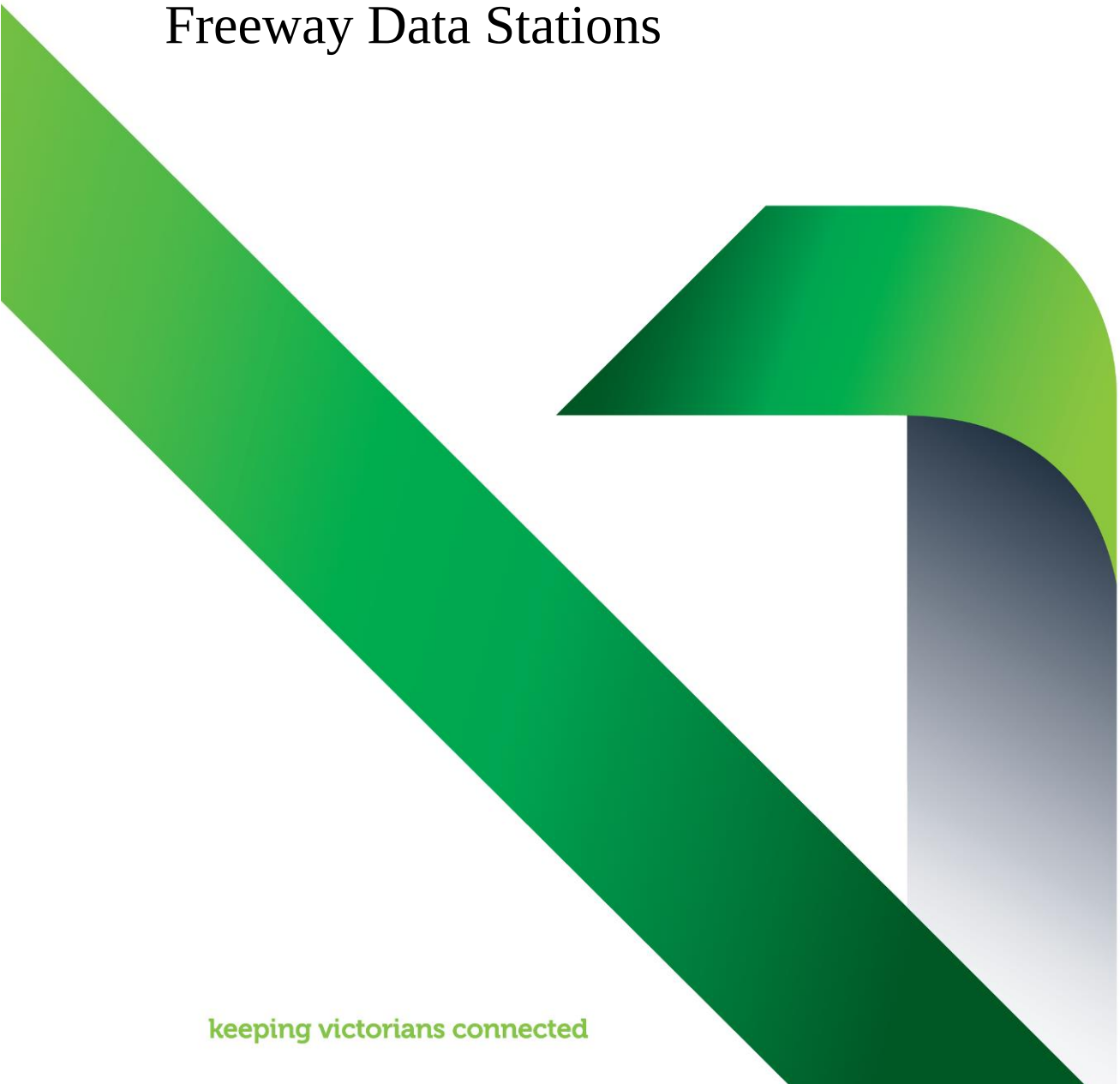
TCS 048 - 2018

Specification for

The Supply of

Freeway Data Stations



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TCS 048 – 2018

Foreword

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

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

VicRoads Standard Drawings, Specifications and Guidelines are available for downloading from VicRoads website at the following address under 'Tenders & Suppliers', http://www.vicroads.vic.gov.au/itsspecs

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

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PREFACE

A. TELECOMMUNICATIONS EQUIPMENT

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

B. CHANGES TO THIS SPECIFICATION

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

- Clarification on traffic data, some editorial changes;
- Changes to administration and configuration tool requirements;
- Changes in data accuracy and response time requirements (Table 1);
- Addition of humidity in Environmental requirements (Section 6); and
- Addition of Field trial in type approval requirements (Appendix B)

The following table details versions to this specification:

Version	Revision	Date	Author	Description
2018	3	December 2018	VicRoads Network Design Services	Addition of data requirements for vehicles detected as travelling in wrong direction; List of data uses increased; Ethernet interface requirements mandated; NTP required to affect accuracy of collected data; No double counting from adjacent lanes; Require different data when speed < 10km/h than when freeway empty and Addition of Warranty Requirements (Section 10) Addition of inclement weather exception
2014	2	September 2014	VicRoads ITS	Additional performance requirements included; Removal of reference to original VicRoads obsolete FD System; Inclusion of FDS protocol
2011	1	July 2011	VicRoads ITS	Modification of headings and reorganisation of sections for greater consistency with Australian Standard; Addition of Related Specification and Drawing (Section 2); Addition of Acronyms (Section 3); and Addition of Environmental Requirements section (Section 7).

