

Technical Specification

**Transport and Main Roads Specifications
MRTS200 General Requirements for Intelligent Transport
Systems (ITS) Infrastructure**

July 2017

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1 Introduction

This Technical Specification applies to the provision of Intelligent Transport Systems (ITS) and Road Operations to be delivered by the Contract.

Project-specific requirements are defined in the Scope of Works and Technical Criteria of the Contract which describes the scope of application of the requirements described within this Technical Specification.

The ITS shall consist of integrated systems and devices specified in the Scope of Works and Technical Criteria which will allow the road operator to:

- a) manage (control) traffic operations
- b) provide traveller information for road users
- c) collect data applicable to road use conditions
- d) manage heavy vehicles, and
- e) manage incidents.

Unless otherwise specified, all Systems and Devices shall connect to the Traffic Management Centre (TMC) specified in the Contract via the ITS Telecommunications Network described in Clause 11.6.

This standard defines the requirements for:

- a) Existing ITS components
- b) Early ITS components
- c) Temporary ITS components, and
- d) Permanent ITS components.

In this version: Maximum distance between adjacent communications pits had been reduced from 250 metres to 240 metres to align with electrical power conduit spacing.

2 Definitions of terms and abbreviations

In addition to using the terms defined in the Contract, this document uses the following terms and abbreviations.

Table 2 – Definitions of terms and abbreviations

Term / Abbreviation	Definition
ANPR	Automatic Number Plate Recognition
CCTV	Closed Circuit Television
CMS	Changeable Message Sign
Contractor	The Contractor and its employees, authorised Sub-Contractors, and Agents including Alliances.
Component	All parts of a System, Device or Infrastructure including all materials, equipment, software and the like.

Term / Abbreviation	Definition
Device	All electronic or computing equipment, including the manufacturer's integral equipment housing.
Early ITS	All systems, devices, mounting structures, and infrastructure for ITS and Road Operations provided by the Contractor prior to the commencement of any activities that affect the traffic operation of the existing road / facility.
Electrical Contractor	Holder of Electrical Contractor Licence under the <i>Electrical Safety Act</i>
Existing ITS	All existing systems, devices, mounting structures, and infrastructure for ITS and Road Operations under the operational control of Transport and Main Roads existing at the date of the Contract. This includes the Traffic Management Centre, the ITS Telecommunications Network and all ITS components under the control of Transport and Main Roads.
FP	Field processor
Infrastructure	All other equipment including cabling, enclosures, field cabinets, mains power supply, mounting structures, ducts and pits (power and telecommunications) and the like as necessary for a system or device to perform its function/s.
ITS Network	As defined in Clause 11.6
LAN	Local Area Network
Lane control zone	An area controlled by lane control signs other than VSL/LCS
Mainline	The running lanes of the main carriageway, excluding entry ramps, exit ramps, shoulders, stopping bays, emergency vehicle cross-overs.
Mounting Structure	All components including poles, posts, gantries, and / or other structures and footings necessary to mount a device.
MRTS	Transport and Main Roads Technical Specification
MUTCD	The <i>Manual of Uniform Traffic Control Devices – Queensland Version</i>
PAPL	Permitted Attachment Private Lines
Permanent ITS	All systems, devices, and infrastructure provided by the Contractor installed in its final location for the duration of the project and beyond.
PSTN	Public Switched Telephone Network
RP&D Manual	Transport and Main Roads' <i>Road Planning and Design Manual</i> , 2 nd Edition (unless the reference refers explicitly to the 1 st Edition).
SIMS	Transport and Main Roads' software system used for recording and managing data associated with Incident Management.
SWTC	Scope of Works and Technical Criteria
STREAMS	Transport and Main Roads' ITS platform and primary user interface to ITS field components (including SIMS).
System	A complete, standalone process required to perform a specific function and includes a system controller, appropriate devices, mounting structures and infrastructure.
Temporary ITS	All systems, devices, mounting structures, and infrastructure for ITS and Road Operations temporarily provided by the Contractor that will be removed prior to completion of the Contract.
TMC	Traffic Management Centre

Term / Abbreviation	Definition
TRUM Manual	<i>Traffic and Road Use Management Manual</i>
TSDM	Traffic Surveys and Data Management system used by Transport and Main Roads to interface to systems used for heavy vehicle management.
TSNET	Traffic Surveys Network used by Transport and Main Roads to connect to systems installed in the field used for heavy vehicle management.
Variable speed limit zone	An area controlled by variable speed limit signs
Variable speed limit / lane control zone	An area controlled by integral variable speed limit / lane control sign.
VID	Vehicle Identification Detector
VMS	Variable Message Sign/s
VSL	Variable Speed Limit Sign/s
VSL/LCS	Combined Variable Speed Limit and Lane Control Sign/s
WiM	Weigh-in-motion
xDSL	All types of Digital Subscriber Lines

3 Reference documents

The requirements of the referenced documents listed in Table 3 of MRTS201 General Equipment Requirements apply to this document.

This Technical Specification shall be read in conjunction with the Scope of Works and technical criteria of the Contract which specifies the project specific ITS requirements.

This Technical Specification shall be read in conjunction with MRTS01 *Introduction to Technical Specifications*, MRTS50 *Specific Quality System Requirements* the Design Documentation, Manuals and Standard Drawings, other referenced standards and Technical Specifications as appropriate, and the quality system requirements of the Contract.

This Technical Specification forms part of the Transport and Main Roads Specifications Manual.

Where inconsistencies exist between the requirements of this Technical Specification and the Scope of Works and Technical Criteria, the requirements of the Scope of Works and Technical Criteria take precedence.

4 Quality system

4.1 Hold Points and Witness Points and Milestones

General requirements for Hold Points, Witness Points, and Milestones are specified in MRTS01 Introduction to Technical Specifications.

