WAKA KOTAHI
NZ TRANSPORT AGENCY

ACTIVE WARNING AND REGULATORY SIGNS

ITS Design Standard

20 DECEMBER 2022
0.5

Draft

New Zealand Government

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More information
If you have further queries, contact the ITS S&S team via email: itsspec@nzta.govt.nz

More information about intelligent transport systems (ITS) is available on the Waka Kotahi website at https://www.nzta.govt.nz/its

This document is available on the Waka Kotahi website at https://www.nzta.govt.nz/itsspecs

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1 DOCUMENT CONTROL

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1.2 Document owner

Role Head of Technology Engineering

Organisation Waka Kotahi

1.3 Document approvers

This table shows a record of the approvers for this document.

Approval date	Approver	Role	Organisation
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1.4 Version history – major changes

Document version control is the process of tracking and managing different versions (or drafts) of a document to easily identify the current iteration of a file.

This table shows a record of all major (published) versions of this document **(for Waka Kotahi use only)**. To record minor versions (author updates, amendments etc), go to section 11 Full version history.

Version	Date	Author	Role and organisation	Reason
1.0	DD/MM/YYYY			
2.0	DD/MM/YYYY			
3.0	DD/MM/YYYY			

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2 TERMINOLOGY USED IN THIS DOCUMENT

Term	Definition
DRAFT	The document is being written and cannot be used outside of Waka Kotahi.
PENDING	The document has been finalised and is pending approval and ratification by Waka Kotahi. It can be used for procurement at this status.
RATIFIED	The document is an official Waka Kotahi document. Road controlling authorities are obliged to follow a document with this status.
RETIRED	The document is obsolete, and/or superseded.
AS/NZS	Australian/New Zealand standard
Aspect	Front face of the sign as observed by road users when activated
AWS	Active warning signs. This abbreviation also covers active regulatory signs
Display matrix	Visible part of an electronic sign or signal which contains the pixels that can be activated to display the message.
EN	European standard
Enclosure	Housing for electronics systems to protect against environmental conditions.
Frangible	Performance capability of structures, which are designed to shear or collapse when struck by a vehicle, minimising the impact hazard to the vehicle's occupants.
Hz	Hertz
ISZ	Intersection speed zones
ITS	Intelligent transport systems
km/hr	Kilometres per hour
LED	Light-emitting diode
M	Metre
mm	Millimetres
m/s	Metres per second
NOC	Network outcomes contract
Pixel	Smallest controllable element of a display matrix for an electronic sign or signal.
RCA	Road controlling authority
RIAWS	Rural intersection advanced warning signs. See ISZ
SAT	Site acceptance test
SID	Speed indicator device
SLA	Service level agreement
TCD	Traffic control devices
TCD manual	Traffic control devices manual

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Term	Definition
TCD Rule	Land Transport Rule: Traffic Control Devices 2004
TOC	Transport operations centre
TTM	Temporary traffic management
TUD	Total underground distribution system – power supply pit
WAVSL	Weather-activated variable speed limit

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3 OVERVIEW AND OUTCOMES

This section defines the operational outcomes for intelligent transport systems with respect to the transport network.

3.1 Purpose

The purpose of this design standard is to specify the minimum requirements for the implementation of a range of electronic active warning signs (AWS) on the roading network by Waka Kotahi.

Design assurance is delivered through a series of design standards. The standards ensure road network level operational outcomes and design for safety, security and maintainability are accounted for in solutions being delivered to Waka Kotahi. Design standards address risks typically generated at the front end of roading or infrastructure projects. Their objective is to ensure solutions address the correct operational need and solutions are fit for purpose.

3.2 Overview

This design standard provides guidance for, and is to be read in conjunction with, the latest version of ITS delivery specification: Active warning and regulatory signs in order to effectively install AWS to current Waka Kotahi standards.

3.2.1 Definition

AWS are intended for use as activated advanced hazard warning devices. The application of an advanced warning sign is to provide a self-contained, automatic, operation at the roadside without any dependency on back-office command and control systems to deliver the safety outcomes for which these devices are used.

For the purposes of this standard an Active Warning Sign is a fixed aspect active electronic display device. The displayed aspect is configured to warn an approaching vehicle of a hazard, using either a graphical or text-based aspect, or a combination of both, with the aspect specified at the time of manufacture. The aspect is presented to a user when a defined parameter related to the hazard is exceeded, such as approach speed, or by means of a pre-defined schedule. By definition the sign will require a trigger, typically this is expected to be integrated into the sign but must also make provision for external triggers to support specialist applications.

