients on the mains supply (AS/NZS 61000.4.4);
(c) surges on the mains supply (AS/NZS 61000.4.5);
(d) radiated radio frequencies (AS/NZS 61000.4.3); and
(e) conducted radio frequencies (AS/NZS 61000.4.6);

SECTION 9 CONDUITS AND PITS

9.1 GENERAL

9.1.1 All installation works shall be installed in accordance with individual site plans and the relevant VicTrack requirements except where detailed below.

9.1.2 All below ground conduits are to be installed in accordance with VicRoads Contract Standard Section 733 “Conduits and Pits for Underground Wiring and Cabling”.

9.2 ELECTRICAL CONDUIT

9.2.1 All underground electrical conduits shall be 50mm, heavy duty grade, rigid orange, UPVC conduit to AS/NZS 2053.2.

9.3 COMMUNICATION CONDUIT

9.3.1 All conduits for communication cables shall be 32mm, heavy duty grade, rigid, white UPVC communication conduit to AS/NZS 2053.2 and to the Australian Communications and Media Authority (ACMA) publications and standards.

9.4 ABOVE GROUND CONDUITS

9.4.1 Unless otherwise specified, conduits above ground and attached to poles (such as frangible poles and electricity supply poles) shall be 25mm diameter galvanise wrought iron conduit or steel sheathing of an acceptable type and shall be attached to the pole or structure using steel straps or other methods acceptable to the relevant authority or owner.

9.4.2 The conduit shall extend up to a termination point for the electrical cables or to a height of three metres, whichever is the lower

9.5 CABLE PITS

9.5.1 Cable pits shall be:

- standard 300mm, round, electrical pits;
- installed at every change of direction of the conduit; and
- installed not more than 120m intervals;

SECTION 10 MARKINGS

10.1 GENERAL

10.1.1 Each AAWS control cabinet shall be legibly and durably marked on the interior surface with the following information

i. The name, trade name or trademark of the manufacturer or responsible supplier.

ii. Batch or serial number or other mark which will clearly identify the date of manufacture of the item.

iii. On the inside of the front door of the cabinet there shall be displayed a sign bearing the legend "DANGER 240 VOLTS". This sign shall conform to the relevant Australian standard.

iv. On the outside of the cabinet there shall be displayed the VicRoads Standard Cabinet Label in accordance with VicRoads Standard Drawing TC-2100.

SECTION 11 DOCUMENTATION

11.1 GENERAL

11.1.1 The following items are to be supplied with the system:

(a) A full operation and maintenance manual. The manual should include as a minimum:
- Detail of the operation of the system, including software;
- Any and all operational and maintenance requirements; and
- Detailed fault finding methodology.

(b) A schematic diagram or chart showing the 'as-supplied' electrical circuits contained within the system;
(c) A list of all major electrical sub-components detailing their electrical characteristics and operations limits.

11.1.2 The Contractor shall supply a minimum of three hard copies and one soft copy of the above documentation for VicRoads records.

11.1.3 One hard copy of the above documentation shall be stored within the AAWS control equipment cabinet.

11.2 AS BUILT PLAN

11.2.1 The Contractor is responsible for the detailed recording of the actual installed (as built) hardware and conduit locations.

11.2.2 The Contractor shall record on an as-built drawing the actual locations of the installed hardware and conduit accurately depicted compatible CAD drawings. Such details shall include:

- Conduits;
- AAWS controller cabinet;
- Signs;
- Pits;
- Point Of Supply (POS) etc.

11.2.3 The installed depth and location of every underground road crossing shall also be clearly dimensioned from an appropriate permanent feature on each side of the road.

11.2.4 The Contractor shall provide two signed, hard copies of each as-built drawing, together with a soft copy in the agreed electronic format to the Superintendent. This information shall be provided to the Superintendent within thirty days of the commissioning.

APPENDIX A

VICROADS ITS PLATFORM

(Informative)

A1 GENERAL

A.1.1 VicRoads ITS platform currently uses the STREAMS system.

A.1.2 STREAMS is owned and maintained by Transmax, a Queensland based company which is part of Queensland Main Roads.

A.1.3 STREAMS is an integrated control system which is being used by VicRoads to operate ITS AAWS devices.

A.1.4 All ITS field devices must be compatible with STREAMS.