Specific Hold Points and Witness Points requirements are described in the relevant MRTS.

Milestones for the design, supply, installation, testing, commissioning, and handover of each ITS component shall be identified in the Contractor's program of works.

There are no Hold Points, Witness Points or Milestones defined.

4.2 Construction procedures

Construction procedures shall be prepared by the Contractor in accordance with the relevant MRTS.

4.3 Compliance with electrical regulations

Electrical work covered by this Technical Specification shall comply with the Electricity Safety Act and subordinate legislation, as well as AS/NZ S3000 and AS/NZS 3008.

Exceptions and additions will be acceptable when approved by the Electrical Safety Office or the Department of Energy.

An Electrical Contractor shall be engaged to perform the duties and functions defined in the Act.

4.4 Compliance with telecommunications regulations

The telecommunications equipment and cabling shall comply with relevant Australian Communications and Media Authority Specifications and requirements.

A registered cabler shall be engaged to perform the duties and functions defined by Australian Communications and Media Authority specifications and requirements.

Upon completion of the telecommunications cabling installation, the Contractor shall supply a TCA1 (Telecommunications Cabling Advice) form to certify the installation of the communications cabling.

5 Scope of Contractor's Works

5.1 Existing ITS components

5.1.1 General

The Existing ITS components will continue to be used by the department for traffic control, traveller information, data collection, incident management and, where applicable, heavy vehicle management on the road network during the construction phase.

The Existing ITS components are connected to an existing ITS Telecommunications Network and may be controlled and monitored using STREAMS.

The existing ITS Telecommunications Network is installed to transmit all data, video and audio between the Existing ITS components and the TMC. The existing ITS Telecommunications Network links use leased services and/or a private network consisting of cable, wireless or a combination of cable and wireless technologies. The existing ITS Telecommunications Network is an integral part of the Transport and Main Roads wider ITS Telecommunications Network. Any damage to the Existing ITS components shall be rectified at the Contractor's expense.

It is important that any existing departmental infrastructure interfaced to, or that fall within, project boundaries are sufficiently protected throughout the project and due consideration given to the effect of any project works having the potential to result in operational outages to departmental systems that use CCTV, STREAMS, backbone communications links, as well as the potential impact on any whole-of-life elements.

Therefore, any project works will need to be carefully planned and any outages minimised.

The Contractor shall provide to the department a dilapidation / condition report on the state of the existing ITS components prior to accepting the responsibility of existing ITS components. If the Contractor fails to provide a dilapidation report by the Contractor to the department, the Contractor

shall assume full responsibility for the operation and maintenance of the existing ITS without any exceptions during the project duration.

5.1.2 Maintenance of Existing ITS components

The Contractor shall protect and maintain each Existing ITS component and ensure its functionality is not reduced until the completion of the Contract unless it is made redundant by either:

- a) Early ITS components that comply with Clause 5.2, or
- b) Temporary ITS components that comply with Clause 5.3, or
- c) Permanent ITS components that comply with Clause 5.4.

Following successful commissioning of the respective Early, Temporary or Permanent ITS components, the redundant Existing ITS components shall:

- a) where accepted by Transport and Main Roads, be relocated in accordance with the requirements of Clause 5.1.3, or
- b) removed in accordance with the requirements of Clause 5.1.4.

5.1.3 Relocation of Existing ITS components

The Existing ITS components that are accepted by the department to be relocated or cutover to temporary or permanent location, shall only be out of service for the relocation or cutover works and/or disconnected from the ITS Telecommunications Network for the maximum duration and the times shown in Table 5.1.3. Where this is not practicable, an alternate functionally equivalent ITS component shall be successfully commissioned and handed over to the department prior to decommissioning the existing ITS component.

No two consecutive ITS Components of the same type or similar functionality as mentioned in Table 5.1.3 in any direction shall be disconnected at any one time for works associated with the relocation of an Existing ITS component.

Unless otherwise specified in the Contract, the maximum outage durations are as described in Table 5.1.3.

Table 5.1.3 – Maximum durations for out of service or disconnection of ITS components

ITS component	Maximum duration (hours)	Out of service requirements
Traffic Signals	4*	Permissible only between midnight and 5 am Sunday to Thursday
Ramp Signalling	4	Permissible only between midnight and 5 am
Lane Control Signs	4	Permissible only between midnight and 5 am Sunday to Thursday
Variable Speed Limit Signs	4*	Permissible only between midnight and 5 am Sunday to Thursday
Variable Message Signs / Travel Time Signs	48*	Provide temporary trailer-mounted signs
Changeable Message Signs	48*	
Road Condition Signs	48*	Provide temporary trailer-mounted signs

ITS component	Maximum duration (hours)	Out of service requirements
Vehicle Detection Systems	48	Shall be operational when CCTV cameras are out of service
Bus Detection Systems / Vehicle Identification Systems	48	Shall be operational when CCTV cameras are out of service
Vehicle Classification Systems	48	
CCTV Cameras	4	Permissible only between midnight and 5 am Sunday to Thursday Shall be operational when web cameras, VDS and bus detection are out of service.
Web Cameras	48	
Road Weather Monitoring Systems	48*	
Help Telephones	4	Permissible only between midnight and 5 am
Weigh-in-Motion Systems	48	
Automatic Number Plate Recognition Systems	48	
ITS Telecommunication Network	2*	Permissible only between midnight and 5 am

Note:

*Transport and Main Roads to assess risks and specify any necessary mitigations for outages to these systems / devices.

Where relocation of Existing ITS components is required, the Contractor shall submit a full detailed design to the department for approval prior to the relocation of the ITS components. The relocated ITS shall be relocated to the current Transport and Main Roads Technical Specifications as defined under the Contract.

