WAKA KOTAHI
NZ TRANSPORT AGENCY

Intersection Speed Zones

Intelligent transport systems (ITS) delivery specification

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0.2

DOCUMENT STATUS: DRAFT

New Zealand Government

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More information
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More information about ITS is available on the NZTA website at https://www.nzta.govt.nz/its

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

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1 OVERVIEW AND OUTCOMES

This section defines the purpose of the equipment within the operational system.

1.1 Purpose

This document specifies the requirement for the procurement of Intersection Speed Zones (ISZ) used for the operational purposes by to NZ Transport Agency Waka Kotahi (NZTA), formerly known as Rural Intersection Activated Warning Signs (RIAWS). In addition, this delivery specification details system integration requirements (such as protocols, interfaces, data specifications and so on) to ensure compliance with NZTA operational and asset management systems.

This delivery specification supersedes Traffic Note 62: Intersection Speed Zones – guidelines and requirements 2022 (Traffic Note 62) and is to be read in conjunction with, the latest version of ITS Design Standard: Intersection Speed Zones.

1.2 Scope

This delivery specification covers ISZ's, including but not limit to:

i. ISZ Sign Requirements
ii. Vehicle Detection functionality and performance
iii. Internal system functionality
iv. Alarms
v. Electrical and power requirements
vi. Technical specifications

In general, the contractor shall supply ISZ equipment as required, in line with this delivery specification.

1.2.1 NZTA ITS class

003 Signals. Equipment which provides visual instructions (often legally enforceable) to the users of the transport network
Class definitions

2 FUNCTIONAL REQUIREMENTS

This section outlines what the equipment and systems need to do (functional), and how they need to do it (non-functional).

Nodes are referred to throughout this specification document. A node is a device which sends, receives, stores, or creates information for ITS systems. The ISZ system relies heavily on the intersection nodes which support the functionality and actuation of the ISZ signs.

The ISZ nodes are as follows:

i. **Advanced detectors –** detecting approaching side road motorists, and then activating the ISZ signs for a defined amount of time.

ii. **Limit line detectors –** detecting stationary motorists when drivers are waiting to turn out of the side road, and then activating the ISZ signs for a defined amount of time or until the driver leaves the side road/ detection area.

iii. Programmable Logic Controller (PLC) – a PLC is a programmable computing device that is used to manage electromechanical processes, typically for ITS systems and securely stored within a roadside cabinet.

iv. **ISZ Sign** – an ISZ sign will receive information via advance or limit line nodes and will activate the signs for a defined amount of time. The ISZ sign shall have ability of to provide sign status, input for operating parameters and the ability to any log faults.

2.1 ISZ Unit

ISZ signs must be R1-2.2 Speed limit variable – white figures on black background, which comprise of an electronic AWRS sign at the advisory speed of 60 km/hr with pulsing roundel and amber beacons. It shall also include the supplementary warning sign, W11-2 as per the 2008 Traffic Control Devices Manual (TCD Manual). Refer to Error! Reference source not found..

Figure 1 - Example of an electronic AWRS sign with supplementary warning sign

2.2 ISZ Detectors

Refer to ISZ Standard document for selection and location of ISZ detectors. This section relates to the function requirements of the ISZ system and nodes.

2.2.1 Approach Detectors

2.2.1.1 High-definition radar

High-definition radar detectors are typically used for advanced approach detection. The detector is to distinguish when a vehicle passes over a point within the approach vehicle lane.

This will activate the ISZ signs for approximately 20 seconds or for a period which meets the parameters element of the approach. The contractor shall confirm activation times on site.

Any radar device shall be used on the basis of prerequisite confirmation of legality on the radio spectrum by referring to New Zealand Radio Spectrum Management Compliance Guide.

2.2.1.2 Radar mounting

The radar detectors can be pole or structure mounted. 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.

The pole to be used for a radar device shall be rigid and ensure that the maximum deflection due to wind at the detector module does not exceed the detectors manufacturer's requirements.

Where detectors are to be structure-mounted, the Contractor shall ensure that the height of the detector modules can be adjusted to meet the performance requirements as recommended by the supplier. If the height adjustment will likely be reduced; the Contractor shall liaise with the supplier to confirm any adjustments to ensure reliable functionality of the device.

