TRAFFIC NOTE 62

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From Regulatory Services

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No. of pages 14

Intersection Speed Zones - guidelines and requirements

1 Purpose

The main purpose of for Intersections Speed Zones (ISZs) (formerly Rural Intersection Active Warning System (RIAWS)) is to slow traffic on the major approaches to an intersection when vehicles are turning or crossing into or out of the side roads. This provides a 'safe system' by proactively managing crash risk and the potential severity in these higher risk situations.

ISZs have the potential to reduce the number and severity of crashes at rural intersections by:

- slowing motorists on major road intersection approaches and thus reducing crash likelihood (effectively increasing available stopping distance) and severity (less energy on impact)
- increasing driver awareness and therefore preparing motorists for a possible event (effectively reducing reaction time); and
- improving motorist gap judgement (accepting longer gaps) on minor road intersection approaches.

2 Introduction

Since being trialled in 2013-14, ISZs have achieved positive outcomes in raising road user awareness of high-risk intersections and in reducing the frequency and severity of intersection crashes. They are generally understood and positively perceived by road users and long-term monitoring shows speed reductions are maintained.

3 Objectives

ISZs have the following objectives with respect to speed management at rural intersections:

- inform motorists of a lower speed limit when potential conflict situations exist
- create a safer environment for road users turning or crossing into or out of the side roads; and
- reduce the number and severity of crashes.

4 Application

ISZs are applicable to rural intersections with speed limits of 80 km/h or more on the main road, where safety benefits would accrue from a lower speed limit activated when a vehicle is about to turn into or out of an intersecting side road. ISZs employ electronic variable speed limit signs in conjunction with supporting signage and road markings.

Successful ISZ implementation raises driver awareness and lower operating speeds sufficient to reduce crash frequency and severity. Traffic data obtained can inform refinement or other interventions.

An ISZ can be an alternative to transformational remediation, such as a roundabout, which are more expensive and apply regardless of traffic or road conditions. An ISZ is an option where an intersection has a high road safety risk rating, but short of that required for transformational works.

ISZ activation is required to be automated. They can be applied permanently or until such time as transformational remediation is implemented.

Although less expensive than roundabouts, sufficient vehicle volumes will justify the cost of ISZ installation, operation and maintenance.

ISZs are not a replacement for good intersection design—usual intersection design and other road safety considerations must be addressed before an ISZ is considered. As with the rural roundabouts, an exception might be where the cost of the physical works is prohibitive and the ISZ is a permanent solution in its own right. Notwithstanding, ISZs are not a substitute for roundabouts when a change in road geometry is required.

5 Speed limit change requirements

Introducing an ISZ is a speed limit change, and must meet the requirements of the Land Transport Rule: Setting of Speed Limits (2022) (ref clause 4.9(1)(b)(iv)), including consultation, speed management plan certification and submitting to the National Speed limits Register. Note the speed limit change only applies to the main road – an ISZ does not change the side road speed limit.

6 Identifying intersections for treatment

Identifying intersections for treatment begins with the 'High Risk Intersections' layer of MegaMaps, based on Collective Risk and utilising the estimated death and serious injuries (DSI) casualty equivalents risk assessment process as defined in the High-Risk Intersections Guide[1].

The KiwiRap star rating (www.kiwirap.org.nz/index.html) is also useful in identifying potential ISZ sites. It is a risk-based evaluation of road design elements that utilises three primary crash types: run-off road crashes; head-on crashes; and intersection crashes. It is applicable for identifying intersections for treatment where the main road is a State highway.

Intersections involving corridors on the top 10% network for greatest reduction in DSIs, also shown in MegaMaps, further support the case for treatment.

7 Intersection profile

The main crash types involving DSIs at uncontrolled rural intersections involve loss of control cornering, head-on and turning versus same direction, as highlighted in Table 1, overleaf, (adapted from Appendix 1 in the High-Risk Intersection Guide):

[1] Estimated DSI casualty equivalents are calculated by multiplying each injury crash (extracted from Waka Kotahi's Crash Analysis System (CAS)) on a road segment by the corresponding severity index.