5.1.4 Removal of redundant Existing ITS components

Unless otherwise specified by the Contract or accepted by the department, the Contractor shall decommission all Existing ITS components made redundant by Early, Temporary or Permanent ITS components.

Prior to the decommissioning of any Existing ITS component, the respective Early, Temporary or the Permanent ITS component shall be successfully commissioned by the Contractor and Transport and Main Roads shall have accepted operational control of the ITS component.

The Contractor shall recover and deliver all redundant Existing ITS Components to:

- a) a location defined in the Contract or nominated by the Transport and Main Roads Representative
- b) dispose of the redundant Existing ITS Components where required by the Contract, and
- c) cancel any temporary electrical or communications service to the redundant ITS component with the respective carrier.

5.1.5 ITS Telecommunications Network

Where an Existing ITS component shall be replaced or relocated, to maintain control and monitoring functions from the TMC, the replaced or relocated ITS component shall be:

- a) connected to the permanent ITS Telecommunications Network defined in Clause 11.6 if this has been successfully commissioned, or
- b) reconnected to the existing ITS Telecommunications Network, or
- c) connected to a temporary telecommunications network, such as a leased wireless service.

The temporary connections shall:

- a) in the case of the CCTV cameras, have a minimum data signalling rate of 512 kbps (or at least equivalent to the pre-existing signalling rate), and
- b) in the case of all other ITS devices, have a minimum data signalling rate of 64 kbps (or at least equivalent to the pre-existing signalling rate).

All additions and alterations to the existing ITS Telecommunications Network shall be agreed to by the Transport and Main Roads' Representative.

5.2 Early ITS components

5.2.1 General

The Early ITS components will be used by Transport and Main Roads to assist in traffic control, traveller information, data collection, incident management and, where applicable, heavy vehicle management on the road network during the construction phase of the project.

Where allowed by Transport and Main Roads, the Early ITS components may also be used by the Contractor to assist in satisfying the traffic management requirements of this Contract, but Transport and Main Roads shall have priority of access/control at all times.

The Early ITS Components shall also comply with Clauses 6, 7, 8, 9, 10, and 11 below.

5.2.2 Provision of Early ITS components

Where required by the Contract, the Contractor shall design, supply, install, test, commission, and give Transport and Main Roads operational control of the Early ITS components.

The design, supply, installation, testing, commissioning, maintenance, and handover of the Early ITS components shall comply with the requirements for Permanent ITS components defined in Clause 5.4.

The Early ITS components shall be installed either in temporary locations in accordance with Clause 5.3 or in the final locations as described by the Permanent ITS components requirements.

Early ITS components that will form part of the Permanent ITS components that need to be relocated to their final location shall only be out of service for the relocation works and/ or disconnected from the ITS Telecommunications Network for the maximum duration and times specified in Table 5.1.3. Where this is not practicable, an alternate functionally equivalent ITS component shall be successfully commissioned and handed over to Transport and Main Roads prior to decommissioning the existing ITS component.

No two consecutive ITS components of the same type or similar functionality, as mentioned in Table 5.1.3, in any direction shall be disconnected at any one time for works associated with the relocation of an Early ITS component.

5.2.3 Maintenance of Early ITS components

The Contractor shall protect and maintain each Early ITS component and ensure its functionality is not reduced until:

- a) The Early ITS component is replaced by a Permanent ITS component of equivalent functionality is successfully commissioned by the Contractor and Transport and Main Roads has accepted operational control of the Permanent ITS component, or
- b) The Early ITS component is relocated to its permanent location as defined by the design documentation and becomes a Permanent ITS component, is successfully commissioned by the Contractor and Transport and Main Roads has accepted operational control of the Permanent ITS component.

5.2.4 Removal of Early Works ITS components

Unless otherwise specified, the Contractor shall decommission and remove all Early ITS components made redundant by Permanent ITS components.

Prior to the decommissioning of any Early ITS component made redundant by Permanent ITS components, the Permanent ITS component shall be successfully commissioned by the Contractor and Transport and Main Roads shall have accepted operational control of the ITS component.

The Contractor shall recover and deliver all redundant Early ITS components (excluding conduits that could remain buried in the works) to a location defined in the Contract or nominated by the Transport and Main Roads Representative.

Unless otherwise specified, the Contractor shall dispose of the redundant Early ITS Components made redundant by Permanent ITS components.

The Contractor shall also cancel any electrical or communications service(s) no longer required with the respective service provider.

5.2.5 ITS Telecommunications Network

To provide a connection to the TMC, the Early ITS components shall be either:

- a) connected to the Permanent ITS Telecommunications Network defined in Clause 11.6 if this has been successfully commissioned, or
- b) connected to the Existing ITS Telecommunications Network if sufficient capacity is available, or
- c) connected to a temporary telecommunications network, such as a leased wireless service.

Where a communications channel and / or network is used, it shall provide the following minimum bandwidth for each device as follows:

- i. CCTV cameras: The upload and download data rate shall be based on functional design requirements to allow the required CCTV to be displayed at the BMTMC. The functional design shall take into consideration the following elements as a minimum:
 - a. number of cameras
 - b. the operational viewing requirement (live view required? or on demand time-lapse recording only?)
 - c. video configuration (frame rate 15-25 fps, resolution, H.264, MPEG4, 4CIF)

- d. the minimum download bandwidth shall be 128 kbps
 - e. consideration as to the type of service that is required which will be dependent on the calculated bandwidth requirements (such as x/x ADSL2+, xMbps GWIP)
 - f. consideration as to whether a backup is required (that is, 3G HSUPA/HSDPA, 4G)
- ii. All other ITS devices: Similar to the CCTV camera, a bandwidth calculation shall be undertaken or the minimum upload and download bandwidth shall be 64 kbps.