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SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

1.1.1 This document covers the requirements for the supply of Freeway Data Stations (FDS) for use on freeways including ramps within the state of Victoria.

1.2 GENERAL

1.2.1 Freeway Data Stations form part of the Freeway Data System (FD System) and are used to monitor the operation of Victoria's freeway network and to gather real time traffic data used in various information, statistical and advisory applications.

1.2.2 For the purpose of this specification, the term 'traffic data' shall mean any of the following:

- Speed
- Volume
- Occupancy / Presence
- Classification / Length

Data is collected from all freeway lanes (mainline) and ramp lanes.

1.2.3 Information collected by the Freeway Data System is typically used for the following applications:

Real-time Control
- Incident Detection;
- Drive Time System;
- Variable Speed Limit System; and
- Ramp Metering System.

Internal Reporting
- Road Performance Monitoring;
- Algorithm Effectiveness Evaluation;
- Algorithm Performance Optimisation; and
- Business Case Development

External Reporting
- Real-time traffic data publication

1.2.4 The data collected from a FDS is transmitted via a TCP/IP compatible network link back to the VicRoads Data Centres.

1.2.5 VicRoads ITS platform is STREAMS as detailed in Appendix A.

1.3 PHYSICAL REQUIREMENTS

1.3.1 Freeway Data Stations shall be designed to be housed within an enclosure as specified in individual tender documents.

1.3.2 Enclosures used are typically:

- An ITS cabinet used to house a number of ITS related devices including the FDS equipment. This option requires the FDS unit, complete with detectors, communications card and internal power supplies shall be designed to fit into a 19-inch rack system; or
- A ‘stand-alone’ roadside cabinet complying with VicRoads specification TCS 011.

1.3.3 The FDS shall have a design life not less than 10 years.

SECTION 2 RELATED SPECIFICATIONS AND DRAWINGS

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

2.2 All installation works shall conform to the relevant VicRoads specifications and related standard drawings as indicated throughout this document.

2.3 Where no specific reference is made to an Australian Standard, the materials and processes used shall conform to the relevant Australian Standard or generally accepted practice.

2.4 The following related Australian Standards and Austroads documents are referenced:

AP – T60/06	AUSTROADS TECHNICAL REPORT Automatic Vehicle Classification by Vehicle Length
AS 2703	Vehicle Loop Detector Sensors
AS/NZ 3000	Australia/New Zealand Wiring Rules
AS 3100	Approval and test specification–General requirements for electrical equipment
AS 60038	Standard Voltages
AS 60529	Degrees of protection provided by enclosures (IP code)
AS 60068.2.29	Environmental testing- Tests-Test Eb and guidance: Bump
AS 60068.2.6	Environmental testing- Tests-Test Fc: Vibration (sinusoidal)
AS/NZS 61000.6.1	Electromagnetic Compatibility (EMC) - Generic standards – Immunity for residential, commercial and light-industrial environments
AS/NZS 61000.6.3	Electromagnetic Compatibility (EMC) - Generic standards – Emission standard for residential, commercial and light-industrial environments

2.5 The following related VicRoads Specifications are referenced:

Specification TCS 011	Roadside Cabinet
Specification TCS 054	The installation of Inductive Detector Loops
Specification TCS 061	ITS Field Cabinet

2.6 The following related VicRoads standard drawings are defined:

TC-2002	Cabinet – Installation Details Freeway Data Stations
TC-2003	Universal Roadside Cabinet
TC-2031	Freeway Data Station – Typical Layout
TC-2032	Loop Installation Details – Freeway Data Station
TC-2033	Loop Pattern – Freeway Data Station
TC-2034	Loop Pattern – Freeway Data Station Retro Installed in Open Grade Course
TC 2100	Standard Cabinet Label
TC-2297	Freeway Data Station using TRTL Managed Motorways - FRS, ERMS and FDS Layouts

SECTION 3 ACRONYMS

3.1 ACRONYMS

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

ACMA	Australian Communications and Media Authority
AS	Australian Standard
CLI	Command Line Interface
EMC	Electromagnetic Compatibility
FDS	Freeway Data Station
FP	Field Processor
GPS	Global Positioning System
HTTPS	Hypertext Transfer Protocol Secure
ICMP	Internet Control Message Protocol
IP	Ingress Protection (degree of protection)
ITS	Intelligent Transport System
LED	Light Emitting Diode
LUS	Lane Use Sign
LUMS	Lane Use Management System
NMS	Network Management System
NEMA	National Electrical Manufacturers Association
SC	Sign Controller
SNMP	Simple Network Management Protocol
STREAMS	An ITS communications/control platform used by VicRoads to manage traffic operations on freeways
SSH	Secure Shell
SSL	Secure Sockets Layer
TCP/IP	Transmission Control Protocol/Internet Protocol
TLS	Transport Layer Security