Table 1: Vehicle movement types associated with DSI injuries at intersections

factors relating to rural intersections highlighted

	TYPE	A	B	C	D	E	F	G	O
A	OVERTAKING AND LANE CHANGE	PULLING OUT OR CHANGING LANE TO RIGHT	HEAD ON	CUTTING IN OR CHANGING LANE TO LEFT	LOST CONTROL (OVERTAKING VEHICLE)	SIDE ROAD	LOST CONTROL (OVERTAKEN VEHICLE)	WEAVING IN HEAVY TRAFFIC	OTHER
B	HEAD ON	ON STRAIGHT	CUTTING CORNER	SWINGING WIDE	BOTH OR UNKNOWN	LOST CONTROL ON STRAIGHT	LOST CONTROL ON CURVE		OTHER
C	LOST CONTROL OR OFF ROAD (STRAIGHT ROADS)	OUT OF CONTROL ON ROADWAY	OFF ROADWAY TO LEFT	OFF ROADWAY TO RIGHT					OTHER
D	CORNERING	LOST CONTROL TURNING RIGHT	LOST CONTROL TURNING LEFT	MISSED INTERSECTION OR END OF ROAD					OTHER
E	COLLISION WITH OBSTRUCTION	PARKED VEHICLE	ACCIDENT OR BROKEN DOWN	NON VEHICULAR OBSTRUCTIONS (INCLUDING ANIMALS)	WORKMANS VEHICLE	OPENING DOOR			OTHER
F	REAR END	SLOW VEHICLE	CROSS TRAFFIC	PEDESTRIAN	QUEUE	SIGNALS	OTHER		OTHER
G	TURNING VERSUS SAME DIRECTION	REAR OF LEFT TURNING VEHICLE	LEFT SIDE SIDE SWIPE	STOPPED OR TURNING FROM LEFT SIDE	NEAR CENTRE LINE	OVERTAKING VEHICLE	TWO TURNING		OTHER
H	CROSSING (NO TURNS)	RIGHT ANGLE (70° TO 110°)							OTHER
J	CROSSING (VEHICLE TURNING)	RIGHT TURN RIGHT SIDE		TWO TURNING					OTHER
K	MERGING	LEFT TURN IN	RIGHT TURN IN	TWO TURNING					OTHER
L	RIGHT TURN AGAINST	STOPPED WAITING TO TURN	MAKING TURN						OTHER
M	MANOEUVRING	PARKING OR LEAVING	"U" TURN	"U" TURN	DRIVEWAY MANOEUVRE	PARKING OPPOSITE	ANGLE PARKING	REVERSING ALONG ROAD	OTHER
N	PEDESTRIANS CROSSING ROAD	LEFT SIDE	RIGHT SIDE	LEFT TURN LEFT SIDE	RIGHT TURN RIGHT SIDE	LEFT TURN RIGHT SIDE	RIGHT TURN LEFT SIDE	MANOEUVRING VEHICLE	OTHER
P	PEDESTRIANS OTHER	WALKING WITH TRAFFIC	WALKING FACING TRAFFIC	WALKING ON FOOTPATH	CHILD PLAYING (TRICYCLE)	ATTENDING TO VEHICLE	ENTERING OR LEAVING VEHICLE		OTHER
Q	MISCELLANEOUS	FELL WHILE BOARDING OR ALIGHTING	FELL FROM MOVING VEHICLE	TRAIN	PARKED VEHICLE RAN AWAY	EQUESTRIAN	FELL INSIDE VEHICLE	TRAILER OR LOAD	OTHER

As stated in section 6.5.3 of the High-Risk Intersection Guide, an intersection approach can have too little visibility or too much visibility. The former arises when a vehicle giving way has visibility from too far back on the intersection approach, causing drivers to slow insufficiently or look too early. This can result in conspicuous road users—especially cyclists and motorcyclists—not being seen.

Where too little or too much visibility is an issue, changing the intersection's geometry, such as by installing a roundabout, may be a more appropriate than an ISZ. This will be more likely to achieve a more consistent and optimum level of visibility on all approaches.

ISZs are therefore suitable where the intersection involves a simple geometry ('T' or 'X' intersection), without complicating factors such as multiple lanes on the main road (accepting that many intersections have acceleration lanes and right turn bays).

A full understanding of any regional site works planned for the intersection over the short to medium term is also required.

8 ISZ sign requirements

ISZ signs **must** be R1-2.2 Rural Intersection Advanced Warning signs, which comprise an electronic VSL sign with the appropriate format W11-2.2 supplementary warning sign. ISZ signs **must** be connected to a control and monitoring system as described in the following sections.

9 Best practice

ISZs should involve more traffic on the main road than the side road. However, volumes approaching the intersection from the side road should be sufficient such that main road traffic would expect it, but not so high that the system is activated most of the time.

The effectiveness of ISZs is dependent on compliance and homogeneity of traffic flow on the main road. It is therefore important to select the correct variable speed limit for the circumstances:

- For main roads with 100 km/h speed limits and mean travel speeds through the intersection that are 80 km/h or higher, 70 km/h ISZ speed limits **must** be used as they are proven to provide the best compliance result
- For main roads with 100 km/h speed limits and mean travel speeds less than 80 km/h, 60 km/h ISZ speed limit is appropriate (as with rural school VSL signs); and
- For main roads with 80 km/h speed limits, 60 km/h ISZ **must** be used.