The Contractor shall seek the written approval from the Transport and Main Roads project representative prior to any additions and alterations being applied to the existing ITS Telecommunications Network.

5.3 Temporary ITS components

5.3.1 Provision of Temporary ITS components

Notwithstanding the requirements of MRTS01, where ITS Components are required for temporary use during construction, the Contractor shall design, supply, install, test, commission and maintain the Temporary ITS Components in accordance with the requirements for Permanent ITS Components.

The Temporary ITS Components shall also comply with Clauses 6, 7, 8, 9, 10, and 11 below.

5.3.2 Maintenance of Temporary ITS components

The Contractor shall protect and maintain each Temporary ITS Component and ensure its functionality is not reduced until it is made redundant by another Temporary or Permanent ITS component providing equivalent functionality in accordance with Clause 5.1.

5.3.3 Removal of Temporary ITS components

The Contractor shall decommission and remove all Temporary ITS Components, excluding conduits that could remain buried in the works.

5.3.4 ITS Telecommunications Network

To provide a connection to the TMC, the Temporary ITS Components shall be either:

- a) connected to the ITS Telecommunications Network defined in Clause 11.6 if this has been successfully commissioned, or
- b) connected to the Existing ITS Telecommunications Network if sufficient capacity is available, or
- c) connected to a temporary telecommunications network, such as a leased wireless service.

The temporary connections shall:

- a) in the case of the CCTV cameras, have a minimum data signalling rate of 512 kbps, and
- b) in the case of all other ITS Devices, have a minimum data signalling rate of 64 kbps.

All additions and alterations to the existing ITS Telecommunications Network shall be agreed to by the Transport and Main Roads Representative.

5.4 Permanent ITS components

The Contractor shall design, supply, install, test, commission, maintain, give to Transport and Main Roads control of, and handover to Transport and Main Roads, the Permanent ITS components listed in the Contract.

Once installed, the Contractor shall protect and maintain each Permanent ITS component until the completion of the project.

The Permanent ITS Components shall also comply with Clauses 6, 7, 8, 9, 10, and 11 below.

6 Design requirements

6.1 General

The design of ITS components shall include / address:

- a) approved RPEQ plans showing final location and detailed site layout for each ITS device and all infrastructure including: field cabinets, mains power supply, facilities for telecommunications, and ducts and pits for power and telecommunications
- b) all systems including all materials, equipment and associated electronics
- c) all devices including all materials, equipment and associated electronics
- d) all infrastructure and all associated device mounting arrangements
- e) equipment layout in field cabinet
- f) all mounting structures, including footings
- g) embedded software systems
- h) software device drivers for operational compatibility with STREAMS and TSDM as required
- i) computer software necessary for testing, commissioning and maintenance
- j) ITS Telecommunications Network, including connections to the network node cabinets
- k) additional services as necessary (such as leased telecommunications services, points of power supply and the like)
- l) where required, all temporary infrastructure including cabinets, mains power, telecommunication systems and associated systems
- m) maintenance access to Early, Temporary and Permanent ITS Components as specified in Clause 11.7.
- n) the need for barrier protection where the component constitutes a roadside hazard as per the Transport and Main Roads RP&D Manual
- o) minimisation of the whole-of-life costs associated with constructing, operating and maintaining the Permanent ITS components over their intended design lives, and
- p) a Risk Analysis assessing workplace and occupational health and safety risks of the components over their intended design lives.

All ITS components shall be designed such that they operate as part of, and integrate with, the Principal's traffic management and control system, STREAMS, and / or standalone systems as specified in the relevant MRTS or nominated in the Contract.

In accordance with Transport and Main Roads' whole-of-government security policy, any ITS infrastructure, where applicable, shall comply with the IS18.

All systems and devices, including its respective telecommunication networks, shall be capable of operating 24 hours per day, 365 days per year, for the design life of the system and / or device specified in Table 6.2.

The design of ITS components, including the location of field equipment, shall provide for future expansion by others to the road network and / or ITS systems with minimal alterations to the Permanent ITS components. Where future modifications to the road network and / or ITS systems by others are detailed within the Contract documents, provisions for expansion and alterations shall be included in the design documentation.

The design of the location of all ITS Components shall consider access for maintenance such that maintenance can be carried out during daylight hours.

6.2 Hardware

All hardware shall employ technology current at the time of the provision of the hardware.

The hardware design for systems and devices shall:

- a) use products and equipment approved for use by Transport and Main Roads
- b) use standard non-proprietary interfaces to facilitate future expansion / extension of the system by others
- c) provide redundancy where required
- d) be suitable for future expansion
- e) be in accordance with the ITS design life of the system and / or device specified in Table 6.2
- f) use a design that permits equipment failures to be easily identified and repaired by module replacement
- g) use commercially available equipment that provide a robust, reliable design, and
- h) comply with the requirements of the relevant MRTS.

Table 6.2 – ITS design life requirements

Asset element		Asset item/sub-item	
Name	Design life (years)	Name	Design life (years)
Sign support structures and other roadside furniture	50		
Mechanical and electrical equipment	25	Electrical services	20
Traffic management and control devices (for each ITS device)	20	Cables	25
		Enclosures	20
		Electronics	10
		Display elements	10
		Uninterruptible power supplies (UPS)/battery power supplies	6

Asset element		Asset item/sub-item	
Name	Design life (years)	Name	Design life (years)
		UPS batteries	3
		Fans	10
		Field processors	10
		ITS telecommunications network devices	10
		Other power supplies	10
		Ventilation filters	1
		WiM sensors	5
		CCTV (all components)	10
		All other ITS devices	10

6.3 Software

All software systems provided by the Contractor, including embedded software device drivers for operational compatibility with STREAMS and embedded software, shall use an open architecture complying with development and programming standards (current at the date of provision) using standard non-proprietary interfaces.