SECTION 4 DEFINITIONS

4.1 DEFINITIONS

Speed (km/h)	Speed in km/h per vehicle per lane
Length in metres	Bumper-to-bumper vehicle length (in metres) per vehicle per lane
Presence Event	Presence of a vehicle in a configured detection zone per lane
Axles Number	Axles Number per vehicle per lane
Axle Groups	Axle Groups Number per vehicle per lane
d1 in metres	Distance in metres between axle group one and two
d2 in metres	Distance in metres between axle group two and three
Vehicle Width	Wheel to wheel width in centimetres per vehicle per lane
Lateral Lane Position	Position of the leading wheel from shoulder side lane line in centimetres
Occupancy	The percentage of time that the detection zone has a vehicle present. This measure is to be based on a 2m effective detection zone length and should be indicated as "occupied" from when the front bumper of the vehicle enters the effective detection zone to when the rear bumper exits the effective detection zone

SECTION 5 SYSTEM REQUIREMENTS

5.1 GENERAL

The FDS shall comply with all relevant statutory requirements including Australian Communications and Media Authority (ACMA) for telecommunications equipment. A copy of approval certifications shall be provided to VicRoads upon request.

5.2 ITS PLATFORM

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

5.3 DATA TRANSMISSION

5.3.1 The FDS Controller shall provide at least one 100/1000Base TX Ethernet interface. The Ethernet interface shall be used for data transmission and device configuration.

5.3.2 The FDS Ethernet interface shall allow minimum 3 concurrent connections for data transmission.

5.3.3 FDS shall transmit data required in this Specification to the ITS Platform via a VicRoads agreed protocol

5.4 TIME ACCURACY

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

5.4.2 All data shall be time stamped in milliseconds.

5.4.3 Any change to the internal clock made by NTP shall not affect the accuracy of any of the measurements made by the FDS.

5.5 ADMINISTRATION AND CONFIGURATION TOOL

5.5.1 The FDS controller shall provide an interactive browser based user interface using HTTP and HTTPS (w/ at least TLS version 1.2) to provide monitoring, configuration and diagnostic related functions.

5.5.2 Device must support SSH when performing remote command line administration and configuration.

5.5.3 The software shall provide for the display and monitoring of the FDS configuration, including:

- Site Name
- Site Location
- Firmware version
- Current Temperature of the controller
- Mains Power Supply status
- Backup Power Supply Status (if one exists)
- Up Time (since last reset)
- System time (Local date and time)
- MAC Address(es) of all Ethernet port(s)
- All the Sensors connected to the controller and, for each sensor, the following information shall be displayed:

    - Sensor ID
    - Sensor operation state
    - Detection Zone measures (speed, length, presence) in real time
    - Battery voltage level (only if the sensor is powered by battery)
    - Current Sensor firmware version (if exists)

5.5.4 Configuration Functions – The software shall allow a user to change FDS controller and Sensors configurations using the browser interface. All FDS parameters/settings for FDS to function correctly shall be only configured via this software. In general, all configuration changes shall be applied immediately and take effect without the need to restart/reset the FDS controller. However, changing certain parameters may cause any currently active connection to be dropped, for example, IP address, etc. As a minimum, the following parameters shall be configurable.

(a) The Site Name – Text field with minimum 150 characters.
(b) Site Location – Text field with minimum 300 characters.
(c) Detection Zones configurations:
    a. Detection Name
    b. Detection Zone ID
    c. Detection Zone - Lane mapping (for mainline Detection Zone only)
    d. Detection Zone – Ramp location &lane mapping (for Ramp Detection Zone only)

5.5.5 Network configuration – The software shall allow a user to change the following network configurations:

- IP address allocation (DHCP or static).
- If the IP address allocation is static – the following parameters: IP Address, Subnet Mask, Default Gateway, Primary DNS and Secondary DNS.

5.5.6 FDS Protocol Configuration – The software shall allow a user to change the following FDS Protocol and communications related configuration parameters for the connection between the FDS controller and VicRoads backend system, such as STREAMS.

- IP Port used for TCP/IP connection.
- Session time out for TCP/IP connection (in seconds).
- Site Number.
- Any other necessary parameter of the FDS protocol.
- Device must support the ability to enable and disable protocols such as TELNET and HTTP

5.5.7 System Time – The software shall allow a user to change the current time, time zone, Daylight saving option and whether to use an NTP server for time synchronisation. The IP address(es) of the NTP servers shall be configurable.

5.5.8 Security – The software shall:

- Allow a user to change the browser interface's username and password.
- Support both HTTP and HTTPS and allow a user to choose the access mode from 'HTTP only', 'HTTPS only' and 'Both HTTP and HTTPS'.
- Allow a user to change the TCP/IP ports used for 'HTTP' and 'HTTPS'.
- Device must support customization of HTTPS and SSH TCP/IP ports
- Allow a user to change the session timeout for the browser interface (duration after the last active web request received).
- Device must enforce VicRoads password complexity standard (refer IDAM standard).
- Passwords stored on the device must first be hashed using an approved algorithm (refer cryptography standard).
- Cryptography algorithms must comply with the VicRoads Cryptographic Security standard.

