

ITS specification Ramp signal supply and installation (ITS-05-02)

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Document management plan

1) Purpose

The purpose of this document is to specify the general requirements for the supply and installation of Ramp signals and system.

2) Document information

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3) Key words

ITS Ramp Signal System Supply and Installation.

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Draft R1	All	AMA Specifications Review	JF & TLH	26/1/2011
Final R2	All	Final	BW & JS	15/2/2012

Superseded

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1.0 Ramp signal supply and installation

1.1 Scope

This section sets out the requirements for the supply, testing, installation and commissioning of the Ramp Signalling System (RSS).

This document specifies the components of a Ramp Signalling System for supply and installation to complete a Ramp Signalling System design done by others.

This document takes precedence over the National Traffic Signal Specification document version 2 dated 1st September 2005, where any conflict occurs.

1.2 General

This document is aligned to the current Travel Demand Management (TDM) project that has installed a large number of Ramp Signal installations in and around Auckland; the components of the systems have been developed in line with the TDM Concept of Operations and Functional Requirements.

In general each Ramp Signal site will consist of:

- a. A Ramp Signal Controller used to manage the operation of the lights and advanced warning signs;
- b. Mainline and ramp count & occupancy detector loops monitoring the flow rates on the motorway for the RSS to determine the best operating conditions;
- c. Queue detector Loops to monitor queue lengths on the on-ramp and arterial road;
- d. Ramp Signals to limit the traffic on the on-ramp to control the flow on traffic onto the motorway;
- e. Type A Advanced Warning Signs giving motorists prior warning of Ramp Signal Operation;
- f. Type B Advanced Warning Signs warning motorists to stop at the Ramp Signals;
- g. Power supply
- h. Roadside Communications cabinet, plinth and apron;
- i. Communications interfacing equipment;
- j. Guardrail protection and other accessories as necessary.

1.3 Standard drawings

The standard drawings for Ramp Signalling System layouts are attached in the Waka Kotahi *ITS specification: Ramp Signalling system standard drawings* (ITS-05-03). The standard drawings are provided for information to provide a basis for design. The contractor shall provide site specific detailed design drawings for all structures and foundations associated with the project for review prior to commencement of fabrication.

The drawings attached in the Waka Kotahi *ITS specification: Ramp signalling system standard drawings* (ITS-05-03) Signalling should be used as guidance only.

2.0 Ramp signal controller

2.1 General

The Ramp Signal Controller provides all the control functionalities associated with the operation of the traffic signals heads and advanced warning signs. The controller also provides the termination points of all inductive loops monitoring the performance of the highway.

The ramp signal controller is supplied with a standard signals controller cabinet.

To date the only approved Ramp Signal Controllers allowed to operate on the Waka Kotahi network shall be RTS TSC/4 compliant.

2.2 Components

2.2.1 General

The Ramp Signal Controller shall be supplied complete with the following:

- a. The logic unit complete with input, output, power, control, communications and processor modules;
- b. A site identification card;
- c. A 3-position external facility switch (off - normal – maintenance (flashing yellow));
- d. A Tele-permitted line isolation unit for SCATS connection complete with 1.5 metres of cable with a B/T or GLUON communications Unit;
- e. Lamp dimming/voltage regulation;
- f. All wiring, looms, terminals, rails, gear tray etc. necessary to complete the installation of the signal;
- g. Hand Held Terminals to interrogate and setup the controller;

2.2.2 Logic unit

The logic unit shall:

- a. Be capable of operating at least 16 signal groups however, unless specified only the required number of signal groups needed for the site shall be provided.
- b. Incorporate solid-state load switching of signal groups.
- c. Be provided with the specified number of detectors and inputs. HOWEVER the logic rack MUST be:
 - capable of being expanded to accept at least 24 vehicle detectors plus 8 external outputs and 8 external inputs (i.e. AWS Signs)
 - Be able to monitor lamp loads for all signal groups and when used with LED lanterns, to be able to
 - Measure lamp loads down to 5 watts.
 - Be, at minimum, SCATS VC 4 compatible.
 - Be approved by RTA (NSW).
 - Be able to automatically or via SCATS dim the signal group lantern outputs by at least 20%.
 - Regulate the voltage supplied to the lamps to within $\pm 2\%$.