Commercially available operating systems shall be used.

As a minimum, the Contractor shall:

- a) License Transport and Main Roads to own and modify all source code developed by the Contractor
- b) License other software in the name of Transport and Main Roads
- c) Provide original distribution media for all software. Where software is downloaded from the manufacturer, the Contractor shall assemble such software on a physical media, the media shall form part of the Operations Manuals described in MRTS201 *General Equipment Requirements*, and
- d) Provide all source code developed by the Contractor. The source code and associated design documentation shall be provided electronically on physical media. The source code shall not be encrypted or in any other way prevent Transport and Main Roads from later modifying the source code independent of the Contractor. The source code shall include suitable comments and be accompanied by software design documentation so as to allow Transport and Main Roads to easily modify the code when necessary.
- e) The installation of software shall not require the removal of any earlier/previous versions of software, unless the new software is fully backwards compatible.

6.4 Design documentation

Design documentation for the ITS components shall be prepared and submitted to the Transport and Main Roads Representative and the Verifier in accordance with the requirements of the Contract, including the requirements of MRTS201 *General Equipment Requirements*.

All road features, including line markings and static signage, shall be shown on the ITS design drawings submitted to Transport and Main Roads for review / acceptance.

The location of all field equipment including, but not limited to CCTV, web cameras, Variable Speed Limit Signs, Variable Message Signs, Changeable Message, Signs, Road Condition Signs and Travel Time Signs shall be shown on the Static Signs Drawings.

The information pertaining to the naming convention of the ITS components shall be sought by the designer prior to the development of the design drawings. All ITS components, and the associated communications/electrical cabling and power supplies, shall be uniquely labelled on the design drawings. The drawings shall include termination detail, including specific pinouts, dip switch settings and any other information pertinent to the installation and maintenance of the ITS components.

6.5 Co-ordination with other road features

The ITS design shall be co-ordinated with all aspects of the Contractor's Work including, but not limited to, the issues highlighted below:

- a) The geometric design to provide for:
 - i. installation of ITS devices and ITS infrastructure included in the Contract and provision for future devices, including field cabinets, footings, and mounting structures
 - ii. access to ITS Devices for maintenance (see Clause 11.7)
 - iii. storage and acceleration requirements for entry ramps for ramp signalling, and
 - iv. heavy vehicle interception sites, and
- b) The bridge design which shall provide for the ITS that needs to be mounted on the bridge as necessary, including providing conduits and junction boxes for cables required for the ITS Telecommunications Network, including future expansions of the road Network
- c) The civil infrastructure design which shall include the conduits and junction boxes for cables required for the ITS telecommunications Network and other ITS, including Infrastructure and Devices
- d) The static sign design, which shall not conflict with the electronic signs provided on ITS devices, and sight distance criteria for all signs which shall be provided in accordance with the MUTCD
- e) The line marking design for traffic signals and ramp signalling
- f) The landscape design allowing for future vegetation growth to occur (without the need for vegetation trimming) while maintaining sight to ITS and static signage in accordance with the MUTCD
- g) The urban design to ensure no conflicts exist with the ITS devices and ITS Infrastructure and other facilities and treatments to be provided in the Works
- h) The lighting design to ensure that the Permanent ITS does not cast unwanted shadows on the carriageways and paths. Road lighting poles shall not obscure any part of the ITS component from the required viewing distance
- i) The noise barrier design to ensure no conflicts exist with the ITS devices and ITS infrastructure or maintenance access to the ITS Devices installed in the field

- j) The safety barrier design to ensure no conflicts exist with the barriers and / or the barrier posts and to ensure that:
 - i. above ground Early, Temporary or Permanent ITS is located in the Hazard Free Zone behind a gating barrier terminal, and
 - ii. the distance from the barrier system to the above ground Permanent ITS is greater than the design dynamic deflection of the barrier, and
 - iii. above ground Permanent ITS is located in an area where they can be maintained free from hazardous objects as required by RPDM or the barrier manufacturer.
- k) The drainage design to ensure no conflicts occur with the drainage systems/structures and to provide drainage for the conduit network, and
- l) The services design to ensure no conflicts occur with any existing, relocated, or new public utility plant or services.

7 Supply and installation requirements

7.1 General

The supply and installation of ITS components shall include:

- a) all ITS infrastructure, materials, and equipment and associated electronics for each system and device
- b) mains power supply, including all cabling, joints, and earthing
- c) field cabinets, including concrete base and / or fixings
- d) conduits, pits, junction boxes, and cable enclosures
- e) all mounting structures, including footings and/or fixings
- f) embedded software systems
- g) software device drivers for operational compatibility with STREAMS
- h) computer software necessary for testing, commissioning and maintenance
- i) ITS telecommunication network, including connections to the network node cabinets
- j) all ITS infrastructure, including cabinets, mains power, telecommunication systems and associated systems
- k) relocation of all Existing ITS components and Early ITS components which are to be incorporated into the Permanent ITS, and
- l) removal of all Existing ITS components and Early ITS components which are not incorporated into the Permanent ITS, excluding underground conduit that can remain buried in the site.

Transport and Main Roads registered suppliers and products shall be used. A current list of registered products and suppliers can be obtained from the Transport and Main Roads Representative.

A current list of ITS Devices supported by STREAMS can be obtained from the Transport and Main Roads Representative.

7.2 Staging of Works

The relocation of the Existing ITS components, where required by the Contract, and the installation/construction of the Early Works ITS, Temporary ITS and the Permanent ITS components shall be included in the Contractor's Staged Construction Plan to show the construction stage in which the ITS components will be installed, tested, commissioned and handed over to Transport and Main Roads.