5.5.9 Administration – The software shall provide the following administration functions.

5.5.9.1 Firmware upgrade

- The software shall allow a user to upgrade the controller's firmware. After the firmware is upgraded, all existing pre-configured parameters (IP addresses, network mask and default gateway etc.) for the controller shall be maintained.
- The software shall allow a user to upgrade firmware for individual sensors that are connected to the FDS controller.
- The system shall ensure that the entire firmware file is successfully downloaded before attempting to apply the firmware upgrade.

5.5.9.2 Save /recover configuration to/from file.

- All of the configuration parameters for the controller shall be able to be saved and retained after rebooting the controller.
- The software shall allow a user to save the current configuration to a local file and be able to restore all the configuration parameters from the file.

5.5.9.3 Reboot and Reset.

The software shall allow a user to reboot/reset the controller with the following options:

- Reset to manufacturer default.
- Reset to manufacturer default, except for the current network configuration (IP addresses, network mask and default gateway etc.).
- Reboot the controller with all configuration maintained.

5.5.9.4 System event logs

The software should log the following system events as minimum:

- Controller and sign fault events.

- The login / logoff events for the browser interface software, including any failure attempts. The parameters to be logged include the attempted usernames, passwords and source IP addresses.
- The software shall log the events into a log file, which shall be able to be displayed via the web interface and to be exported to text or CSV format files.

The software shall keep a minimum of the last 30 days or 5000 log entries, whichever limit comes first. Each log shall contain a timestamp with the resolution to 1ms.

Significant system and audit events must be logged. At a minimum, the following events must be logged:

- System start & stop
- Network port up/down
- Configuration changes
- Critical errors
- Authentication events (success & failure)

Device must support sending events (see item above) to a central SYSLOG server. Server address must be configurable.

Device must support monitoring and discovery using the SNMPv3 protocol. The following information at a minimum must be available over SNMPv3.

- make & model
- serial number
- firmware version
- location / site number
- network & serial port enumeration
- network & serial port status (up/down)

5.5.9.5 Non-functional requirements

(a) Performance – The software shall respond to every user interaction within less than 3 seconds (excluding delays in the network).

(b) Security – FDS shall meet the following requirements:

- The software shall verify the username and password before granting access to the system.
- The software shall support both HTTP and HTTPS and allow a user to choose access mode from 'HTTP only', 'HTTPS only' and 'Both HTTP and HTTPS'.
- Only TLS shall be used for the HTTPS connection.
- After three successive failed login attempts, the minimum time allowed between login attempts shall be changed to 60 seconds.

(c) Bandwidth /network requirement

The software shall be designed to run on a relatively slow IP network, such as 3G wireless network with around 500Kbps bandwidth and 500ms latency. The user interface shall be simple to avoid long response times. Where large amounts of information is to be displayed (such as logs), the information shall be displayed over multiple pages with page down and page up functions.

5.6 FAULT REPORTING

5.6.1 Each FDS shall monitor the fault status of the roadside data station including each detection device and provide fault information to VicRoads via ITS platform.

5.6.2 FDS shall classify the faults to two severity levels:

- Critical failure (one or more detection zones not working),
- Non-critical failure (all detection zones working but attention required e.g. battery low).

5.6.3 FDS shall send notification event to the ITS Platform if the reported fault is cleared.

5.6.4 FDS shall keep fault logs as a minimum for the last 30 days or 5000 log entries.

5.7 PERFORMANCE REQUIREMENTS

5.7.1 General

5.7.1.1 Each FDS shall:

a) Continuously monitor traffic flows 24 hours a day;

Operate in all light and weather conditions;

b) Be designed to provide greater than 99.8% availability of each FDS, however under inclement weather condition (floods, fire, snow, fog, ice, thunderstorms) it's acceptable for FDS to operate at 98% availability.
c) Provide accurate per vehicle 'speed', 'length' and 'presence event' data within the response times in accordance with Table 1.
d) The time between the arrival and departure 'presence events' shall correspond to the time between the front bumper arriving in the detection zone and the rear bumper departing the detection zone. This ensures that the occupancy data calculated from the 'presence' data reflects the time that the bumper-to-bumper length of the vehicle was in the detection zone.
e) Allow minimum 8 lanes configurable per direction;
f) Be designed for easy constructability and maintainability including civil works;
g) Be designed such that no routine calibration activities shall require to be done in less than 24 months;
h) Be designed such that frequency of routine maintenance activities including cleaning shall not be less than 12 months;
i) Predict and report, where any parts of the FDS are battery operated, on individual battery powered part's remaining battery life and shall provide events to the ITS Platform when any part's remaining battery life is less than 6 months;
j) Detect and log for reporting all faults and clearances of the faults within 5 seconds of the fault/clearance occurring.

5.7.2 Data accuracy and response time

5.7.2.1 Each FDS shall send only one event against one vehicle at one site to ensure that there is no double-counting from adjacent lanes.