- Provide full operation when the intersection is fitted with LED lanterns that comply with the Australian / NZ Standard for Traffic Signal Lanterns AS/NZS 2144:2002

2.2.3 Controller cabinet

The controller cabinet shall conform to the Waka Kotahi *ITS Specification for Roadside cabinets* (ITS -02-04) and in addition have the following features:

- a. Dimensions: Minimum internal dimensions of 1205 mm high by 410 mm deep by 565 mm wide.
- b. Materials: 2.5 mm aluminium alloy.
- c. A front door with three internal hinges on the left-hand side.
- d. Rust resistant recessed handles complete with top and bottom rods and side tongue for locking and using a key
- e. The door is to be constructed so the levering of the door open with a screwdriver or crow bar is not possible and be earth bonded.
- f. Have welded construction with no rivets or nuts or bolts visible from the outside.
- g. Be stiffened to prevent the cabinet from flexing once installed.
- h. Be ventilated at the bottom and top to facilitate circulating airflow.
- i. Be weather proof with a minimum IP55 rating and vermin proof (including the ventilation grills)
- j. Include a document holder, capable of holding 4 A4 laminated sheets, securely fixed to the inside of the door. The holder must be at least 2/3rds the height of an A4 sheet and be free draining.
- k. A shelf installed across the full width of the cabinet but with 50 mm clearance from the front face. The clearance between the top of the cabinet and the shelf shall be 450 mm or sufficient to hold the controller logic module.
- l. Have sufficient mounting rails to secure all field wiring terminations and internal hardware.
- m. A switchboard mounted on the gear plate facing forward or on the right-hand side cabinet wall, pre-wired for the Local Electrical Supply Authority's requirements.
- n. The transformer and contactors are to be easily accessible.
- o. Provision for mounting the 3 pole facility switch on the top front right hand side of the cabinet.
- p. Be designed to prevent direct access to 230V potential wiring when the front door is open. This may be achieved by the use of a 3 mm clear plastic cover.
- q. All internal and external surfaces shall be powder coated to a minimum dry film thickness of 50 microns. Unless specified, the coating colour shall be Beige.

Ramp Signal Controller cabinets shall be labelled in the format "E-RRRR-D" typically E-8006-N.

- a. Where "E" is E for equipment cabinet.
- b. Where "RRRR" is the SCATS identifier number assigned to the Ramp Signal and used for the entire Ramp Signal equipment connected to the controller.
- c. Where "D" is the direction of traffic on the carriageway on which the cabinet is located, e.g.: N (northbound), S (southbound), E (eastbound) or W (westbound).

2.2.4 Signal lamp control

Provision shall be made to switch the signal lanterns “on” or “off” or “flashing yellow” external to the controller housing by the standard type triangular facility key incorporating a brass shaft.

This switch shall control the signal lamp circuit only and in its “off” or “flashing yellow” position shall leave the control equipment fully operative.

The switch positions shall be:

- a. left - off
- b. centre - flashing yellow (maintenance)
- c. right - normal operating mode (on)

2.2.5 Service switchboard

Each traffic signal controller cabinet shall be provided with a proprietary service switchboard that shall include:

- a. One single pole mains power isolation switch (30A).
- b. One controller circuit breaker (10A).
- c. One signal lamp circuit breaker 16A) to suit the cable size. (REV 2)
- d. One flashing yellow circuit breaker (10A).
- e. One general purpose outlet circuit breaker (10A).
- f. One neutral bar with a minimum of 4 ways. (REV 2)
- g. One earth bar with a minimum of 4 ways. (REV 2)
- h. One double switched 3 pin socket

The switchboard shall be positioned to provide unobstructed access to the main field wiring terminals. The recommended location for the switchboard is mounted on the right-hand wall of the cabinet

Note that the specification detailed above was taken from the National traffic Signal Specification document version 2 dated 1st September 2005. For further details please refer to this document.

3.0 Advanced warning signs

3.1 General

Within each RMS Installation electronic advanced warning signs shall be used to inform the travelling public of the current status of the ramp signalling.

AWS signs are installed on the approach to a motorway on-ramp and on the ramp itself. Two types of AWS are used:

- a. Type A (Usually installed on the approach to the ramp)
- b. Type B (Always installed on the ramp itself and usually installed in pairs)

3.1.1 AWS general specification

The minimum requirements for Advanced Warning Signs are as follows:

- a. Design life of 10 – 15 years
- b. All signs shall employ LED technology
- c. Minimum casing size of each sign 1675mm(W) x 990mm(H) x 205mm(D)
- d. Display colour in accordance with EN 12966-1 Class C1
- e. Communication Protocol TCP/IP
- f. Luminance EN 12966-1 Class L3
- g. Luminance ratio EN 12966-1 Class R3
- h. Signs shall include a light sensor to measure ambient light conditions and automatically adjust display intensity to a minimum of 10 levels
- i. Beam width EN 12966-1 Class B2 minimum angle of 14 degrees
- j. The ability to be gantry mounted, post mounted or cantilevered
- k. Operating temperatures of -15 to + 60 Celsius.
- l. Option for colour display
- m. The ability to operate amber flashing lanterns
- n. Visual performance in accordance with EN 12966-1
- o. Ingress protection of EN 12966-1 Class P2 Water (minimum of IP55) Class D3 Dust & other pollutants
- p. Environmental protection EN 12966-1 Class T1

3.1.2 Communications

Options for communications to the AWS signs are:

- a. Fibre optic cable
- b. Copper Cable
- c. Wireless Connectivity

The preferred option is multimode fibre optic cable supplied and installed in accordance with the Waka Kotahi ITS specification: *Optical fibre supply and installation* (ITS-02-03).