3.2.2 Waka Kotahi ITS class

001 Signs. Equipment which provides visual messages or warnings to users of the transport network.
Class definitions

3.3 Scope

This design standard provides guidance for the installation requirements for all AWS types. Commonly installed AWS include:

i. speed indicator devices (SIDs)

ii. curve warning signs
iii. cycle warning signs
iv. kura/school zones – active warning
v. variable speed limit signs – used in intersection speed zones (ISZ), weather-activated variable speed limit (WAVSL) zones, and kura school variable speed limit signs
vi. slippery surface warning signs
vii. truck warning signs
viii. livestock warning signs
ix. Pedestrian warning signs
x. Equestrian warning signs

This list is representative but not exhaustive. Designers need to consult the TCD Rule for a comprehensive list of approved aspects. Any new signs, or a different layout of a sign illustrated in this delivery specification, must have their word/font/symbol/light-emitting diode (LED) layouts approved by gazette notice or the TCD Rule. In the first instance, contact tcd@nzta.govt.nz.

These AWS are denoted as R1-2.1 Variable speed sign and W19-2.1 “Symbolic warning – Active LED” in the Land Transport Rule: Traffic Control Devices 2004 (TCD Rule), sections Regulatory signs and W19 General and symbolic signs.

3.4 Outcomes

3.4.1 Operational

By developing this design standard, Waka Kotahi is to achieve the following strategic outcomes specifically to ensure and enhance the Waka Kotahi dynamic hazard warning capability, including but not limited to:

i. providing a safer environment for road workers, drivers, road users using other modes of transport, and pedestrians
ii. increase road user acceptance of the information by improving the quality, operation and standardisation of information and images on all AWS types
iii. Define the ability for all AWS to be remotely monitored, operated, and updated by improving asset monitoring capabilities
iv. Improve safety by providing hazard warnings to road users in advance of hazards and with enough time for a user to respond.
v. improving whole-of-life ITS-related costs by supplying quality AWS assets, including reducing the Waka Kotahi environmental footprint through reduced energy consumption
vi. improve utility of asset by capturing traffic data for analysis and compliance activities by developing a standard system to capture and report data.

This design standard for AWS contributes to the Waka Kotahi strategic fit, operational services, safety, efficiency, and value for money.

3.4.2 For users of the transport network

AWS are intended to provide advance warning to the road user when approaching hazards on or adjacent to the roadway, ensuring easy identification of the hazard by means of appropriate aspect and any corrective actions the user needs to take. The desired outcome is to give users a clear, intuitive advanced warning of

upcoming hazards or speed changes to improve the safety of all road users, including cyclists and pedestrians.

3.4.3 For road controlling authorities

AWS are tools that enable RCAs to warn of hazards on or adjacent to the roadway to meet safety outcomes. AWS will also provide data to enable the RCA to assess the effectiveness of the treatment for future measures.
This standard will improve the solutions available to RCAs to manage safety outcomes and improved alignment with best practice and regulations of solutions.

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4 DESIGN FOR OPERATION

This section defines the functionality required to achieve successful operation of the intelligent transport system.

4.1 Selection of AWS as a solution

This design standard does not detail the method for initial site assessment and site selection which requires treatment via the application of AWS, nor the choice of application for each site.

Guidance can be found in the Waka Kotahi Speed management guide road to zero edition (July 2022), associated appendices and additional information.

Site and application type selection shall be undertaken with the assistance of Waka Kotahi, the local RCA and/or the network outcomes contract (NOC) and other stakeholders.

Designers should read the relevant Waka Kotahi traffic notes for each installation type in conjunction with this design standard where available. Waka Kotahi traffic notes are listed in section 9.2.2 Resources.

4.2 Sign visibility

AWS must be positioned to the left of approaching motorists. In virtually all situations, it is considered unsafe to position a single AWS on the right-hand side of approaching traffic because it may confuse motorists' point of reference under nighttime conditions and create potential crash hazards.

Signs may be gated with one on either side of the road at suitable locations with good nighttime visibility on agreement with the Regional Safety Engineer.

4.2.1 Clear sight distance

From the left of approaching motorists, AWS should be visible from a clear sight distance of at least 2m for every km/hr posted speed limit. This ratio will provide motorists driving at the legal speed limit with at least seven seconds to read the display, and those approaching at 50% above the legal speed limit with at least four seconds to read the display.

AWS shall be positioned so that adjacent vegetation or structures will not obscure the visibility of the sign and that any vegetation clearance, including for solar panels, is completed and can be legally enforced for future maintenance.

4.3 Road environment

4.3.1 Road geometry

The section of road within the radar coverage of AWS must be sufficiently straight to ensure the sideways vector will not cause the radar to underestimate the approach speed.