5.7.2.2 Where a data value (speed, length, presence, width, lane position, etc.) returned by an FDS is unable to be measured, the FDS shall return a value that is clearly identifiable as an indicator of "no data". For example, where speed cannot be measured, an indicator value (e.g. 255) shall be returned (not 0).

5.7.2.3 It is desirable that data provided by the FDS when speed < 10km/h is different to the data provided when there are no vehicles on the freeway.

5.7.2.4 Each FDS shall ensure that data is provided by the FDS when a vehicle is travelling in the wrong direction and that this data identifies the vehicle as travelling in the wrong direction. The FDS must be able to identify 98% of vehicles travelling the wrong-way on the freeway.

5.7.2.5 Each FDS shall provide data as detailed in Tables 1 to 4 below:

Data per Vehicle	Uncontrolled Motorway		
	Range	**Accuracy**	**Maximum Response time***
Speed (km/h)	10 - 160	±2%	0.3s
Length in metres	1.5 - 35	±2% or ±100mm#	0.3s
Presence Event↔	'On' or 'Off'	±2%	0.3s

Table 1: Basic FDS Data Accuracy and Response time

*Maximum Response Time: For all measurements except for "Presence Event", the "Maximum Response time refers to the maximum time gap between the measurement value is sent by the FDS and the time of the measured vehicle leaves the configured detection zone.
Accuracy required is ±2% for vehicles greater than 5m and 100mm for vehicles below 5m. Length accuracy only needs to be to 1 decimal place.
For "Presence Event", the "Maximum Response time refers to the maximum time gap between the event data is sent by the FDS and the actual time of the event happens.

Data per Vehicle	Controlled Motorway Mainline		
	Range	**Accuracy**	**Maximum Response time***
Speed (km/h)	10 - 160	±2%	0.3s

Length in metres	1.5 - 35	±2% or ±100mm	0.3s
Presence Event↔	'On' or 'Off'	±2%	0.3s
Vehicle Width	0 – 4m	±20 cm	0.3s
Lateral Lane Position	0 – 3m	±20 cm	0.3s

Table 2: Motorway Control FDS Data Accuracy and Response time

Data per Vehicle	**Controlled Motorway Ramps**		
	Range	**Accuracy**	**Maximum Response time***
Speed (km/h)	10 - 130	±2%	0.3s
Length in metres	1.5 - 35	±2% or ±100mm	0.3s
Presence Event↔	'On' or 'Off'	±2%	0.3s

Table 3: Motorway Control Ramps FDS Data Accuracy and Response time

Data per Vehicle	Motorway Statistical Sites		
	Range	Accuracy	Maximum Response time
Speed (km/h)	10 - 160	±2%	0.3s
Length in metres	1.5 - 35	±2% or ±100mm	0.3s
Presence Event↔	'On' or 'Off'	±2%	0.3s
Axles Number	1 - 6	±2%	0.3s
Axle Groups	1 - 6	±2%	0.3s
d1 in metres	1 - 4	±2%	0.3s
d2 in metres	1 - 4	±2%	0.3s
Vehicle Width	0 – 4m	±20 cm	0.3s
Lateral Lane Position	0 – 3m	±20 cm	0.3s

Table 4: Statistical FDS Data Accuracy and Response time

↔ Arrow: **Presence of a vehicle in a configured detection zone per lane.**

SECTION 6 ELECTRICAL REQUIREMENTS

6.1 GENERAL

6.1.1 The FDS, unless specified otherwise, shall be designed to operate on Mains Supply. All wiring shall comply with AS/NZS 3000.

6.1.2 The mains supply voltage shall be deemed to be 230VAC +10%, -6% in accordance with AS 60038. The system and/or sub-elements of the system shall be capable of operating satisfactorily from the same within ±15% (percent).

6.1.3 The requirements for the power supply will be detailed in individual tender documents.

6.1.4 All cables and wires shall be insulated with a material not inferior to V-90 grade PVC and shall be suitably labelled.

6.1.5 Where alternative power supply is required, such as solar power, details will be specified in individual tender documents.

6.2 FDS HOUSED WITHIN AN ITS CABINET

6.2.1 Where an FDS is installed within an ITS field cabinet, it shall be designed to fit into a standard 19 inch rack mount system in accordance with TCS 061 ITS Field Cabinet.

6.3 STANDALONE ENCLOSURE

6.3.1 Where the FDS is housed within a standalone enclosure, the electrical system shall incorporate the following facilities:

a. A circuit-breaker board comprising appropriately rated mains isolation switch and circuit breaker(s) to operate and protect the expected load; and
b. The ability to isolate the FDS from mains supply at ground level using a suitable isolator switch or circuit breaker.

6.3.2 All socket outlets shall be connected to an RCD in accordance with AS/NZS 3000 or include an integral RCD.

6.3.3 All electrical equipment and wiring shall comply with the safety requirements of applicable Australian Standards.

6.4 INTERNAL PROTECTION

6.4.1 All equipment including data lines shall be internally protected against damage resulting from:

a. Lightning striking at or near the FDS;
b. Electrical transients on power cabling;
c. Electrical transients on communications wiring;
d. Radio frequency interference;
e. Static electrical discharge; and
f. Any harmonics by the above and any equipment in the cabinet.