3.1.3 Power

Power will be taken to the AWS from the Ramp Signal Controller and shall have the capability to be isolated at the signs and controller.

- a. AC Mains Powered
- b. Means of local power isolation

In addition to mains power a backup battery will be provided to allow the sign controller to raise and alarm in the event of a power failure to the AWS. The backup battery is connected directly into the sign controller and is only required in AWS where the controller is mounted internally to the sign i.e. Type A and type B signs.

3.1.4 Text display

Minimum Character Height of 175mm for urban environment

Minimum Character Height of 350mm for Motorway environment

Minimum Three Possible Lines of Text with a minimum of eight characters per line.

Capability of Alpha, Numeric and Graphic Message

3.1.5 Status information

Each AWS shall be directly connected to the Ramp Signal Controller I/O board and be capable of relaying the following status information:

- a. Power failure;
- b. Communications failure;
- c. Display failure;
- d. General equipment fault (dim/ bright failure);

3.2 Type A AWS

Type A AWS is installed along the local arterial road on the approach to the motorway on-ramp.

The Type A AWS sign shall be "Blank" when the ramp signals are switched off and shall display "Ramp Signal ON" during operation.

The Type A AWS can have additional yellow flashing lanterns when used to advise of a motorway to motorway Ramp Signals.

Type A signs shall be capable of displaying and storing the following messages:

- a. Message 1 - Blank
- b. Message 2 - Ramp Signal ON
- c. Message 3 - Blank
- d. Message 4 - Motorway Closed
- e. Message 5 - Onramp Closed

- f. Message 6 - Incident on Motorway
- g. Message 7 - Works on Motorway
- h. Message 8 - Queue on Motorway
- i. Message 9 - Reduce Speed
- j. Message 10 - All pixels on"

3.3 Type B AWS

Type B AWS are installed on the motorway on-ramp.

The Type B AWS sign shall display two messages only. When the ramp signals are switched off the sign shall display "Ramp Signal OFF" during the operation of the ramp signal the sign shall display "Prepare to Stop"

A PW-43 Static sign is mounted on the top of the Type B AWS as shown in figure 1.

Figure 1: Type B AWS Operation with PW-43 Sign



3.4 AWS pole and bracket

3.4.1 Pole types

The type of pole and bracket required to support the AWS signs will vary dependant on site conditions and installation restraints. Typically there are two types of pole and two types of bracket that are used, these being:

- a. Special Pole, preferably 4.9m. For use in areas where viewing height is restricted or ground conditions dictate the need for a taller pole (Design Dependant)
- b. 3.5m Standard Pole. For use in standard installation environments.
- c. F Type Bracket. For use over walkways or where the installation is in close proximity to the road
- d. C Type Bracket. For use in standard installation environments.

Dependant on the design criteria and local conditions these poles shall either be ground planted or shear base (attached to a ground mounted stub).

The standard pole and bracket details are detailed in section 5 Ramp signal and AWS of the Waka Kotahi ITS specification: *Ramp signalling system standard drawings* (ITS-05-03).

3.4.2 Protective coatings

AWS support poles and brackets shall be hot dip galvanized steel in accordance with the following requirements:

- a. AS/NZS 4680:2006 Hot-Dip Galvanised (zinc) coatings on fabricated ferrous articles.
- b. AS/NZS 4791:1999 Hot-Dip Galvanised (zinc) coatings on ferrous open sections, applied by an in-line process.

- c. AS/NZS 4792:1999 Hot-Dip Galvanised (zinc) coatings on ferrous hollow sections, applied by a continuous or specialised process.
- d. AS 1650:1989 Hot dipped Galvanised coatings on ferrous articles.