This shall be achieved through design and engineering certification of a mounting pole and/or bracket which complies with AS/NZS1170.2 Structural Design Actions Standard. The maximum allowable sway and vibration will depend on detector beam width, sensitivity and the distance between transmitter and receiver.

2.2.2 Limit Line Detectors

2.2.2.1 In-ground loop detection

In-ground vehicle loop detectors are typically used for limit line detection. The detector is to distinguish when a vehicle is stopped at the limit line (where the loop is positioned) on the side road and when a vehicle has left the detection area. This will activate the ISZ signs on the main road for approximately 8 seconds. The contractor shall confirm activation times on site.

For ISZ applications the number of detector cable turns for in-ground loops should be at least two turns and the loop configured in a simple rectangular design. For more information on installation of inductive loops, refer to P43 Specification for traffic signals (P43).

The contractor shall mark the required position once confirmed by the designer and to liaise with designer if inconsistencies are determined on site. It is to be ensured that no damage is caused to the pavement during detector loop installation.

2.2.3 Right Turn Bay (RTB) Detectors

2.2.3.1 In-ground loop detection

In-ground vehicle loop detectors are typically used for RTBs and upstream flush medians. Vehicles passing over these nodes will activate the ISZ sign for approximately 8 seconds. Functional requirements for RTB detection shall be approved by the RCA. The contractor shall confirm activation times on site.

2.2.3.2 Above ground or radar detection

Functional requirements for above ground or radar detection at RTB's shall be approved by the RCA.

2.3 Roadside cabinet and PLC

The cabinet is to house the intersection detection equipment, radio frequency transmission equipment, central processing unit and back-up power supply (UPS).

The system will be managed by an industrial PLC which, as well as controlling the signs, collects and stores all vehicle, fault and sign operation data that is then sent to a PC server (NZTA network). GUI system is also linked the PLC to provide real-time working view of site, nodes and performance.

The roadside cabinet shall contain an electrical distribution system, circuit breakers, programme logic controller (PLC) equipment, communications system interface components. Refer to the latest ISZ Design Standard and Specification: Cabinets.

2.4 ISZ Logic System Function

The ISZ logic system requires continuous monitoring of all system nodes and active devices, such as detectors and signs to promptly detect and display any defect on a real-time GUI system.

All nodes are to be linked together via 50mm diameter orange underground PVC ducting, loop feeder cable and/ or industrial grade wireless network devices. The wireless network must have the ability to communicate across the ISZ site for a maximum of 500m.

2.4.1 PLC and GUI

The primary PLC must be an off-the-shelf product readily available in New Zealand, with an existing interface compatible with the NZTA monitoring system to minimise integration costs for the Road Controlling Authority (RCA).

The industrial 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 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.

Refer to the latest corresponding ITS Design Standard: ISZ and IEC 61131 standard for more details.

2.4.1.1 Positioning

PLC shall be installed close to detector units to prevent transient interference and minimise length and complexity of wiring infrastructure.

2.4.1.2 PLC Software

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

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

2.4.1.3 PLC Data Latency and Vehicle queuing

Minimal latency is crucial for ISZ detection and message events. The control system utilises detector data to manage vehicle queues, allowing signs to remain illuminated until potentially colliding traffic clears the intersection (typically around 20 seconds). Final activation times will be confirmed on-site by the contractor.

2.4.2 Network for local devices and inter-connectivity

A wireless communication device is connected to the ISZ sign - this enables communication between the sign and the ISZ central control system. Signs shall be networked together with a PLC controller to allow bidirectional communication. Interconnectivity between the devices needs to be defined.

The system shall allow for up to 500m of communication network range.

Reliable communication between field locations will be achieved using fixed wireless (UHF) networks, or a cost-effective combination of both Fibre Optic and UHF networks. Wireless commercial services are essential for radar detectors due to the rural and remote nature of ISZ sites and distance to intersection PLC.

Network boosters may be used to support any distance or connection requirements to system nodes.

RCA to confirm specific network requirements.

2.4.3 Communication to the site

2.4.3.1 Communications system connection

Use wireless commercial services such as Broadband or Cellular provided by a NZTA approved telecommunications provider for communication to the site. NZTA's existing fibre optic network cannot be used due to its' rural and remote nature.