SECTION 7 ENVIRONMENTAL REQUIREMENTS

7.1 TEMPERATURE AND HUMIDITY

7.1.1 The cabinet which houses the FDS and associated equipment shall be designed to operate under any combination of the following conditions:

a) Ambient air temperatures within the range –15°C to 50°C at a relative humidity of 90%;
b) Insolation of up to 1000 W/m2, incident at an angle of 30° from the vertical, applied to the maximum exposed surface of the equipment.

NOTE: Where it is not practical to provide the required insolation during testing, it is acceptable to increase the upper ambient temperature limit by 10°C as a substitute.

7.1.2 FDS shall be protected against the effects of high humidity, including condensation following a drop in ambient temperature.

7.2 ENCLOSURE PROTECTION

7.2.1 Any enclosure used to house equipment shall meet manufacturer's recommended IP rating and shall not be less than IP45 for the complete control housing in accordance with Australian Standard AS 60529.

7.3 SHOCK AND VIBRATION

7.3.1 Shock

7.3.1.1 All removable sub-assemblies, in an unpacked condition, shall withstand the bump test (Test Eb) to AS 60068.2.29. The severity shall be 1000 bumps at an acceleration of 98m/s² (10g) with a pulse duration of 16ms.

7.3.1.2 The entire FDS, packaged for transport, shall be subjected to a bump test. This test shall be carried out in accordance with AS 60068.2.29. The severity shall be 4000 bumps at an acceleration of 98m/s² (10g) with a pulse duration of 16ms.

7.3.2 Vibration

7.3.2.1 The entire FDS shall be subjected to the vibration test specified in this Clause. The test procedures shall be in accordance with Australian Standard AS 60068.2.6 for sinusoidal vibration. For all tests specified in this clause, the amplitude shall be 0.75mm up to the cross-over frequency, (approximately 8.2Hz), where the acceleration is 0.2g, and for higher frequencies the acceleration shall be maintained constant at 0.2g.

7.3.2.2 The test shall be performed for 3 mutually perpendicular axes with the FDS in the normal (upright) orientation.

7.3.2.3 For each axis of the tests, an investigative sweep cycle shall be performed on the test specimen over the frequency range 5-55 Hz with an amplitude of up to 0.75mm to identify critical frequencies at which –

a) FDS malfunction and/or deterioration of performance are exhibited which are dependent on vibration; and/or

b) Mechanical resonances and other response effects, such as chatter, occur.

7.3.2.4 The frequencies and the applied amplitudes at which these effects occur shall be noted, together with the behaviour of the test specimen at each critical frequency.

7.3.2.5 The FDS shall be tested for 10 minutes at each of the critical frequencies identified, with vibration amplitude of 0.75mm below the cross-over frequency, and 0.2g acceleration above the cross-over frequency.

7.3.2.6 For each axis of the tests, the entire controller shall be tested with an endurance of 20 sweep cycles over the frequency range 5-55 Hz with initial amplitude of 0.75mm. The sweep rate shall be 1 octave per minute.

7.3.2.7 The FDS shall operate without malfunction during the tests.

7.4 ELECTROMAGNETIC COMPATIBILITY (EMC)

7.4.1 Immunity

7.4.1.1 The complete FDS shall comply with the relevant requirements of AS/NZS 61000.6.1.

7.4.2 Electromagnetic emissions

7.4.2.1 The complete FDS shall comply with the relevant requirements of AS/NZS 61000.6.3.

7.4.3 Wireless systems

7.4.3.1 FDS that utilise wireless communications shall comply with all relevant EMC requirements as specified by ACMA.

7.4.3.2 The manufacturer shall obtain written confirmation from the ACMA specifying what the relevant standard for the wireless system is.

7.4.3.3 A copy of the above ACMA determination shall be provided to VicRoads.

SECTION 8 MARKINGS

8.1 MARKINGS

8.1.1 Any field equipment shall be legibly and durably marked, preferably on an interior surface, with the following information:

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

b) Catalogue number or marking which shall distinguish the particular product from other similar items supplied and/or manufactured by the supplier.

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

d) Other information required in accordance with AS 3100.

e) All regulatory markings such as RCM.

SECTION 9 DOCUMENTATION

9.1 DOCUMENTATION

9.1.1 The following documents are to be supplied with the FDS:

(a) Documentation showing how the FDS operates, maintenance requirements, fault finding methodology and tuning procedures;

(b) A schematic diagram or chart showing the, as supplied, electrical circuits contained within the FDS;

(c) A list of all major electrical sub-components detailing their electrical characteristics and operational limits.

SECTION 10 WARRANTY

10.1 WARRANTY

10.1.1 The warranty provided with the equipment must be for a minimum of 3 years.

10.1.2 Specific projects may require a longer warranty period than the minimum and impose additional conditions.

APPENDIX A

VICROADS ITS PLATFORM

(Informative)

A1 GENERAL

A1.1 VicRoads ITS communications/control platform currently uses the STREAMS system.