Where the safe and appropriate speed for the main road is 80 km/h but yet to be reduced to that, RCAs should futureproof their ISZ signs by providing for both the 70 km/h and 60 km/h ISZ speeds as part of the sign design at the time of installation.

ISZ system design

The ISZ is designed to instruct motorists of a lower speed limit when potential conflict situations exist i.e. the presence of a vehicle waiting at a side road or an opposing right turning vehicle on the main road. This is achieved by potentially conflicting vehicles triggering side road or right turn bay sensors and activating the electronic signs on the main road.

The ISZ consists of the following elements, as shown in Figure 1:

- Side-road radar sensors (high-definition radar) to detect approaching side road traffic approximately 150m from the intersection and activate main road electronic signs.
- Side-road limit line sensors to detect waiting traffic and trigger the end of sign activation following a delay.
- Right turn bay sensors (where right turn bays exist) 50-66m from limit line, to activate signs, plus limit line sensors to detect queuing traffic and terminate sign activation following a delay; and
- Variable speed limit signs approximately 150m from intersection, in each direction.

- A central control system to manage the ISZ and accommodate data collection equipment.

More detail about the system and how it functions is provided in the following section.

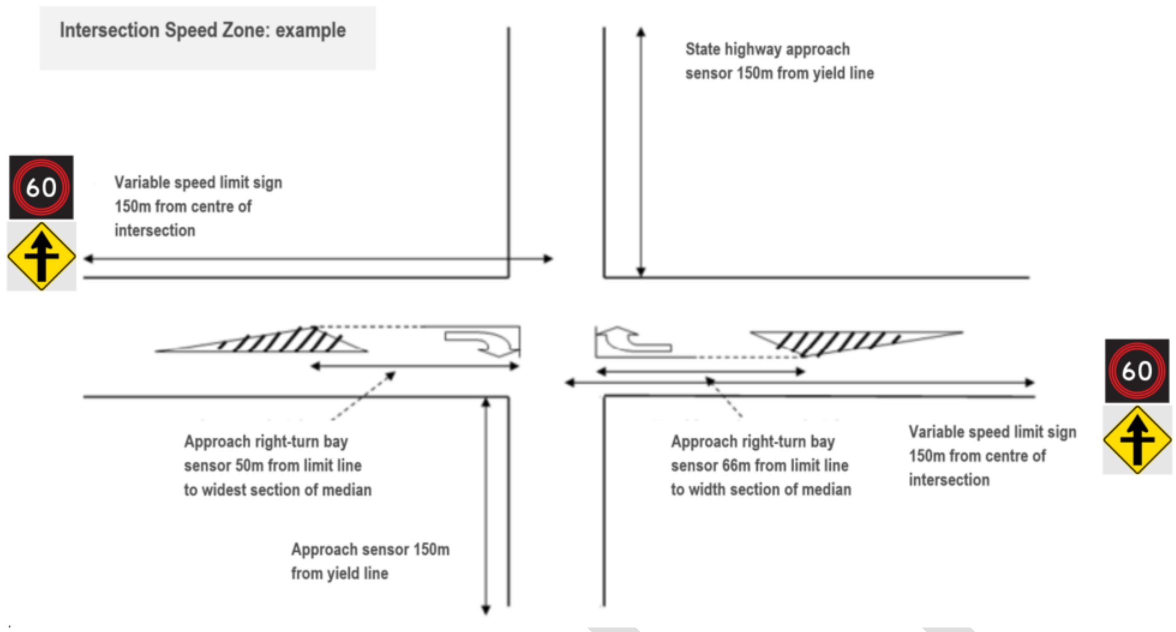

Figure 1: Basic outline of ISZ componentry, example.

As part of the monitoring and quality control system for ISZ a Graphical User Interface (GUI) monitors the system (Figure 2), ensuring the system can be monitored remotely in real-time.