Alternate backhaul data connection should be provided by using commercial services such as ADSL or Cellular provided by a NZTA approved telecommunications provider. Use of any other network service other than NZTA's existing ITS field network solutions requires consultation with the RCA.

2.4.3.2 PLC connection

The PLC controller will be required to poll the signs at regular intervals requesting current status and availability (refer to Section 2.4 in ITS Delivery Specification: Active Warning and Regulatory Signs for functional requirements of status reporting). 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 too remotely.

2.4.4 Remote monitoring software

For management purposes, software that monitors, logs, and manages all the system activity at any ISZ location are required to be compliant with NZTA server infrastructure and to be accepted on base-by-base case. Monitoring Software developed and supplied by contractor will be integrated and hosted on NZTA server infrastructure.

2.5 Procurement

All signs should be approved through Austroads' product acceptance process (Development of Product Acceptance Techniques for Road Network Devices, 2015).

Having a procurement strategy ensures the selection of ITS equipment is aligned with the project objectives and enables the correct outcomes are achieved. This strategy also provides best value for money through consideration of the following aspects to identify logical delivery or works packages and procurement methods:

- Key performance requirements
- Risk
- Whole-of-life or life-cycle requirements
- Organisational capability
- Market/industry capability

The strategy should consider the volume of work, budget, reliability, and maintainability, and involves asset management from the start.

2.6 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 NZTA – this system must be located on NZTA housed servers/platform and be compliant with their operating protocols.

ISZ system must also be capable in the future of interfacing with the existing NZTA approved national traffic management system – 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.

3 PERFORMANCE REQUIREMENTS

This section outlines the reliability and availability requirements of equipment, which may require independent certification and/or declarations of conformity.

Reliability and availability of electrical systems is important so ISZ systems can operate consistently. Refer to Section 4 of ITS-01-01 General Requirements for further details.

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.

3.1 Reliability / Operational Life

3.1.1 Mean Time Between Failures (MTBF)

Each subsystem's (i.e., Radar, AWRS, etc.) MTBF is to be defined by RCA.

3.2 Availability

To be defined.

3.2.1 Definitions

Operating period - total number of hours within a specified period.

Down time - total time lost in hours due to Lost Time and Acceptable Down Time.

Lost time - the time in hours commencing service stops and is reported contractor and this time stops when service has been reinstated.

Acceptable down time - time (hrs) when service is lost due to routine maintenance or events beyond the Contractor's control.

3.3 Monitoring

All system nodes and active devices must be monitored continuously, and any defects quickly detected and displayed and recorded (logged somewhere) for reporting purposes on the real time Graphical User Interface (GUI). Any anomalies are reported via email or text alerts.

As part of the monitoring and quality control system from ISZ, a GUI (that works with NZTA systems) monitors the system, ensuring the system can be monitored remotely in real-time.

3.3.1 System interface

The PLC hardware used shall be compatible with NZTA approved monitoring software platform provided by contractor as part of ISZ operational support and maintenance.

The Software must be accessible through a web interface and meet agreed NZTA protocols and approved control and monitoring system. This control and monitoring system shall log any faults detected by the individual ISZ systems monitoring the site.

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

The interface must include, data logging for monitoring purposes and can include,

- Sign status
- Sign availability
- Operating parameters
- Baseline values with abnormal values as faults

3.3.2 Closed-Circuit Television (CCTV) for monitoring (optional)

Controls are to be defined (privacy, access to footage etc).

Refer to the ITS Delivery Specification: Closed-Circuit Television – operational.

3.4 Resistance to the effects of external conditions

For Design Life requirements, refer to Section 3.1 in ITS Delivery Specification: Active Warning and Regulatory Signs and refer to ITS Delivery Specification: Cabinets for requirements for cabinets.

The operating environment of ISZ can be relatively harsh. Equipment that is deemed fit for purpose is expected to continue to operate effectively exposed to the New Zealand environment. It is essential that materials and manufacturing processes take this into account.

These conditions may require part of the design to be upgraded. Upgrading of foundations and structural support may be applicable (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.
Ongoing maintenance requirements that are a result of these conditions.

ISZ shall be capable of continuous, normal operation (24 hours, seven days per week) and maintaining performance criteria.

4 TECHNICAL REQUIREMENTS

This section outlines specific technical and physical constraints for the equipment.