A1.2 STREAMS is owned and maintained by Transmax Pty Ltd, a Queensland based company which is part of Queensland Main Roads.

A1.3 STREAMS is an integrated control system which is being used by VicRoads to operate it's ITS Freeway Management Devices on Melbourne's freeway network.

A1.4 All ITS field devices must be compatible with STREAMS.

A1.5 Typical ITS field devices connected to and operated by STREAMS include:

- Variable Message Signs (VMS)
- Freeway Data Stations (FDS)
- Ramp metering/control signs
- Lane Use Signs (LUS)

A1.6 The above devices are typically connected to STREAMS via a Field Processor (FP).

A2 FIELD PROCESSOR

A2.1 The FP is used to interface internet protocol (IP) and serially connected field devices to STREAMS.

A2.2 Communications between the FP and the ITS Field Device is typically RTA protocol.

A2.3 The FP is typically installed within an ITS Field Cabinet.

A2.4 The ITS Field Cabinet is typically located adjacent to the freeway.

A2.5 In some situations, the FP may be located in VicRoads building at Kew.

A2.6 FDS system connected to STREAMS typically use fibre optic cable or wireless connection between VicRoads and the Field Processor (FP).

A2.7 FDS is typically connected to the FP via a copper cable or wireless connection using STREAMS compatible LUS protocol.

A2.8 A typical STREAMS connection schematic is shown in Figure A1.

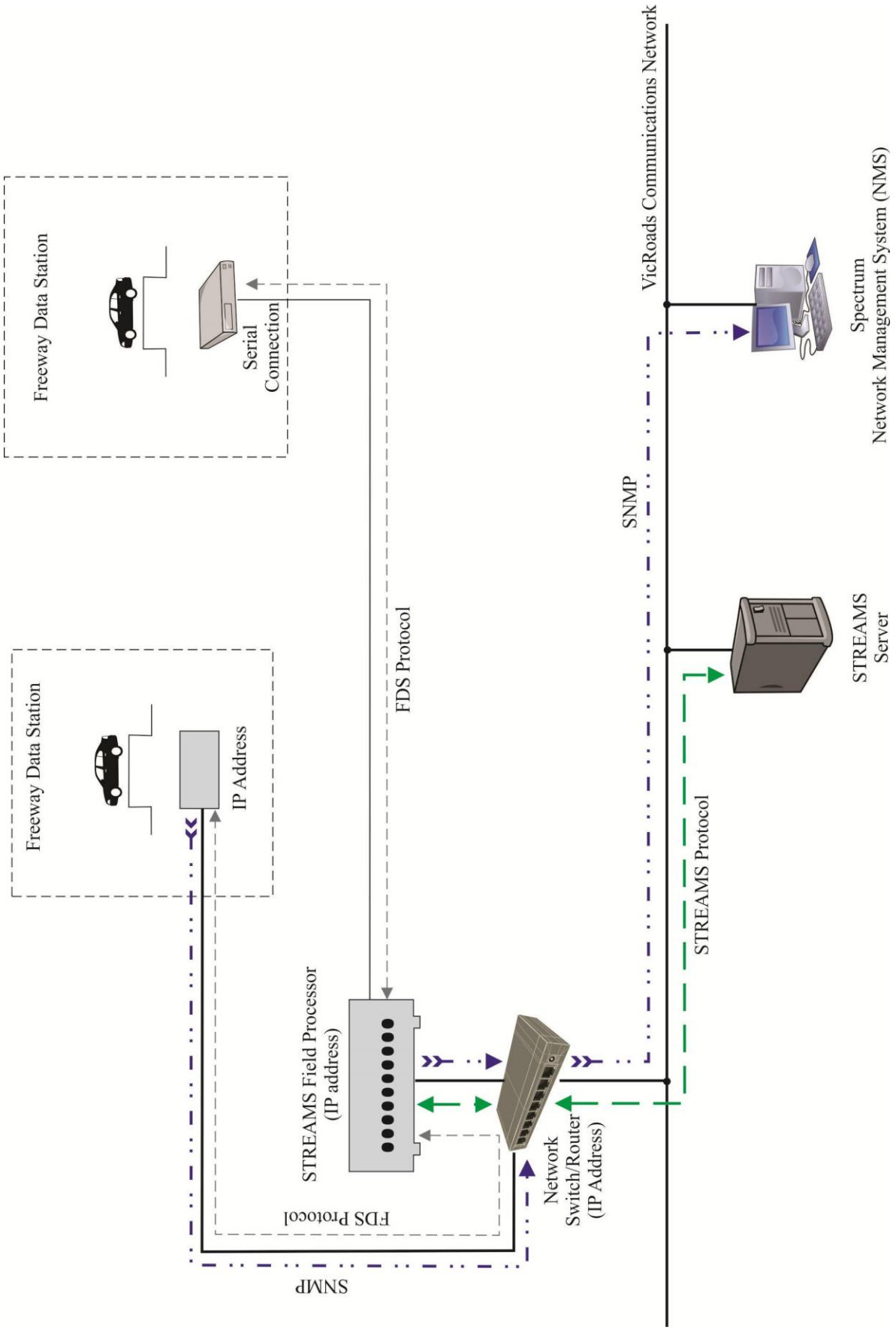

Figure A1 - LUS connected to STREAMS

A3 COMPLIANCE WITH STREAMS

A3.1 FDS must be fully compliant and compatible with STREAMS.