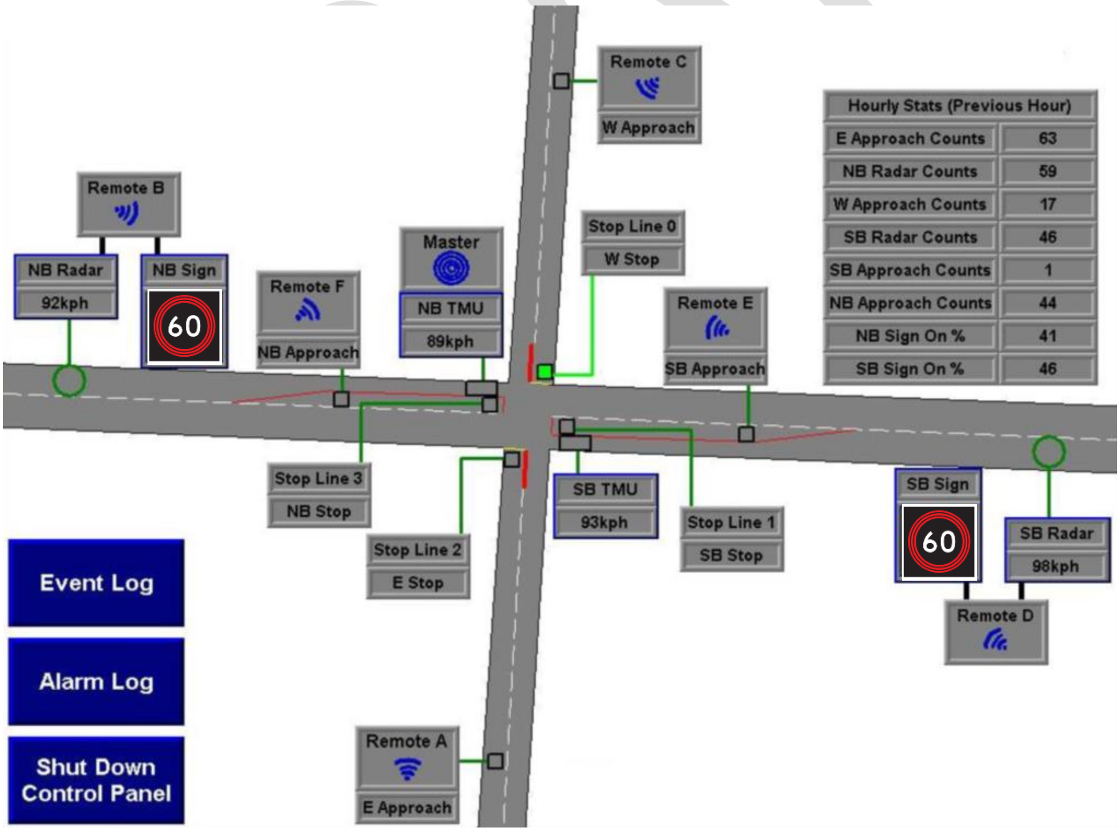

Figure 1: Graphical User Interface monitors

10 High-level detection criteria

The signs will be activated when vehicles are detected approaching on the controlled side road approaches and by right turning vehicles on the priority approaches to the intersection. Actual sign and sensor placement needs to be calculated based on expected Time to Collision information for each site. This taking into account typical approach speed along with physical geometry and layout.

It is accepted that detection of some right turning vehicles will be too late for oncoming vehicles that have already passed the sign (which will be on a theoretical collision course with right turning vehicles). However, if the right turning vehicle must wait, then the sign will be activated for the tail of any substantial platoon of traffic, which may increase right turning vehicle waiting time.

High-level intersection Speed Zone performance

All system nodes and active devices must be monitored continuously and any defects quickly detected and displayed on the site real time GUI. Any anomalies or outages are reported via email or text alerts.

High-level hardware configuration and system function

The following details typical requirements to ensure an ISZ system has a high level of accuracy and reliability, and to be flexible enough to allow additional features should requirements change.

Crossroad sites consist of six nodes all linked together using an industrial grade wireless network. Two nodes are positioned approximately 150m from the intersection down the approach roads to serve as advanced warning detectors. They are each fitted with Frequency Modulated Continuous Wave (FMCW) radar heads, which trigger only when a vehicle passes a marked point on the road near to the radar unit. Vehicles passing either of these nodes cause the signs to be activated, typically for approximately 20 seconds.

To capture vehicles turning right into the side roads, two additional nodes are placed approximately 50-60 metres either side of the intersection on the major road approaches at the beginning of the right turn bays, using inductive loops. Vehicles passing over the loop linked to these nodes activate the appropriate sign (one only) for a period of time given by the same method as the side approach nodes (but typically around 8 seconds). A variation on this configuration would use radar for detecting right-turn traffic when no right turn bay exists.

Inductive loops cut into the heads of the right turn bays and side roads provide information on the vehicles queuing. The control system uses this information to keep the electronic signs illuminated until all potentially colliding traffic has cleared the intersection. On side roads, where a particularly wide entry to the intersection exists, additional loops to detect left-turning traffic should be considered.