Ideally, avoid positioning AWS directly in front of a rising or setting sun as this may significantly reduce effective visibility. Similarly, reflections of the sun on the display face may reduce legibility.

Where these display visibility factors cannot be mitigated (e.g. by taking advantage of a natural backdrop of a hill or trees, or a downhill slope) then the use of a hood, louvers or backing boards may be necessary or required to shield the display. The designer should seek approval for any changes from the relevant regional or safety authority.

4.3.2 Presence of other signage

Signs or other large objects in front of AWS may partially block the radar beam. AWS must be positioned to minimise any such effects.

AWS should not compete with existing signs, other light-emitting sources or interfere with traffic control devices (TCDs). The designer must make an inventory of all signs and TCDs both preceding and beyond the potential site. Based on this inventory, existing signs may need to be moved or removed to accommodate the placement of AWS.

An assessment of existing signage should be undertaken to understand if modifications or removal of existing signage is required. In general, the minimum spacing distance between signs will be based on (0.6 x V85), where V85 is the 85th percentile speed of traffic, in km/hr, at the sign location (Waka Kotahi Manual of traffic signs and markings, MOTSAM).

4.3.3 Metal railings

Where AWS incorporate a radar unit, metal railings such as bridge railings may partially shield the radar's beam and reduce its ability to register vehicles. The designer should take these effects into account when selecting a site.

4.4 General roadside location

4.4.1 Horizontal placement

AWS are usually centrally mounted on a single frangible aluminium post. Where a larger solar panel is needed, or other conditions require it, there may be two posts adjacent to each other, either side by side or front to back. Refer to section 4.5.2 Support structures for design requirements.

On a roadway with kerbing, the central post should be positioned at least 2m from the kerb face, and possibly more if the road has a pronounced camber, to ensure a high-sided vehicle will not clip the sign.

In urban environments or alongside footpaths, the sign position should in no way obstruct the established footpath width. However, the mounting height will allow for some aerial overhang of the footpath.

On roadways without kerbing, the central post should be positioned at least 3m from the edge line to ensure the roadside edge of AWS cabinets are at least 2.5m from the edge line. AWS should not protrude over the legal boundary (aerial trespass). Survey may be required to establish the legal boundary.

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4.5 Foundations and structures

4.5.1 Ground conditions and foundation design

Typically, each AWS installation shall have a single-post support structure with a standard foundation design. Standard foundations are used for a specific set of ground conditions (bearing capacity, material type, ground water etc), wind loading and sign weight.

Ground conditions should be tested for each installation to assess whether the existing ground parameters fit within the standard design template. If ground conditions are unsuitable for the design envelope, a more robust foundation design must be developed.

Designers should reference NZTA P24:2020 Specification for permanent traffic signs (NZTA P24), sections 5.5 Foundation design and 7.7 Foundations.

4.5.2 Support structures

There are a variety of support structure systems available. Designers should reference NZTA P24 Section 4.7 Sign support systems and appendix F for approved products.

Typically, AWS are installed without guardrail protection and therefore will need to be installed on an approved frangible structure or with a breakaway base system. Designers should confirm all installations meet the frangibility guidelines, NZTA P24 Section 5.8 Impact performance for sign supports provides design guidance.

Each support structure and foundation will be site specific. Designers should reference NZTA P24 Section 5 design and appendices B & C to select a suitable structure for each installation.

Support structures should not prevent maintenance access to the AWS.

4.5.3 Mounting brackets

There are a variety of bracket systems available but the most commonly used is aluminium channel type.

Designers should reference NZTA P24 Section 4 compliance to select a suitable mounting bracket design for each AWS type.

No additional penetrations are allowed through AWS cabinets so all bracket attachments must be installed by the manufacturer or enclosed using sealed captive nuts.

Mounting brackets should not prevent maintenance access to the AWS.

4.6 Mounting height

Minimum mounting heigh to the underside of the AWS is 2.4m however it is recommended that signs are mounted at 3.0m to reduce vandalism.

The tops of AWS (note the additional height of those with solar panels) shall not be located any closer than 2.0 m from overhead low-voltage power lines, and not closer than 4.5 m for high-voltage lines. However, some

power companies may require greater separation distances and this must be established during site design. Designer should also reference the New Zealand Electrical Code of Practice for Electrical Safe Distances.

Note should be made if the site is under power lines low enough to interfere with erection of the support structure, and this information made available to the AWS installer. When using relocatable AWS, there must be adequate clearance to safely lift the support structure in and out of the foundation socket.

For solar-powered sites, the designer must also check that trees and/or the nearby topography will not unduly shade the solar panel throughout the sun's summer and winter arcs, and confirm that tree growth will not cause an issue in the future.