A.1.5 Typical ITS field devices connected to and operated by STREAMS include:

1) Variable Message Signs (VMS)
2) Freeway Data Stations (FDS)
3) Ramp metering/control signs
4) Lane Control Signs (LCS)

A.1.6 A typical STREAMS connection schematic is shown in Figure A1.

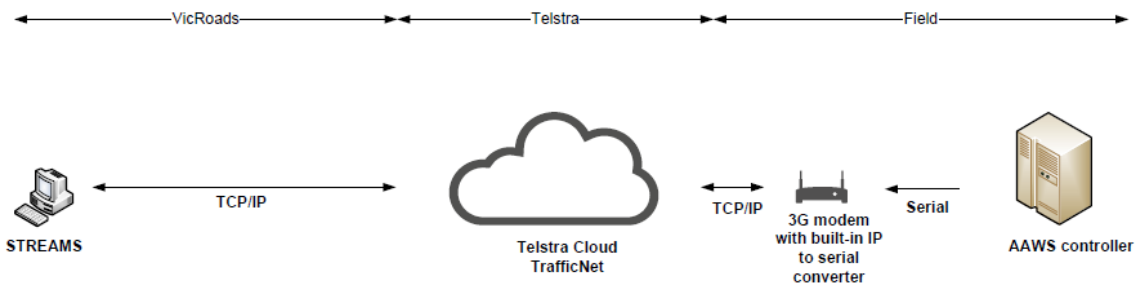

Figure A1 - AAWS connected to STREAMS

A2 VICROADS ANCILLARY ITS DEVICE PROTOCOL (VERSION 1.10)

A.2.1 VicRoads Ancillary ITS Device Protocol has been designed to manage simple road side devices.

A.2.2 Currently the protocol is used for Advanced Active Warning Signs (for rail crossings) (AAWS) and Ice Warning Station Systems.

A.2.3 This protocol has been created to cater for communications transport upgrades for remote AAWS and RTWS from dial-up to TCP/IP.

A.2.4 The protocol can be provided by ITS Improvement & Standards team.

APPENDIX B

REQUIREMENTS FOR TYPE APPROVAL

(Normative)

B1 GENERAL

B1.1 Active Advance Warning Systems for use on VicRoads projects are required to hold current VicRoads Type Approval.

B1.2 Following components of the system require VicRoads Type Approval:

- Cabinet & Controller;
- Signal Lantern Aspects;
- Sign Support Post;

B1.3 The Product Compliance evaluation process shall be carried out in accordance with VicRoads Guideline TCG 016.

B1.4 To enable assessment for the purpose of granting Type Approval, the supplier must provide the following:

a. A complete working sample of the Active Advanced Warning System.
b. An outline drawing showing the general presentation and overall dimensions of the complete system.
c. Documentation to demonstrate that the system has been manufactured and supplied under an approved quality assurance system.
d. Documentation to demonstrate that the system conforms to the requirements of VicRoads Specification. This may be by means of submitting test results from approved and appropriately qualified independent testing organisations, or providing the manufacturer's assurance that the product complies with each paragraph of the specification.

B1.5 Alternatively, the supplier may submit evidence of Type Approval of the same product by another Australian State Road Authority, together with details of volume and period of usage by other jurisdictions.

B2 REQUIRED NATA ACCREDITED TESTING

B2.1 Notwithstanding B1 above, the supplier shall submit test results from a NATA accredited testing organisation to demonstrate compliance with the following:

Clause	Requirements	Evidence
7.1	Temperature and humidity	Test Report
7.2	EMC Compliance	Test Report

B3 STREAMS COMPATIBILTY

B3.1 The supplier shall provide evidence of compatibility with STREAMS.

B4 COMPATIBILTY WITH VICROADS ANCILLARY ITS DEVICE PROTOCOL

B4.1 The supplier shall provide evidence of compatibility with VicRoads Ancillary ITS Device Protocol.

B5 ASSESSMENT PROCEDURE

B5.1 The assessment procedure for Advanced Active Warning System will include, but not be limited to, the following:

- Assessment of construction, workmanship and critical dimensions;
- Evaluation of the submitted data against the requirements of the specification;
- Operation of the sign on VicRoads system;

B6 OTHER REQUIRED TESTING

a. VicRoads may require field testing to be carried out as part of its evaluation of the product.
b. VicRoads may require additional information or testing to be carried out as part of its evaluation of the product.
c. If the product is approved, a Certificate of Type Approval will be provided to the supplier. Until such time as this Certificate is issued, the product is not to be used in the State of Victoria.