The final two nodes are connected to the active warning signs. Each node provides a serial communication interface to the sign allowing activation and continuous monitoring. Information such as sign status and operating parameters are continuously compared with baseline values with abnormal values being logged as faults.

The central control cabinet would normally be positioned beside the intersection to provide a suitable environment for the intersection detection equipment, radio frequency transmission equipment, central processing unit and backup power supply. The complete system is managed by an industrial programmable logic controller (PLC) which, as well as controlling the signs, collects and stores all vehicle, fault and sign operation data that is later updated to a PC server for longer-term storage. The GUI (pictured in the previous section) is linked to the PLC to provide a real time working view of the site. Activations from each node are displayed on the monitoring screen and provide confirmation that the site is performing as intended.

The final form of an ISZ, as installed, is illustrated below. The variable speed limit is not activated as an intersection vehicle conflict risk does not exist. In the photo on the right the variable speed limit is activated as the waiting side road vehicle (circled in red) represents a vehicle conflict risk.

Figure 2: Intersection Speed Zone in operation

11 Technical specifications

11.1 Major components

ISZs involve the following major technical components:

- **Roadside cabinet** to contain electrical distribution system, circuit breakers, PLC control equipment, communications system interface components.
- **Side road vehicle detector modules** to detect vehicles approaching the intersection from side roads – these could either be above ground detectors (e.g., radar) that can be mounted to new or existing poles/structures or underground options such as inductive traffic loops (loops).
- **Right turn and stop line vehicle detector modules** to detect vehicles at the intersection and intending to turn right from the main road into the side road or from the side road onto the main road. Due to the complex nature of an intersection with turning bays and through lanes in close proximity, it would normally necessitate the use of inductive traffic loops rather than above ground detectors (e.g., radar), however radar options may be appropriate in some circumstances.
- **ISZ signage** - refer Section 8 above – ISZ Sign requirements.
- **PLC** (local logic) to act as the primary interface between field devices and the local control system on site.
- **Network for local device inter-connectivity** that provides seamless and reliable highspeed communications between field locations. May be delivered over fixed (e.g., copper or fibre) network or wireless (UHF) or a combination that is suitable and cost effective.
- **Power solutions** are required at numerous locations around the intersection and identifying appropriate options for each location based on site configuration, potential usage and relative access points is a priority consideration during the design phase. Mains power should always be used for electronic signs due to the higher levels of guaranteed operating performance required as the most visible aspect of ISZs.

- **Remote management software** is required to monitor, log and manage all system activity at any ISZ location. Software developed and supplied by contractor will be integrated and hosted on Waka Kotahi server infrastructure.