Designers should ensure that site topography such as road alignment, shoulder gradient and vegetation will allow the sign to be read and understood at the required sight distance. Visibility requirements of each installation will be determined by speed environment and sign type. Unless otherwise stated in this document designers should aim for a minimum visibility distance of 2m per km/hr of posted speed limit.

4.7 AWS with associated static sign panels

Many AWS types are mounted with static panels on the same pole or structure, such as kura school variable speed limit and SID signs. Refer to Appendix A: Static panels for examples of typical AWS and static panel integration.

Static panel materials design and manufacture must meet all NZTA P24 requirements.

Static panel layout design, fonts and colour should meet TCD Manual – Sign Specifications.

4.8 Power supply

4.8.1 Mains power

All electrical installations must meet the AS/NZS 3000 electrical standard.

If readily available at the location and installation is cost effective, mains power is the preferred option. Mains-supplied AWS will require a battery backup system within the sign itself (refer to the latest version of ITS delivery specification: Advanced warning and regulatory signs) which can support sign operation in the event of a mains failure.

The power supply TUD must be located at a suitable distance from the base of the pole so that it will be unlikely to be impacted at the same time as the support pole.

All underground cabling type, location and depth as-built information to be collected and supplied to the road assessment and maintenance management (RAMM) database. As-built drawings will be required for all new underground services and should be approved by the RCA.

Electrical certification should be supplied as part of the site sign off. Testing should also be provided to ensure the cables installed meet the volts/amps required for the installation.

4.8.2 Mains power – street light circuits

Commonly used where there are streetlights but no easily available 24/7 mains power. This system may result in a separate battery box installed on the pole structure. Any additional equipment on the pole will have to be taken into consideration when selecting the structure.

4.8.3 Solar power

Commonly used in more regional areas or where mains power supply is prohibitively expensive. Where achievable, the preference is to mount all batteries within the sign enclosure. There will be installations which may result in a separate battery box installed on the pole structure. Any additional equipment on the pole will have to be taken into consideration when selecting the structure.

When sizing the solar panel and battery backup system, suppliers and designers must take into consideration factors such as average sunlight hours per year, geographical location, potential shading, expected number of activations, typical power draw and the criticality of the AWS. Often solar-powered sites will fail when the system has not been designed to suit the environment and frequency of activation.

4.8.4 Other power supplies

Some sites may not be suitable for any of the three usual power options, such as winter operation in high mountain areas, shading from trees or general topography. Where this occurs, other options for power supply such as wind turbines or fuel cell generators may be considered.

Any additional long-term maintenance or recharging requirements must be taken into consideration and factored into the whole-of-life costs of the installation.

4.9 Communications coverage

All AWS will be connected remotely to allow for data download and upload. The options should be assessed as far as possible on site with a suitable signal strength meter and may determine location, particularly in rural areas with lower coverage.

A number of suppliers are able to provide low-bandwidth devices which can connect to a communication network. Designer will manage the communication connection to the sign.

4.10 Environmental impact and public consultation

AWS and their support structures may be visually intrusive on the surrounding area. The requirement to consult with nearby residents and businesses, particularly those within the LED illumination cone, must be considered, as the light emitted at night may create adverse effects.

Engineering judgement must be exercised and, if necessary, an alternative site selected.

4.11 Speed indicator devices

Designers should reference Traffic note 23: Speed indicator devices – guidelines for additional information on positioning and operational procedures of a SID.

4.11.1 Positioning

SIDs should be positioned far enough away from a speed limit change sign to ensure motorists do not receive the message to slow down before they reach the speed limit change sign. Otherwise, this will challenge the credibility and reduce the effectiveness of the SID.

Where possible SIDs should be sited:

i. at least 200m after the speed limit change sign
ii. around a corner or over the brow of a hill from the speed limit sign
iii. so that the radar can be aimed at a suitable point on the roadway for the road alignment, general traffic environment, posted speed limit.
iv. where the sight distance to the SID is at least 2m for each km/hr of posted speed limit.

Avoid placing AWS just after an intersection (no closer than 200m). Vehicles crossing the intersection will cause a zero-speed readout, potentially confusing other motorists approaching the sign.

4.11.2 Threshold settings

Activation threshold settings will be modifiable within the SID, but the following shall be the default settings:

i. The lower speed threshold should be set 20 km/hr below the posted speed limit.
ii. When the speed of an approaching vehicle is below the lower threshold setting, the sign remains blank.
iii. When the lower speed threshold setting is exceeded, the sign will display the vehicle's speed.
iv. The upper speed threshold shall be set at not more than 10km/hr above the posted speed limit. When the approaching vehicle's speed exceeds the upper threshold, the words SLOW DOWN will replace the speed or flash up if separate LED text is used.