4.1 Electrical safety

All ITS equipment must comply with and be installed in accordance with Electricity (Safety) Regulations 2010 (SR 2010/36) and AS/NZS 3000 Wiring Rules.

4.2 Power

4.2.1 Electrical supply

Electrical supply for all components of ISZ should be installed/connected by an NZTA approved contractor or electrical supplier.

Power supply and distribution should have the capabilities to do AC and DC, and have surge protection. The central control cabinet must comply with Electricity (Safety) Regulations 2010 (SR 2010/36) and AS/NZS 3000 Wiring Rules.

The electrical terminations at the central cabinet must be correctly earthed and grounded in accordance with AS/NZS 3000 Wiring Rules, including all cabinets and doors.

4.2.2 Power supply hierarchy

To be defined.

4.2.3 Mains power

The central control cabinet and PLC must always be powered with mains power due to higher levels of guaranteed performance requirements.

ISZ signs shall be connected to solar power. In areas of extensive tree cover, mains power should be considered to support the functionality of the sign.

This would not be conducive to solar power and therefore, mains power must be used to get the best performance outputs from the ISZ sign.

4.2.4 Uninterrupted 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 24 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.

A UPS shall be considered in an area with a history of power failure or has limited alternative options to mains power due to its rural environment. A UPS is not typically used for ISZ signs but should be considered for cabinet and PLC installation. Refer to the ITS Core Standard: Requirements for Intelligent Transport Systems for information and requirements for UPS.

4.2.5 Solar Power

If solar power is to be used for each node, the contractor shall demonstrate that there is enough power output from the solar panels to reliably power the site and systems to the RCA.

4.3 Physical Characteristics

Refer to Section 4.4 in the ITS Delivery Specification: Active Warning and Regulatory Signs for more details about sign physical characteristics.

4.4 Display

Refer to Section 4.5 in the ITS Delivery Specification: Active Warning and Regulatory Signs for more details about the sign display matrix.

4.5 Required Documentation

4.5.1 Software and licensing

Refer to Section 4.6 in ITS Delivery Specification: Active Warning and Regulatory Signs.

4.5.2 As-built documentation

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

- Cabinet foundation/mounting arrangements
- Cabinet electrical switchboard, mains reticulation and earthing
- Cabinet control system schematic diagram
- ISZs mounting poles/foundations/structures/brackets
- Layout of set up
- RAMM data

4.5.3 Other documentation

Contractor supplies docs:

- Device manuals
- Warranty info
- Data device was installed in-field.
- Docs that support environment parameter requirements
- Certificate of electrical safety

5 Appendix A: <Title>

5.1 Use this heading as required 1

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5.2 Use this heading as required 2

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5.3 Use this heading as required 3

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6 Appendix B: <Title>

6.1 Use this heading as required 1

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6.3 Use this heading as required 3

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7 References

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

7.1 Industry standards

Standard number/name	Source
AS/NZS 3000:2018 Electrical Wiring Rules	
AS/NZS1170.2 Structural Design Actions	

7.2 NZTA standards, specifications and resources

7.2.1 Standards and specifications

See the NZTA website for the latest versions of the ITS S&S listed below.

Document name
ITS design standard: Intersection Speed Zones
ITS design standard: Requirements for Intelligent Transport Systems
ITS delivery specification: Roadside cabinets
ITS design standard: Commissioning and Handover requirements – ITS core requirements standard
ITS design standard: Active Warning and Regulatory Signs
ITS Design Standard: Closed-Circuit Television
ITS Delivery Specification: Closed-Circuit Television – Operational Cameras
P43 Specification for Traffic Signals

7.2.2 Resources

Document name/code	NZTA website link
Traffic Note 62: Intersection Speed Zones – guidelines and requirements 2022 (Traffic Note 62)	NZTA Traffic Notes website and Traffic Note 62 pdf here: https://www.nzta.govt.nz/assets/resources/traffic-notes/docs/traffic-note-62.pdf
Traffic Control Devices Manual (TCD Manual)	https://www.nzta.govt.nz/resources/traffic-control-devices-manual/
Development of Product Acceptance Techniques for Road Network Devices, 2015.	https://austroads.com.au/publications/traffic-management/ap-r471-15
New Zealand Radio Spectrum Management Compliance Guide	https://www.rsm.govt.nz/assets/Uploads/documents/compliance-guide.pdf