Milestones shall be defined for:

- a) the installation, testing, commissioning and handover of Early Works ITS Components
- b) replacement of Existing ITS components
- c) relocation of Existing ITS components, and
- d) the installation, testing, commissioning and handover of Permanent ITS Components.

These Milestones shall be defined to indicate when the individual ITS components can be used by Transport and Main Roads in traffic management and incident management of the road network during subsequent construction stages.

8 Testing and commissioning

The Contractor shall test and commission the Early ITS, Temporary ITS and Permanent ITS components including:

- a) all ITS devices, including all equipment, associated electronics components, telecommunications and mains power supply
- b) software device drivers for compatibility with STREAMS
- c) all associated systems
- d) ITS telecommunications network, including connections to the network node cabinets
- e) where required by the Contract, the ITS Telecommunications Network connection between a designated network node cabinet and the TMC
- f) STREAMS interface, including device drivers to all relevant systems and devices, and
- g) end-to-end testing of all system components from field device to the TMC.

Information on the requirements of the STREAMS interfaces for the above ITS components can be obtained from the Transport and Main Roads Representative.

The Contractor shall develop the inspection and test plans and shall submit them to the Transport and Main Roads Project Representative and receive approval or permission to use prior to the commencement of any tests.

Testing and commissioning of the Early ITS, Temporary ITS and Permanent ITS components shall be performed in accordance with all specific requirements described in MRTS201 *General Equipment Requirements* and the relevant MRTS.

9 Maintenance

The Contractor shall maintain all ITS components during the maintenance period in accordance with the Contract, MRTS201 *General Equipment Requirements* and all specific requirements described in the relevant MRTS.

During the maintenance period, the Contractor shall rectify all failures in accordance with MRTS201 *General Equipment Requirements*.

The Contractor shall keep records of all maintenance performed and any faults attended to during the maintenance period. The record should identify what the fault was and the exact nature of the rectification. This information shall be forwarded in a spreadsheet to the Transport and Main Roads project representative.

10 Handover

The Contractor shall handover all Early ITS components and all Permanent ITS components in accordance with the Contract, MRTS201 *General Equipment Requirements* and all specific requirements described in the relevant MRTS.

11 Technical requirements for ITS devices

11.1 General

In addition to any specific requirements included in the Contract, all ITS systems, sub-systems, equipment and associated infrastructure provided under the Contract shall comply with the following:

- a) MRTS61 *Mounting Structures for ITS*
- b) MRTS91 *Conduits and Pits*, and
- c) MRTS201 *General Equipment Requirements*.

Where two or more ITS devices are in close proximity, they may share the associated infrastructure, such as mains power supply, conduits, field cabinets and the like.

11.2 Traffic Control Systems

11.2.1 Traffic Signals

Traffic signals shall comply with:

- a) MUTCD
- b) RP&D Manual
- c) Austroads Guide to Traffic Engineering Practice Part 7 Traffic Signals, and
- d) TRUM Manual.

All traffic signal equipment shall comply with the following Technical Specifications:

- a) MRTS92 *Traffic Signal and Road Lighting Footings*
- b) MRTS93 *Traffic Signals*, and
- c) MRTS204 *Vehicle Detectors*.

Vehicle detectors used for traffic signals shall be placed and configured to comply with TRUM Manual, Volume 4, Chapter 5 *Configuration and Placement of Vehicle Detection Sensors* and tested in accordance with MRTS204 *Vehicle Detectors*.

Signs and pavement markings for traffic signals shall comply with the MUTCD.

Each traffic signal control system shall include the following:

- a) a fully functioning traffic signal controller together with all associated infrastructure, including lanterns, mounting structures, cabinet, pits, conduits, cabling and the like
- b) an operating personality suitable and/or customised for each site
- c) a co-located Field Processor
- d) mains power supply
- e) advance Warning Signs (if project design and MUTCD applicable)
- f) ramp metering signs (if project design and MUTCD applicable), and
- g) a telecommunications link either leased or via the ITS telecommunications network defined in Clause 11.6 to the TMC to allow for control and monitoring using STREAMS. Where fibre optic ITS networks are installed, traffic signal communications should be connected to this infrastructure.

11.2.2 Ramp signalling

11.2.2.1 General

Ramp signalling systems shall comply with:

- a) MUTCD
- b) RP&D Manual
- c) Austroads Guide to Traffic Engineering Practice Part 7 Traffic Signals
- d) TRUM Manual
- e) MRTS204 *Vehicle Detectors*, and
- f) Transport and Main Roads *Managed Motorways Policy*.

Ramp signalling equipment shall comply with Clause 11.2.1.

Vehicle detection systems shall comply with Clause 11.4.1.

11.2.2.2 ITS infrastructure

All entry ramps shall be provided with underground infrastructure to suit an entry ramp signalling system unless specified otherwise in the Contract.

The underground ITS infrastructure shall allow the ramp signalling system to be installed without disturbance to the finished road pavement (with the exception of in-pavement vehicle detectors), roadside furniture (including barriers) and / or hard shoulders. This shall include, but not necessarily be limited to, cross-road conduits terminated in accordance with MRTS91 *Conduits and Pits*.

Where bypass lanes are required, the ramp signalling system shall include underground infrastructure for all lanes on the ramp including the bypass lanes.

11.2.2.3 Fully operational systems

Fully operational ramp signalling systems include the design, installation, testing, commissioning and handing over to Transport and Main Roads all traffic signals, cabinets, structures, controller, footings, vehicle detection system, electrical and telecommunication conduits, pits, cabling, mains power supply and signage.