4.12 Curve warning signs

4.12.1 Positioning

Curve AWS have no fixed installation distance in advance of the curve as it is related to the upper speed threshold (refer to section 4.12.2 Threshold settings) which may vary from site to site. Due to the variability of each site, Engineering judgement will be required to locate AWS in the optimum position. Designers should refer to TCD Manual section 7.3 Location for guidance.

Curve warning AWS are also typically installed at locations which will already have a static horizontal curve advisory sign installed in advance of the curve. It is generally better to retain the static warning sign as an advanced warning and position AWS closer to the curve. This may require relocation of the static sign during installation of AWS.

For AWS to be effective, motorists must not receive a SLOW DOWN message before they enter the desirable deceleration zone. AWS and radar must be positioned so that the sign is not activated when the vehicle is greater than 200m from the curve.

4.12.2 Threshold settings

Determining the lower and upper speed threshold setting requires a degree of Engineering judgement. The main factors to consider include the:

i. distance from the curve to AWS
ii. distance from AWS to the point where approaching motorists will first see the electronic message
iii. differential between the 85th percentile approach speed and the advisory speed for the curve
iv. influence of up or downhill gradient on ability to decelerate safely
v. influence of poor climatic conditions on ability to decelerate safely.

Generally, the lower speed threshold setting should be the same as the advisory speed for the curve.

When the speed of an approaching vehicle is below the lower threshold setting, AWS will remain blank.

When the lower speed threshold setting is exceeded, AWS will display a curved arrow.

When the approaching vehicle's speed exceeds the upper threshold, AWS will continue to display the arrow and in addition, the message SLOW DOWN.

The upper speed threshold is the most challenging to determine and is dependent on the factors listed above. For typical high-risk curves it is reasonable to set the upper threshold 15–25km/hr above the advisory speed for the curve, and adjust, if necessary, based on observations of driver behaviour and data from the sign radar or site testing.

If evidence suggests the upper threshold setting should be >25 km/hr above the advisory speed for the curve, AWS may have been positioned too far away from the curve and consideration should be given to shortening the radar range or shifting the AWS closer to the curve.

4.13 Cycle warning signs

4.13.1 Positioning

Cycle AWS are usually located at narrow bridges or narrowing sections on state highways such as merge lanes, where there will already be a static cyclist warning sign. The static sign should be relocated in advance of AWS in order to locate AWS closer to the bridge or hazard.

For a bridge, activation loops on the shoulder of the road will generally be adequate to trigger the sign. Other forms of activation such as radar, video or other RCA approved device detection may also be suitable. Loops must be configured to activate only on detection of a cyclist, e.g., below 50km/hr, or there be a clear separation between the vehicle traffic and cycle traffic.

For other applications, eg where cyclists are expected to cross an off-ramp, or sections of road where there is no safe cycle shoulder, cyclist hold rails with an activation button may be considered, in addition to activation loops on the shoulder of the road. The activation button and hold rail must be located close enough to the crossing point to enable useful application for cyclists.

4.13.2 Activation loop positioning

The key considerations for placement of the induction loops and cycle AWS are as follows:

i. The induction loop must be positioned far enough ahead of any pinch point forcing a cyclist into the traffic lane, or where a cyclist is required to cross an onramp to ensure motorists have time to react when a cyclist activates the sign.
ii. The electronic cycle sign should be placed after the induction loop so cyclists can see that the sign has been activated.

For guidance, in an 80–100km/hr speed environment the following are recommended:

i. On a flat or slightly uphill approach, induction loops should be approximately 40m ahead of the pinch point (typically, this allows the sign to warn motorists for seven or eight seconds before cyclists reach the pinch point). This distance should be reduced or extended for steep uphill or downhill approaches respectively.
ii. There should be an obvious diamond pattern on the shoulder (usually the sealed-over cuts in the asphalt for the loops) to enable cyclists to see the location of the loops. Refer Land Transport Rule: Traffic Control Devices 2004—Shared Path Behavioural and Cycle Detector Loop Road Markings M2-3F Cycle loop detection marking. Cycle AWS should be positioned a minimum 30m after the induction loops.
iii. The clear sight distance for motorists approaching cycle AWS should be consistent with section 4.2.1 Clear sight distance.

4.13.3 Time settings

As a general guideline, the length of the illumination period should be based on ensuring the majority (lower 15th percentile cut off) of cyclists will cross the bridge while the sign is illuminated. It is recommended to undertake site surveys to collect accurate data on cyclist speeds. If site-specific data is not available, designers are recommended to use a cyclist default speed for a flat bridge of 20km/hr, which equates to approximately 5m/s.