7.3 Legislation

Name	Website link
Electricity (Safety) Regulations 2010 (SR 2010/36)	NZ Legislation website

7.4 Other resources

Name	Website link

7.5 ITS standard drawings

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

Drawing number
000-0000-0-7104-03-R1 (Roadside control cabinet)
000-0000-0-7104-04-R1 (Roadside control cabinet apron details)
000-0000-0-7104-17-R1 (Advanced warning signs)
000-0000-0-7104-20-R1 (Advanced warning sign pole with shear base)
000-0000-0-7104-21-R1 (Advanced warning sign pole - ground plant)
000-0000-0-7104-22-R1 (Advanced warning sign pole - mounting brackets)
000-0000-0-7104-45-R2 (CCTV folding pole general layout)
000-0000-0-7104-46-R1 (CCTV fixed pole general layout)
000-0000-0-7104-47-R2 (CCTV pole foundation details)

8 Terminology used in this document

Term	Definition
DRAFT	The document is being written and cannot be used outside of NZTA.
PENDING	The document has been finalised and is pending approval and ratification by NZTA. It can be used for procurement at this status.
RATIFIED	The document is an official NZTA document. Road controlling authorities are obliged to follow a document with this status.
RETIRED	The document is obsolete, and/or superseded.
ITS	Intelligent transport systems
RIAWS	Rural Intersection Activated Warning Signs
ISZ	Intersection speed zones
AWS	Advanced warning signs
CSV	Comma-separated values
AS/NZS	Australian/ New Zealand standard
EN	European standard
IP	International Protection code (sometimes interpreted as Ingress Protection code) classifies the degree of protection provided by mechanical casings and electrical enclosures against intrusion, dust, accidental contact and water.
IoT	Internet of Things-based communications device
Enclosure	Housing for electronics systems to protect against environmental conditions.
Frangible	Performance capability of structure, which are designed to shear or collapse when struck by a vehicle, minimising the impact hazard to the vehicle's occupants.
Hz	Hertz
Ohm	Unit of electric resistance between two points of a conductor (equivalent of one volt per one ampere (V/A).
km/hr	Kilometres per hour
LED	Light-emitting diode
LR	Luminance ratio
M	Metre
mm	Millimetres
m/s	Metres per second

Term	Definition
ms	Milliseconds
NOC	Network outcomes contract
Pixel	Smallest controllable element of a display matrix for an electronic sign or signal.
RCA	Road controlling authority
SAT	Site acceptance test
SID	Speed indicator device
SLA	Service level agreement
OEM	Original equipment manufacturer
TCD	Traffic control devices
TCD manual	Traffic control devices manual
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
AGD	Above ground detector
ASD	Approach sight distance
UHF	Ultra high Frequency
ISZ	Intersection Speed Zone
PLC	Programme logic controller
CoO	Concept of Operations
SSS	Safe system solutions
VSLS	Variable speed limit signs
SRS	Side-road radar sensor
SLL	Side-road limit line
RTBS	Right turn bay sensor
CCS	Central control system
GUI	Graphical user interface
AC	Alternating current
DC	Direct current

9 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

10 Document control

10.1 Document information

Document number	ITS-SPEC-ISZ-202404
Previous document number/s (if applicable)	
Document status DRAFT | FINAL DRAFT | RATIFIED | RETIRED	DRAFT
[IF RETIRED] New document details	
Online ISBN	TBC
Document availability	The controlled version of this document can be accessed from https://www.nzta.govt.nz/roads-and-rail/intelligent-transport-systems/standards-and-specifications/its-current-interim-and-legacy-standards-and-specificationshttps://www.nzta.govt.nz/resources/intelligent-transport-systems/its-standards-and-specifications/

10.2 Document owner

Role Head of Technology Engineering

Organisation NZTA

10.3 Document approvers

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

Approval date	Approver	Role	Organisation
DD/MM/YYYY			

10.4 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	23/02/2024	Alex Lumsdon Alyssa Greaney Allan Arora	Associate - Transportation Engineering Transport Planner Transportation Engineer	Initial draft for expert panel review
0.2	22/04/2024	Alex Lumsdon Alyssa Greaney Allan Arora	Associate - Transportation Engineering Transport Planner Transportation Engineer	Revised draft for industry consultation
0.3	DD/MM/YYYY			