12 Typical layouts of ISZ major components

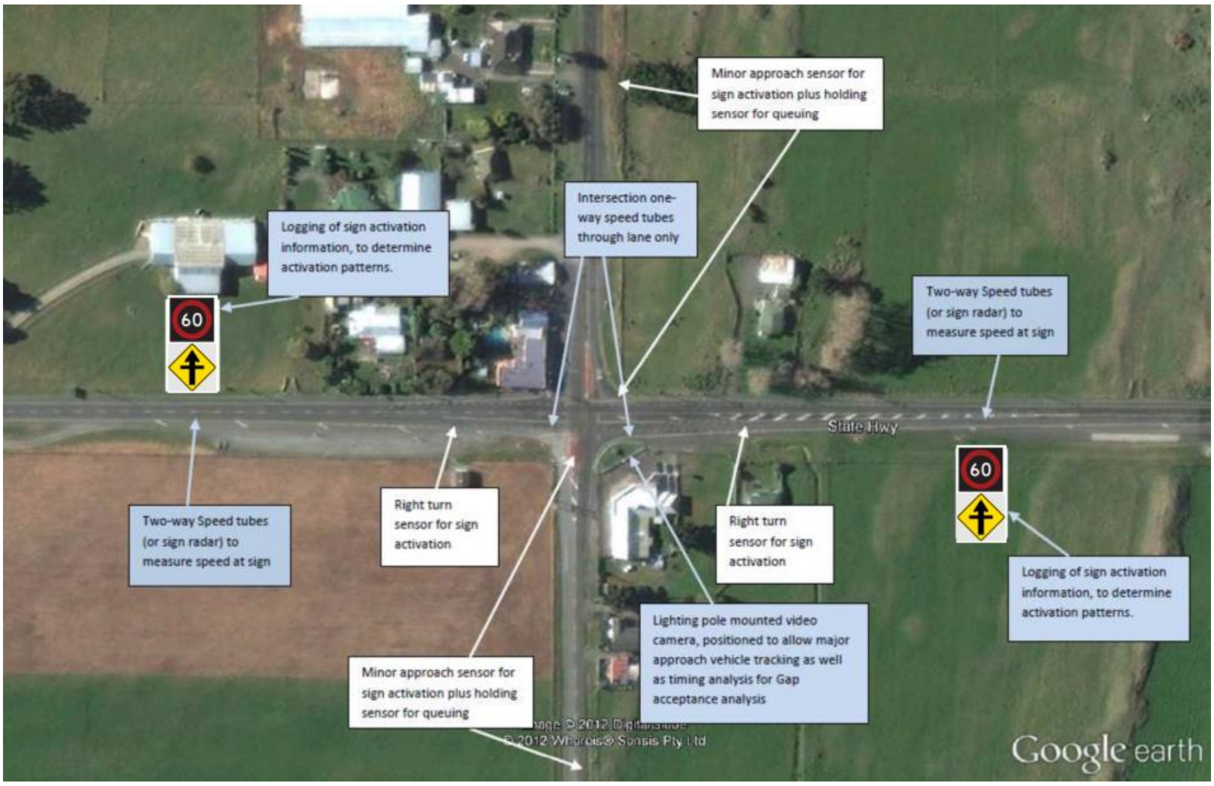

Figure 3:
Example layout of ISZ system components (white boxes) and data collection hardware (blue boxes)

13 ISZ Modules – requirements and performance

The following outlines the typical components that make up an ISZ and expected minimum requirements along with performance of these:

13.1 LED signage

All LED signage specified for Waka Kotahi should conform to national standards and protocols where applicable. In this instance the most appropriate reference for ISZs is contained in:

www.nzta.govt.nz/assets/resources/intelligent-transport-systems/p-series/P32-electronic-warning-signs.pdf

Signs shall be networked together with a PLC controller to allow bidirectional communication. The PLC controller will be required to poll the signs at regular intervals requesting current status and availability. On detection of faults or failure of a sign to respond the PLC controller will have the ability to log and report to parties nominated by the client. The PLC controller will have the ability to temporarily disable the ISZ system in the situation where one or more signs is not responding, or when instructed to remotely.

13.2 Inductive traffic loops

An ISZ is typically made up of multiple sets of Inductive Traffic Loops that have tails which terminate into the central control cabinet via a toby box.

Limit Line Loops are required to detect the presence of a stationary vehicle so should be of the same design and construction as those doing the same job at signalised intersections. To avoid running large numbers of tails back to the toby box, each loop should be wound as a single loop.

If Speed Sensing loops are required at the intersection in the main through lanes then loop tails should also be run back to the central toby.

Notes:

- These loops should not run in the same saw cuts as the limit line loops.
- For ISZ applications the number of turns has been reduced to three turns and the loop configured in a simple rectangular design

For right-turn bays, advance detection inductive loops are installed approximately 35 – 40m back from the limit line where the centre-line taper and advance diagonal stripe markings transition into the right-turn lane.

In addition to these specific requirements the inductive traffic loops for ISZs should conform to applicable industry best practice and meet overall Waka Kotahi requirement, unless previously covered above – see: www.nzta.govt.nz/resources/intelligent-transport-systems/

Vehicle detectors

Digital radar detectors (if used for vehicle detection) shall be utilised rather than doppler due to the ability to focus on a specific vehicle direction and point on road and must be compliant with relevant NZ RSM and EMI specifications. Other types of vehicle detection are possible but will require approval from Waka Kotahi before acceptance.

If being used to trigger the ISZ system on side roads they must act as an induction loop replacement and trigger only when the vehicle advances past a predetermined fixed point on the road.

13.3 Wireless network

Any Wireless equipment needs to be compliant with New Zealand Radio Spectrum Management specifications and operate within the requirements of a General User Radio Licence for Short Range Devices (SRDs). Wireless equipment must be suitable for the environments they are used in or housed in an enclosure that meets the environmental requirements while allowing the device to operate within the parameters specified by the device manufacturer.

All wireless Service Set Identifiers (SSID) should be suppressed to reduce unwanted attention.

13.4 Closed circuit television (CCTV) and video

If CCTV is chosen for a particular ISZ site it is preferred to try and use existing infrastructure for mounting the camera – such as a lighting column or power pole. The camera should be fitted with a suitable lens that allows the stacking bays and turning areas of the intersection to be clearly seen from a single fixed position.