4.14 Rural kura/school active warning

Designers should refer to Waka Kotahi Traffic note 56 revision 1: Active school warning signs – guidelines, for guidance on positioning and operation.

4.15 Kura/school variable speed limit

Designers should refer to the speed management guide variable speed limits outside schools for guidance on positioning and operation.

Signs should be the R1-6 LED Variable Kura/School speed limit type B option only.

4.16 Rural intersection activated warning signs (ISZ)

Designers should refer to Waka Kotahi Traffic note 62: Intersection speed zones – guidelines and requirements, for guidance on positioning and operation of RIAWS (ISZ).

4.17 Weather-activated variable speed limit

Installations are site specific for weather-activated variable speed limit (WAVSL) signs. Due to the likely difficult nature of the terrain and site-specific weather conditions, they will require detailed design for each installation.

4.18 All other AWS types

4.18.1 Positioning

Designers should refer to Waka Kotahi Traffic note 57: Active warning signs (not at schools) – guidelines, for guidance on positioning and operation.

Positioning for other types will be site specific and will rely on Engineering judgement. Key considerations shall include the following:

i. AWS are to be located sufficiently in advance of the hazard to enable drivers enough time to take the required action. Some of the guidance in section 4.12 Curve warning signs may assist.
ii. Radar activation shall occur at the required point for drivers to notice and take action – not too early or too late.
iii. Site distances shall be maintained.
iv. Speed thresholds shall be assessed on a site-by-site basis, which may affect AWS positioning. Some of the guidance in section 4.12 Curve warning signs may assist.

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5 DESIGN FOR SAFETY

This section defines the requirements to ensure the intelligent transport system can be operated and serviced safely.

5.1 Health and safety

All ITS equipment must be designed to ensure installation and maintenance in accordance with the Health and Safety at Work Act 2015.

5.2 Safety outcomes

5.2.1 Site access design

All sites must allow reasonable access for installation and maintenance of AWS. Due to the nature of these installations, the working areas are likely to be within 5m of the edge line, requiring some form of temporary traffic management (TTM). The designer should identify any unusual TTM requirements for all future activities. designs shall eliminate the need for lane closures during maintenance.

Maintenance vehicles should be able to safely exit from the live lane and park a safe distance from the edge line. Sites should be designed so that maintenance vehicles can safely re-enter the live lane from the area of operation.

Designers are responsible for ensuring safe maintenance access to the site.

5.2.2 Working at heights

Most AWS will be installed higher than 3.0 m from the existing ground level and will require ladder access. AWS should be installed on firm, flat ground. Designers shall incorporate a flat concrete pad or well compacted flat gravel hardstanding area on roadside shoulders and verges to facilitate safe ladder access for maintenance.

For construction, heavy maintenance and decommissioning, the site will facilitate the use of portable access equipment (e.g., scissor lift or cherry picker).

It is the designer's responsibility to ensure each site is safe for access. Refer to Commissioning and Handover requirements standard.

5.2.3 Working near overhead powerlines

Designers should ensure maintenance access requirements for signs located under powerlines will not encroach on the safe exclusion zones around the powerlines. Designer should also reference the New Zealand Electrical Code of Practice for Electrical Safe Distances.

5.2.4 Services

The tops of AWS (note the additional height of those with solar panels) shall not be located any closer than 2m to overhead low-voltage power lines, and not closer than 4.5 m for high-voltage lines. However, some power companies may require greater separation distances, and this must be established during site design. The local power distribution company will be consulted prior to installation and approval to install received.

Note should be made if the site is under power lines low enough to interfere with erection of the support structure and this information should be made available to the AWS installer. If the site is to have relocatable AWS, there must be adequate clearance to safely lift the support structure in and out of the foundation socket.

No ground penetration shall be undertaken without an on-site service markup following a desktop investigation.

5.2.5 Site acceptance test

All AWS installations shall undergo a full site acceptance test (SAT). SATs will vary with installation types. Part of each SAT will be an assessment for maintenance and operational safety. Installers will be required to supply an electrical certificate of Compliance (COC) and a Record of Inspection (ROI) if on mains power, prior to the SAT being undertaken.

5.3 Site assessment

To be defined

5.4 Site audit

It is the designer's responsibility to ensure each site has a post construction site audit undertaken to match the requirements of each installation type. Refer to Commissioning and Handover requirements standard.

5.5 System-specific safety requirements

To be defined

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6 DESIGN FOR MAINTAINABILITY

This section defines the requirements to ensure the intelligent transport system can be maintained.