Each ramp signalling system shall include:

- a) a ramp signal system suitable for ramp signalling utilising either:
 - i. a traffic signal controller in accordance with Clause 11.2.1, or
 - ii. a Field Processor and a lamp switching module that allows the Field Processor to control and monitor the ramp metering traffic signal lanterns via a serial communications protocol in accordance with MRTS201 *General Equipment* requirements
- b) a vehicle detection system suitable for entry ramps
- c) three-aspect traffic signal lanterns and associated infrastructure
- d) a Field Processor if a traffic signal controller as mentioned above is used
- e) a field cabinet that houses all electronics associated with the ramp signalling system
- f) all ITS Infrastructure defined in Clause 11.2.2.3, including conduits, pits and cabling to connect the ramp signalling system to the backbone conduits installed along the mainline, and
- g) signage and pavement markings relevant to ramp signalling system.

Each ramp signalling system shall be connected to the ITS Telecommunications Network defined in Clause 11.6 for control and monitoring by STREAMS.

11.2.3 Variable Speed Limit (VSL) zone

11.2.3.1 VSL zone requirements

Where required by the Contract, the Contractor shall provide VSL Systems spanning the entire VSL zone as defined in the Contract.

Variable Speed Limit Zones shall comply with the following:

- a) MUTCD
- b) RP&D Manual Volume 5: ITS
- c) TRUM Manual
- d) MRTS206 *Provision of Variable Speed and Lane Control Signs*
- e) Transport and Main Roads Managed Motorways Policy, and
- f) Transport and Main Roads *ITS Placement Guideline*.

11.2.3.2 VSL system requirements

Each VSL site shall be provided with the following:

- a) A group controller complying with MRTS206 *Provision of Variable Speed Limit and Lane Control Signs*
- b) Variable Speed Limit Signs (VSLS) complying with MRTS206 *Provision of Variable Speed Limit and Lane Control Signs*
- c) A co-located field processor
- d) Supplementary static signage as prescribed in the TRUM Manual
- e) A field cabinet that houses all electronics associated with the variable speed limit signs, group controller and the field processor, and
- f) Other electronics and infrastructure as necessary.

Each group controller shall be connected to the ITS Telecommunications Network defined in Clause 11.6 via a field processor for control and monitoring by STREAMS.

A separate group controller shall be provided for VSL signs on the ramp and the adjacent through carriageway.

The location of each VSLS shall comply with the TRUM Manual, Volume 1, Part 10, Supplement 5.7-1 *Guidelines for the Placement of Variable Speed Limit and Lane Control Signs for Motorways, Long Bridges and Tunnels*.

11.2.3.2.1 Single and two-lane carriageway

Unless otherwise defined in the Contract, the Variable Speed Limit Zone for single and two-lane carriageways shall be implemented using pole mounted Variable Speed Limit Signs (VSLS) on both sides of the carriageway.

11.2.3.2.2 Three or more lane carriageway

Unless otherwise defined in the Contract, the Variable Speed Limit Zone for carriageways with three or more lanes shall be implemented using one combined Variable Speed Limit / Lane Control Sign (VSL/LCS) located over the centre of each lane, mounted on overhead gantries. Where Lane Control Signs are not required, two Variable Speed Limit signs can be placed on side mounted poles, one on each side of the carriageway.

11.2.3.2.3 Entry ramps

Unless otherwise defined in the Contract, for single-lane entry ramps, the variable speed limit zone shall be implemented using a single pole-mounted Variable Speed Limit Signs (VSLS) mounted on the left hand side of the entry ramp.

Unless otherwise defined in the Contract, for entry ramps with two or more lanes, the variable speed limit zone shall be implemented using ground mounted Variable Speed Limit Signs (VSLS) on both sides of the ramp.

11.2.3.2.4 Exit ramps

Unless otherwise defined in the Contract, static speed limit signs shall be installed on all exit ramps to define the end of the variable speed limit zone.

11.2.3.2.5 Provision for future road widening

The design of the VSL gantries shall allow for future widening of the through carriageways or future lane reconfigurations with minimal alterations to the ITS components by:

- a) allowing the VSL to be located over the centre of each lane in the modified lane configuration
- b) either providing:
 - i. a gantry to span the full width of the final lane configuration, or
 - ii. providing a gantry design that allows for extension/modification to suit the final lane configuration.
- c) details of the gantry design, including requirements for extension/modification, shall be included in the design documentation.

11.2.4 Lane Use Management System (LUMS) Zone

Unless otherwise defined in the Contract, the LUMS Zone for carriageways with three or more lanes shall be implemented using one combined Variable Speed Limit / Lane Control Sign (VSL/LCS) located over the centre of each lane, mounted on overhead gantries.

Where required by the Contract, The Contractor shall provide a LUMS complying with:

- a) MUTCD
- b) RP&D Manual Volume 5: ITS
- c) TRUM Manual
- d) Austroads Guide to Traffic Engineering Practice Part 7 Traffic Signals
- e) MRTS206 *Provision of Variable Speed Limit and Lane Control Signs*
- f) Transport and Main Roads *Managed Motorways Policy*, and
- g) Transport and Main Roads *ITS Placement Guideline*.

LUMS shall be provided with the following:

- a) a group controller at each site complying with MRTS206 *Provision of Variable Speed Limit and Lane Control Signs*
- b) combined Variable Speed Limit/Lane Control Signs (VSL/LCS) complying with MRTS206 *Provision of Variable Speed Limit and Lane Control Signs*
- c) a co-located field processor
- d) supplementary static signage as prescribed in the TRUM Manual
- e) a field cabinet that houses all electronics associated with the lane control signs, group controller and the field processor, and
- f) other electronics and infrastructure as necessary.

Each group controller shall be connected to the ITS Telecommunications Network defined in Clause 11.6 via a field processor for control and monitoring by STREAMS.