APPENDIX C

GUIDELINES FOR FACTORY ACCEPTANCE TESTING AND COMMISIONING

(Informative)

C1 FACTORY ACCEPTANCE TESTING

C1.1 The Contractor should develop a Factory Acceptance Test (FAT) which is then approved by VicRoads. While it is envisaged that this will be the case for AAWS, the following is a list of the minimum tests that are required and should be covered by the Contractor's FAT.

- Communications test, using site specific SIM card, to ensure that AAWS is fully compatible with VicRoads ITS Platform (See Appendix A);
- Simulated functional operation as described in C3 below;
- Simulated alarm testing as described in C4 below;
- Correct reporting of current status when requested by VicRoads; and
- Correct reporting of faults to VicRoads;

C2 COMMISSIONING

C2.1 The Contractor should develop a test and commissioning procedure to ensure that the system is installed and operating correctly at switch-on. As a minimum, the following checks should be made as part of the commissioning procedure:

- Power connected and functioning;
- Communications system functioning;
- Connection to Victrack functioning;
- System functional test as detailed in C3 below;
- System alarm test as detailed in C4 below;
- Manuals supplied;

C3 FUNTIONAL TESTING

C3.1 The following functional tests should be conducted:

- Cable monitor operational;
- CALL functioning correctly;
- Flashing yellow lanterns operating correctly;
- UPS operational;
- Manual/Auto switch operational;

C4 ALARM TESTING

C4.1 The following simulated alarm tests should be conducted:

- Cable monitor fail reporting;
- Mains fail reporting;
- Lantern fail reporting;
- Lamps supply fail reporting;
- Door open reporting;
- CALL functioning correctly;
- Battery fail reporting;
- Battery charger failure reporting;
- Manual switch status reporting;

APPENDIX D

INSTALLATION AND COMMISSIONING GUIDELINES

(Informative)

D.1 SITE INSTALLATION

D.1.1 The exact locations of all components of the Active Advance Warning Systems will be detailed in individual tender documents.

D.1.2 The contractor shall be responsible for the supply and installation of all equipment required for the Active Advance Warning Systems including but not limited to:

a) the Active Advanced Warning Signs;
b) LED yellow lanterns and associated control gear and flasher units;
c) posts and/or mounting structures;
d) cabinets and enclosures at each site;
e) power cabling from the "point of supply" to the equipment;
f) communication cable from the communications network to the equipment; and,
g) all pits and conduits required for connection of power and communications.

D.2 COMMISSIONING

D2.1 The contractor shall be responsible for the commissioning of the whole system, including:

a) operation, communication and associated control equipment;
b) access for local operation and maintenance purposes;
c) testing the integrity of the signs and system;
d) submission of documentation relating to the maintenance and testing procedures for the system and the associated components.

D.3 FREE STANDING SIGN MOINTING REQUIREMENTS

D3.1 All signs shall be mounted on type approved slip base post, such that the base of the sign is 5 metres above ground level.

D3.2 It shall be the contractor’s responsibility to ensure that the posts are dimensioned appropriately to withstand wind forces for the region as defined in AS 1170.2.

APPENDIX E

RECOMMENDED MAINTENACE GUIDELINES

(Informative)

E1 GENERAL

E1.1 Regular routine maintenance of Active Advance Warning Systems is recommended.

E1.2 The maintenance activities to be carried out for Active Advance Warning Systems should include, but should not be limited to the following:

(a) Check that the overall system is intact, secure, clean and undamaged;
(b) Ensure all cables and connectors are in good condition and firmly placed in sockets and connectors;
(c) Ensure all wiring and cabling is securely connected and supported;
(d) Ensure signal and connection strength;
(e) Ensure pole is secure at base and tighten rag bolts as necessary;
(f) Inspect and ensure locks, where fitted, are secure;
(g) Inspect, repair or replace all faulty, damaged or missing fixing accessories (i.e. washers, nuts and bolts etc.)
(h) Ensure there is power to assets;
(i) Perform preventative maintenance as per manufacturer's specifications; and
(j) Ensure Active Advance Warning System operation is legible;