6.1 Maintenance outcomes

6.1.1 Extreme weather or environmental conditions

Consideration must be given to extreme or unusual conditions that may require part of the design to be upgraded. Extreme winds may necessitate upgrading of foundations and structural support. This is more likely when the site is located above 500m altitude, is on a ridge, in a cutting, or in a lee effect multiplier zone (refer to AS/NZS 1170.2.2021 Structural design actions – Part 2: Wind actions).

Corrosive environments requiring enhanced coating systems, and the need to protect vulnerable components such as weather seals from native parrots in alpine locations, should also be considered. Consideration should also be given to ongoing maintenance requirements that are a result of these conditions.

6.1.2 Doors and maintenance access

All doors, plates, glands, external connectors etc shall be provided with rubber seals or equivalent materials which are maintenance free and shall remain effective for the design life of the equipment. Door seals are considered essential to protect against ingress of dust/insects and to meet the ingress requirements of EN 12966:2014+A1:2018 Road vertical signs – Variable message traffic signs (EN 12966). In addition, they may form part of water and pollutant ingress protection systems.

6.1.3 AWS structures and sign inspection and maintenance

Inspection of AWS structures should be undertaken by the network contractor or a dedicated ITS maintenance contractor. Generic maintenance activities will be developed between Waka Kotahi and the contractor.. Routine inspections may be tasked to the contractor on a six-monthly basis (or a greater or lesser interval as required). AWS structures are classified as ‘other structures’ within the RAMM database.

Inspection activities will include, but not be limited to:

i. checking for damage (accident, or vandalism)
ii. ensuring the security of any power cable
iii. checking on the condition of the corrosion protection system
iv. checking and tightening of connections between the support structure, cabinet, and any solar panel particularly the torque on approved bolted slip-bases
v. confirming the activation and operation of the display
vi. confirming the accuracy of display
vii. Identifying any dim or dead LEDs
viii. checking on weather tightness and security of cabinet
ix. ensuring clear line of sight to the AWS for motorists (removal vegetation etc)
x. confirming solar panel is not being significantly shaded throughout the sun’s winter and summer arcs
xi. reviewing whole site for any safety issues
xii. confirming correct radar activation and checking that radar is correctly measuring and reporting speed (particularly important for Speed Indicator Devices).

All installations will comply with AS/NZS 3000 electrical installation requirements. Where mains-powered AWS are installed, test for:

i. earth loop impedance
ii. earth continuity
iii. circuit breaker operation.

Following the identification of defects, any required maintenance shall be undertaken by the network contractor or ITS maintenance contractor with the agreement of Waka Kotahi.

Preventative and emergency maintenance will be included with any purchase of AWS. This may be carried out for a limited time by the supply vendor and then covered by other Waka Kotahi maintenance contracts

It is important that whoever is managing the procurement and installation process includes the requirement for handover process to the maintenance contract should be agreed.

Time frames and service level agreements (SLAs) including such items as battery checking and replacement (the suggested default battery replacement interval is every three years), checking solar panel recharging, and running basic health checks on the electronics, will be negotiated with sign vendors as part of the procurement process.

6.1.4 As-built documentation

As-built drawings shall be supplied by sign vendors and contractors and will include:

i. site layout
ii. support structures
iii. installation elevations/plans
iv. cabinet drawings
v. power-supply arrangements
vi. electrical compliance certificates
vii. RAMM data.

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7 DESIGN FOR SECURITY

This section defines the requirements to ensure the intelligent transport system can be secured and maintain integrity.

7.1 Security outcomes

To be defined

7.1.1 Use this heading if required for another level of detail

To be defined

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8 APPENDIX A: STATIC PANELS

Some AWS will require static panels to be installed on the same poles/structures. Additional surface area for wind loading should be taken into account when choosing structure size.

The size of static panels will be determined by the posted speed limit.

8.1 Kura/school variable speed limit

Kura/school variable speed limit signs have a static panel WU22 mounted immediately underneath the AWS. For dimensions and details, refer to Traffic control devices manual (TCD manual): Sign specifications, rule W16-5.1 Permanent warning general supplementary non-motorised users kura/school.

Figure 1. WU22 Kura/school static panel

8.2 ISZ signs

Depending on layout of the ISZ, AWS will have a static panel mounted immediately underneath. Typically, it will be a 750mm WJ2A. For dimensions and details, refer to TCD manual: Sign specifications, rule W11-2 Intersection crossroads junction controlled priority route straight ahead.