Typical Camera and associated recorder specifications

a) The CCTV recording system should be able to record images in real time (25 frames per second)

b) The recording shall have the capacity to store recorded footage for a period of no less than two weeks.

c) Live and recorded footage shall be able to be viewed remotely if required.

d) The recording system shall have the ability to export footage from the site by removable mediums such as DVD, portable HDD and remote download.

e) The use of a device capable of reducing file size and band width is recommended – any such device must meet H.264 or an equivalent video compression standard.

f) Analogue video signals shall be Phase Alternating Line (PAL) standard.

13.5 Programmable Logic Controller (PLC)

In general, the ISZ system's PLC should be installed in close proximity to the actual detector units to prevent transient interference and minimise the length and complexity of any hard-wired infrastructure. The main PLC must be a readily available off the shelf product available in New Zealand and that has an existing interface written for DYNAC to prevent additional integration expenses for the principal when or if they choose to migrate the ISZ site onto the DYNAC platform.

13.5.1 PLC data update latency

The PLC shall update its internal baseline data with minimal latency from the onset of an event. Externally published data must be set or updated in accordance with the following time constraints:

Latency for ISZ detection events:

The allowable latency for the PLC to update its internal database of the passage of a vehicle entering from a side road (measured from the time a vehicle is positively identified) shall be 50ms.

Latency for ISZ message events:

The allowable latency for the PLC to send a signal to the ISZ signs indicating both the posting and removal of a fixed message shall be 100 milliseconds.

13.5.2 PLC Software

The PLC software shall be written and deployed in consultation with the Principal. The Contractor shall produce concept flowcharts and logic diagrams showing the intended functionality of the software prior to commencing development.

The software program running on the PLC shall be stored in non-volatile memory. The software shall automatically resume normal operation in the event the PLC is rebooted or power is cycled off and on again.

13.5.3 PLC Software Integration

The PLC hardware used shall be compatible with Waka Kotahi approved remote monitoring software platform provided by contractor as part of ISZ operational support and maintenance. Software must be accessible through a web interface and meet agreed Waka Kotahi protocols – it will also be compatible with the DYNAC control and monitoring system. It is envisaged that in the future existing DYNAC system will monitor the ISZ site and log any faults detected by the individual ISZ systems.

Specific details of what will be monitored by the contractor supplied system and DYNAC system including the fault thresholds shall be agreed with the client.

13.6 Detector and Sign Mounting – Poles and Structures

13.6.1 Mounting Detectors on Poles

Where the Contractor is to make use of existing poles, or, intends to install one or more poles to support the ISZ modules, the Contractor shall adhere to the following design requirements:

- The poles must be frangible or protected by a new or existing barrier in accordance with the relevant Waka Kotahi standards.
- The installation must cater for the access and maintenance requirements of the Road Controlling Authorities' Network Maintenance, Traffic Services and Lighting Contract(s).
- The pole's installed rigidity shall ensure that the maximum deflection due to wind at the detector module does not exceed the detectors manufacturer's requirements. The detector's mounting arrangement (including poles and any brackets) shall ensure that the system's performance is not degraded, nor false alarms generated due to wind-induced vibration or sway. This shall be achieved through design and engineering certification of a mounting pole and/or bracket which complies with AS/NZS1170.2. The maximum allowable sway and vibration will depend on detector beam width, sensitivity and the distance between transmitter and receiver.

13.6.2 Mounting Equipment to Existing Infrastructure

Existing infrastructure may be used to support the ISZ modules where site conditions permit. Permission to use any existing infrastructure shall be agreed in consultation with the Principal and any other affected Road Controlling Authority. In cases where the existing infrastructure does not come under the jurisdiction of the Principal, the Contractor shall be responsible for identifying and seeking permission from the appropriate party(s) and shall provide clear advice on future maintenance obligations and responsibilities.

Where detectors are to be structure-mounted, the Contractor shall ensure that the height of the detector modules can be adjusted. If the height adjustment will likely be reduced; the Contractor shall liaise with the Principal in order to agree a suitable solution.

13.7 Central Roadside Cabinet

The ISZ system's main components shall all be housed within a single roadside cabinet. This cabinet may be either a structure mounted unit that is accessible from the ground or a ground mounted unit that should not exceed the existing cabinet footprint or profile without an agreement by the Principal. Where an existing roadside controller cabinet is situated in close proximity to the proposed ISZ system location, the contractor may consult with the Principal and seek agreement to mount some or all of the ISZ system components within it.

13.7.1 Remote Roadside Cabinets

Unless it is more cost effective or technically prudent to terminate all remote detector and signage equipment to one master Roadside cabinet, it is highly anticipated most solutions will require remote roadside cabinets. These (smaller) cabinets will likely be mounted to ISZ structures such as poles or other existing infrastructure (e.g., lighting columns).