The protective coatings shall be either:

- a. zinc with a dry film build-up of 0.350mm or
- b. hot dip Galvanised the minimum thickness of zinc coating shall be in accordance with Table 1 of 2 of AS/NZS 4680:2006

Superseded

4.0 Ramp signals

4.1 Ramp signal lanterns

4.1.1 General

The signals lanterns used for ramp signal shall conform with the National Traffic Signal Specification document version 2 dated 1st September 2005, appended to the Waka Kotahi *ITS specification: Ramp signalling system standard drawings* (ITS-05-03), and conform with the following requirements and standards:

- a. AS 1939 Degrees of protection provided by enclosures for electrical equipment (IP code)
- b. AS/NZS 2053 Conduits and Fittings for Electrical Installations
- c. AS 2144 Traffic Signal Lanterns
- d. AS/NZS 3000 Electrical Installations
- e. AS/NZS 3100 Approval and Test Specification – General Requirements for Electrical Equipment
- f. AS/NZS 4251.1 Electromagnetic Compatibility - Generic Emission Standard – Residential, commercial and light industrial
- g. AS 3147 Approval and test specification - Electric cables –Thermoplastic insulated for voltages up to and including 0.6 / 1 kV.

Unless otherwise indicated in individual tender documents, all lanterns supplied for Ramp Signalling shall be LED.

LED displays shall generally operate from a 240 volt ac mains supply. However the ability to operate on a 12 volt dc supply shall be considered.

4.1.2 LED arrangement and characteristics

LED's shall be arranged such that they produce an even display free from dark spots. Each aspect shall conform to the requirements for chromaticity and photometric performance of AS 2144:2002.

The LED's shall be mounted in way that prevents individual LED's from becoming misaligned.

LED lanterns shall be compatible with the operation of, and allow full functionality of, approved traffic signal controllers.

LED aspects shall operate with the following characteristics:

- a. Maximum load of LED aspect (undimmed including power supply) 30W
- b. Minimum load of LED aspect (undimmed including power supply) 5W
- c. Maximum wattage of LED aspect in "Shut Down" mode(undimmed) 0.6W

4.1.3 Signal size

The nominal diameter of Ramp Signals lanterns as referred to in clause 4.1.1 of AS/NZS 2144:2002 shall be either 200mm or 300mm.

Reflectors shall comply with Section 7.3 of AS/NZS 2144: 2002.

4.1.4 Lantern body construction

Lantern bodies shall be constructed from polycarbonate plastic.

All lanterns shall comprise individual aspects connected together to make a display.

The M12 mounting studs shall be locked to the lantern body such that they are prevented from turning if a torque of 25 Nm is applied externally.

The lantern doors shall be capable of being hinged both left and right without the need for tools. It shall also be possible, as a simple field procedure, to replace any door without the need to disturb the lantern mountings.

4.1.5 Visors (cowls) and louvres

Each visor shall fit tightly against the door and shall not permit any perceptible filtration of light between the door and the visor. The construction and dimension of visors shall comply with AS/NZS 2144: 2002 and shall be fully interchangeable in accordance with the criteria recommended in Appendix F of AS/NZS 2144: 2002.

A visor shall be fitted to each optical system of each signal lantern and shall be one of the following:

- **Open type visor:** For use on primary lanterns. Such visors shall extend a minimum of 200 mm from the lantern face and shall be so constructed that the face of the lantern is shielded from sunlight without unduly obstructing the driver's view of the aspect when at the stop line.

This will require a visor enclosing about two-thirds of the lens at the end adjacent to the lantern and, about one-third of the lens at the end of the visor furthest from the lantern.

- **Closed type visor:** For use on lanterns that are in close proximity to the motorway mainline which are highly visible to the motorist. Such visors shall extend a minimum of 300 mm from the lantern face and shall enclose the whole of the circumference of the lantern lens except for an opening at the bottom.

Both of the above types of visors shall be constructed so that they are cylindrical in shape to facilitate the fitting of louvres.

- **Louvres:** When specified, louvres complying with the dimensions shown in Figure 7.10 of AS/NZS 2144: 2002 shall be fitted to the visors.

4.1.6 Target boards

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

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

4.1.7 Mounting straps

Mounting straps shall comply with section 4.1.2 of AS 2144:2002 and shall be 290mm in length with 250mm between mounting hole centres for all lanterns.

4.2 Traffic signal pole

Traffic Signal Poles shall be used to mount the traffic signal in order for the aspect to be seen by the motorist.

There are a wide variety of posts available to suit a number of installation requirements, each post will be hot dip galvanised steel. The standard ramp signal pole arrangements are detailed in section 3 Ramp signal and AWS of the Waka Kotahi *ITS specification: Ramp signalling system standard drawings* (ITS-05-03).

4.3 Ramp signal gantry

Dependant on the design criteria a Ramp Signal Installation may require gantry mounted LED Traffic Signal Heads.

These shall normally be used when a priority bypass lane has been installed on the on-ramp.

The gantry detail and traffic signal head alignment is provided in section 5 Ramp signal and AWS of the Waka Kotahi *ITS specification: Ramp signalling system standard drawings* (ITS-05-03).

Superseded

5.0 Loop detectors

For detailed loop specifications refer to the Waka Kotahi *ITS specification: Inductive loops and feeder cables* (ITS-03-01).

Superseded