Figure 2. WJ2A Intersection layout static panel

Other sign types will be used depending on intersection layout, such as WK5L (rule W11-4 Intersection side road junction controlled on left) and WXL1 (rule W15-1 Railway level crossing on controlled crossroad level crossing to the left). This will be determined on a case-by-case basis.

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Where the posted speed limit is 100 km/hr all ISZ signs shall have a 750mm diameter RS2 mounted immediately under the AWS on the reverse. For dimensions and details, refer to TCD manual: Sign specifications, rule R1-1.1 Speed limit standard 100km/hr.

Figure 3. RS2 100km/hr static panel

Where the posted speed limit is 80 km/hr the signs will be replaced with R1-1 speed limit standard 80km/hr signs.

8.3 SIDs

All SIDs will have a white reflective sign with black font and border, mounted immediately above the SID enclosure. Font will have a minimum 150mm character height. (Confirm code if available in TCD rule).

Figure 4. Your speed static panel

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9 REFERENCES

This section lists all external and Waka Kotahi references included in this document.

9.1 Industry standards

Standard number / name	Source	Licence type and conditions
Health and Safety at Work Act 2015	NZ Legislation website	Publicly available
AS/NZS 1170.2:2021 Structural design actions - Part 2 Wind actions	Standards NZ website	Available for purchase
AS/NZS 3000:2018 Electrical installations – Known as the Australian/New Zealand Wiring Rules	Standards NZ website	Available for purchase
EN 12966:2014+A1:2018 Road vertical signs – Variable message traffic signs	Standards NZ website	Available for purchase
NZECP 34:2000 New Zealand Electrical Code of Practice for Electrical Safe Distances	Worksafe NZ	Publicly available

9.2 Waka Kotahi standards, specifications and resources

9.2.1 Standards and specifications

See the Waka Kotahi website for the latest versions of the ITS design standards, delivery specifications and core requirements listed below.

Document name
ITS design standard: Active warning and regulatory signs
Commissioning and Handover requirements - ITS core requirements standard ITS-01-000-2023MM-STD-CMH

9.2.2 Resources

Document name / code	Waka Kotahi website link
Land Transport Rule: Traffic Control Devices 2004 (TCD Rule)	https://www.nzta.govt.nz/resources/rules/traffic-control-devices-2004/
NZTA P24:2020 Specification for permanent traffic signs	https://www.nzta.govt.nz/resources/traffic-signs-perf-based-specs/
Speed management guide: Road to Zero edition Appendices and additional technical information	https://www.nzta.govt.nz/resources/speed-management-guide-road-to-zero-edition/

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Document name / code	Waka Kotahi website link
Land Transport Rule: Traffic Control Devices 2004—Shared Path Behavioural and Cycle Detector Loop Road Markings	https://gazette.govt.nz/notice/id/2021-au4249
Traffic control devices manual: Sign specifications	https://www.nzta.govt.nz/resources/traffic-control-devices-manual/sign-specifications/
Traffic note 23: Speed indicator devices – guidelines	https://www.nzta.govt.nz/resources/traffic-notes/traffic-notes/
Traffic note 56 revision 1: Active school warning signs – guidelines	https://www.nzta.govt.nz/resources/traffic-notes/traffic-notes/
Traffic note 57: Active warning signs (not at schools) – guidelines	https://www.nzta.govt.nz/resources/traffic-notes/traffic-notes/
Traffic note 62: Intersection speed zones – guidelines and requirements	https://www.nzta.govt.nz/resources/traffic-notes/traffic-notes/

9.3 ITS standard drawings

See the Waka Kotahi website for the latest versions of the ITS standard drawings listed below.

Drawing number

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10 CONTENT TO BE REDIRECTED

This section records any circumstances where content from this document will be reclassified and moved into future documents. This table is then updated with a reference to the new location.

Section reference	Section name	Future document	Class
4.8	Power supply	Communications infrastructure core requirements standard	000 Core requirements
4.9	Communications coverage	Electrical core requirements standard	000 Core requirements

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11 FULL VERSION HISTORY

This table shows the full history of changes made to this document, both minor and major, in chronological order, since the document was first authored.

Minor versions are numbered 0.1, 0.2 etc until such point as the document is approved and published, then it becomes 1.0 (major version). Subsequent edited versions become 1.1, 1.2 etc, or if it's a major update 2.0, and so on.

Version	Date	Author	Role and organisation	Reason
0.1	10/06/2022	WSP	WSP	First draft
0.2	31/07/2022	Final Word	Editorial services	Proofread first draft
0.3	14/09/2022	WSP	WSP	Second draft
0.4	10/11/2022	WSP	WSP	Third draft
0.5	20/12/2022	WSP	WSP	4th draft

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