13.8 Communications System Connection

13.8.1 Leased Network Connections

Due to the remote and rural nature of any ISZ system there would normally not be any option to use or interconnect to Waka Kotahi's existing fibre optic network. Alternate backhaul data connection should be provided by using commercial services such as ADSL or Cellular provided by an Waka Kotahi approved telecommunications provider. Use of any other network service other than Waka Kotahi's existing ITS field network solutions requires consultation with the Principal.

14 Electrical Requirements

14.1 General

Power supply and distribution to multiple components must have the ability to be both AC and DC along with adequate surge protection for both types of supply at all equipment locations.

14.1.1 Uninterruptable Power Supply (UPS)

A UPS shall be provided to enable full power to the ISZ system, allowing it to continue to operate normally in the event of a mains power loss. The UPS shall ensure that communication with the system's backhaul network access point is maintained.

The UPS shall allow full operation of the ISZ system for a minimum period of 72 hours after mains power failure.

The UPS shall be an on-line type and shall provide an automatic no-break transfer to battery backed power in the event of a mains power failure.

15 Alarms

On top of any local fault monitoring and logging the ISZ system must have the capability to interface to a remote ISZ management system developed and provided by the contractor that is approved by Waka Kotahi – this system must be located on Waka Kotahi housed servers/platform and be compliant with their operating protocols. ISZ system must also be capable in the future of interfacing with the existing Waka Kotahi national traffic management system (DYNAC) – any ISZ system must remotely alert control room operators within the operations centre of an alarm on site, based on pre-determined thresholds or levels.

Typical types of alarms that should be included for detection include, but are not limited to the following:

- Loss of power – main site and all remote detector and sign locations.
- Communication failure with field devices.
- Sign faults such as LED performance, luminance and overall integrity of a sign.
- Operation of loops – failed, intermittent or latched on for extended periods of time.

16 Environmental Requirements – Typical Component Devices

All standard or typical ISZ hardware and infrastructure should have the following performance life and operation parameters:

- Must have an ingress protection rating of IP55 (equipment protection rating) or higher
- Normal operating temperature -10 °C to 40 °C

- Must be fit for purpose when used within the manufacturers' specifications.
- Heaters should be considered for colder locations

17 ISZ System Reliability and Availability

17.1 General

Electronic subsystems supplied are required to operate 24 hours per day, every day, and shall be specified by the Contractor and installed to minimise maintenance.

Evidence shall be provided demonstrating that the required reliability and availability will be met by the equipment offered. The equipment offered shall have proven track record in similar traffic surveillance applications.

17.2 Reliability

Each sub-system (i.e., Radar, VMS, etc.), shall have a Mean Time Between Failures (MTBF) of ten years.

17.3 Availability

The System Availability shall be monitored and reported using the following parameters:

a) Operating Period: The total number of hours within the specified period.

b) Down Time: The total time lost in hours due to Lost Time and Acceptable Down Time.

c) Lost Time: The time in hours commencing when loss of service is reported to the

Contractor and terminating when the service has been reinstated by the Contractor.

d) Acceptable Down Time: The time in hours when service is lost due to routine maintenance or events beyond the Contractor's control, e.g. lightning or knockdowns.

17.4 Maintenance

Regular preventative maintenance should be undertaken in order to ensure system is operating as designed and enable potential early detection of future faults. Calibration and testing of all sensors can be performed plus cleaning of signage and other roadside infrastructure.

18 Deliverables and Documentation

18.1 Major Components

For each component of the ISZ system the contractor shall supply the following design documentation in electronic and hard-copy format:

- All survey drawings
- Diagrams showing conduits and pits
- As-built drawings for:
    - cabinet foundation/mounting arrangements
    - cabinet electrical switchboard, mains reticulation and earthing
    - cabinet control system schematic diagram; and

- ISZs mounting poles/foundations/structures/brackets

For each component of the ISZ system the contractor shall supply the following documentation:

- Device manuals
- Device warranty information
- Date device was installed in-field
- Documentation supporting all environmental parameter requirements
- Certificate of electrical safety

19 Testing Requirements

19.1 Site Acceptance Testing (SAT)

SAT is performed after ISZ site has been commissioned and has run for a period of time gathering baseline data and has passed. The facility is connected to the communications system allowing monitoring of alarms and alerts from the remote control system.

The contractor shall produce a SAT test plan in consultation with the Principal.

20 Enforcement

To be effective, the ISZ must be enforced. The length of the zone, visibility of the signs, proof of display and other issues are all matters the Police must take into account in determining whether they are able to proceed with enforcement and subsequent action. It is therefore imperative any associated variable speed limit considerations involve the District Road Policing Manager of NZ Police.