A3.2 To ensure compliance with STREAMS, the supplier shall obtain a compliance certificate from Transmax Pty Ltd for operation on Vic Roads FDS system.

A3.3 A copy of Transmax Pty Ltd certification shall be provided to VicRoads.

A4 SPECTRUM NETWORK MANAGEMENT SYSTM

A4.1 The Spectrum Network Management System (Spectrum NMS) is a communications monitoring/management system used to monitor/manage IP addressable devices connected to the VicRoads communication network.

A4.2 Spectrum NMS can be used to monitor/manage any device that has an IP address without any modification required by the device.

APPENDIX B

REQUIREMENTS FOR ACCEPTANCE

(Informative)

B1 General

B1.1 To enable assessment for the purpose of Acceptance, the supplier shall submit a formal request accompanied by the following:

a. A complete working sample of the Freeway Data Station for verification on returnable basis.

b. A technical and maintenance manual.

c. Documentation to demonstrate that the FDS has been manufactured and supplied under an approved quality assurance system including product quality plan.

d. A clause by clause compliance statement with Yes, No and Partial Compliance indicated including evidence (where possible) of compliance.

e. Methodologies for demonstrating compliance with this Specification and the accuracy of data.

B2. STREAMS Compliance

B2.1 The supplier shall provide evidence of STREAMS certification from Transmax Pty Ltd.

B3. Required NATA Accredited Testing

B3.1 Notwithstanding B1 above, the supplier shall submit test results from a NATA accredited testing organisation to demonstrate compliance with the following:

Clause 6.1	Temperature and Humidity
Clause 6.2	Enclosure Protection
Clause 6.3	Shock and Vibration
Clause 6.4	Electromagnetic Compatibility (EMC)
Clause 6.4	EMC for wireless systems (where applicable)

B4. Field Trial

B4.1 Part of the assessment of the FDS may include a field trial on VicRoads FDS trial site.

B4.2 The purpose of such trial is to determine the accuracy of the provided data in relation to the required accuracy as detailed in Table 1 of this specification.

B4.3 The performance of the FDS shall be assessed by comparing data from the FDS under test against the data from a benchmark device nominated by VicRoads and installed at the test site.

B5. Other Required Testing

B5.1 VicRoads may require additional information or testing to be carried out as part of its Acceptance process.

B5.2 If the product is accepted, a Letter of Acceptance will be provided to the supplier. Until such time as this Letter is issued, the product is not to be used in the State of Victoria.

B6. Assessment Procedure

B6.1 The assessment procedure for an FDS will include, but not be limited to, the following:

a. Assessment of construction, workmanship and critical dimensions.
b. Evaluation of the submitted data against the requirements of the specification.
c. Installation and testing of the FDS.
d. Demonstration of the reliable and accurate detection of vehicles.

B6.2 Where some of these procedures have been completed prior to formal submission, the results will be considered in the evaluation, provided there is no relevant change in the design. The supplier is to state whether tests carried out prior to formal submission were carried out on an identical sample.

APPENDIX C

INSTALLATION GUIDELINES

(Informative)

C1 LOCATION

C1.1 Freeway Data Stations should be installed at approximately 500m intervals and shall cover all through lanes and on and off ramps.

C1.2 FDS should not be installed at intervals greater than 1000m.

C1.3 Where possible, FDS cabinets on any particular freeway should be installed on the same side of the road. This provides easy access for maintenance purposes.

C1.4 Cabinets installed to accommodate FDS equipment should be located directly adjacent to the associated FDS site.

C2 FOUNDATION

C2.1 Each FDS housed within a standard universal roadside cabinet should be installed on a standard VicRoads FDS foundation in accordance with VicRoads standard drawing TC-2002.

C2.2 Where the contractor wishes to use a different foundation, details of the alternative should be submitted with the tender submission. Design of the foundation should be proof engineered by an independent, VicRoads approved, engineering consultant and the details provided to the Department upon award of any works.

C2.3 All FDS should have a suitable concrete apron installed around the cabinet foundation at least 500mm larger than the foundation.

C3 DETECTION SYSTEMS

C3.1 Inductive loops should be installed in accordance with VicRoads Specification TCS 054.

C3.2 Other approved detection systems (i.e. video detection, wireless detection systems etc), where installed, should be installed in accordance with manufacturer's requirements.

C3.3 The contractor should submit a detailed step-by-step installation procedure for VicRoads' review prior to installing any devices.

C4 SITE NUMBER

C4.1 Each 'standalone' cabinet should be supplied and installed complete with a standard VicRoads public information label including the site number in accordance with VicRoads Standard Drawing TC-2100.

Note: Details of the site number for each site will be supplied by VicRoads.