The location of the Variable Speed Limit / Lane Control Signs (VSL/LCS) shall comply with TRUM Manual, Volume 1, Part 10, Supplement 5.7-1 *Guidelines for the Placement of Variable Speed Limit and Lane Control Signs on Motorways, Long Bridges and Tunnels*.

11.2.4.1 Provision for future road widening

The design of the LUMS gantries shall allow for future widening of the through carriageways or future lane reconfigurations with minimal alterations to the ITS components by:

- a) allowing the LCS to be located over the centre of each lane in the modified lane configuration
- b) either providing:
 - i. a gantry to span the full width of the final lane configuration, or
 - ii. providing a gantry design that allows for extension/modification to suit the final lane configuration.

Details of the gantry design, including requirements for extension/modification, shall be included in the design documentation.

11.3 Traveller Information Systems

11.3.1 Variable Message Signs (VMS)

All VMS shall comply with:

- a) Volume 1, Part 10, Variable Message Signs (VMS) Use and Operations of the TRUM Manual
- b) RP&D Manual Volume 5: ITS, and
- c) MRTS202 *Variable Message Signs*.

All VMS shall be provided with the facilities to allow it to be connected to the ITS telecommunications network defined in Clause 11.6 for control and monitoring by STREAMS.

11.3.2 Changeable Message Signs (CMS)

All CMS shall comply with the requirements of:

- a) RP&D Manual Volume 5: ITS, and
- b) MRTS227 *Changeable Message Signs*.

All CMS shall be provided with the facilities to allow it to be connected to the ITS telecommunications network defined in Clause 11.6 for control and monitoring by STREAMS.

11.3.3 Road Condition Information Signs (RCIS)

All RCIS shall comply with the requirements of:

- a) MUTCD
- b) RP&D Manual Volume 5: ITS
- c) TRUM Manual, and
- d) MRTS202 *Variable Message Sign*.

All RCIS shall be provided with the facilities to allow it to be connected to the ITS telecommunications network defined in Clause 11.6 for control and monitoring by STREAMS.

11.3.4 Travel Time Signs (TTS)

All TTS shall comply with the requirements of:

- a) MUTCD
- b) RP&D Manual Volume 5: ITS
- c) TRUM Manual, and
- d) MRTS202 *Variable Message Sign*.

All TTS shall be provided with the facilities to allow it to be connected to the ITS telecommunications network defined in Clause 11.6 for control and monitoring by STREAMS.

11.3.5 Web cameras

All Web cameras shall comply with the requirements of:

- a) TRUM Manual, Volume 1, Part 4, Supplement 4.2.3-1 *Implementation Guidelines for Internet Enabled Video Cameras (Web Cameras)*, and
- b) RP&D Manual Volume 5: ITS.

Each Web camera shall be provided with the facilities to allow it to be connected to the TMC and departmental 13 19 40 website via ITS telecommunications Network defined in Clause 11.6.

11.4 Data Collection Systems

11.4.1 Vehicle Detection Systems

11.4.1.1 General

Vehicle detection systems shall be capable of measuring speed, volume, occupancy, length and headway.

Vehicle detection systems shall comply with:

- a) RP&D Manual
- b) Austroads Guide to Traffic Engineering Practice Part 7 Traffic Signals
- c) TRUM Manual
- d) MRTS204 *Vehicle Detectors*
- e) MRTS93 *Traffic Signals*, and
- f) TRUM Manual, Volume 4, Part 5 *Guidelines for the Configuration and Placement of Vehicle Detection sensors*.

Each vehicle detection system shall include the following:

- a) fully functioning vehicle detectors for each lane together with all associated infrastructure, including transducers, transmitters, mounting structures, cabinet, pits, conduits, cabling and the like
- b) a field processor, and
- c) mains power supply.

Each vehicle detection system shall be provided with the facilities to allow it to be connected to the ITS Telecommunications Network defined in Clause 11.6 to allow for control and monitoring by STREAMS.

11.4.1.2 Vehicle Detectors

In addition to the requirements of a vehicle detection system mentioned above, unless otherwise specified, Vehicle Detector systems shall include:

- a) in-pavement vehicle detector loops
- b) vehicle detector electronics
- c) the loop feeder cables, and
- d) all associated infrastructure.

The configuration and placement of loops shall be in accordance with TRUM Manual, Volume 4, Part 5 *Guidelines for the Configuration and Placement of Vehicle Detection sensors*.

The vehicle detector electronics shall comply with MRTS204 *Provision of Vehicle Detectors*.

11.4.2 Bus detection system/Vehicle identification system

Bus detection systems and Vehicle identification systems shall be capable of performing vehicle identification and measuring volume, occupancy and bus tag information.

All bus detection/vehicle identification systems shall comply with the requirements of:

- a) RP&D Manual Volume 5: ITS
- b) MRTS204 *Vehicle Detectors*, and
- c) TRUM Manual, Volume 4, Part 5 *Guidelines for the Configuration and Placement of Vehicle Detection sensors*.

Bus detection / Vehicle identification systems shall include:

- a) in-pavement vehicle detector loops
- b) vehicle identification electronics
- c) a field processor
- d) the loop feeder cables, and
- e) all associated infrastructure.

The bus detection / vehicle identification electronics shall comply with requirements of MRTS204 *Vehicle Detectors*.

Each bus detection / vehicle identification system shall be provided with the facilities to allow it to be connected to the ITS telecommunications network defined in Clause 11.6 to allow control and monitoring using STREAMS.

11.4.3 Vehicle classification systems

Vehicle classification systems shall be able to classify vehicles in accordance with the Austroads classification system.

For motorways, vehicle classification sensors shall be located in each lane on:

- a) both carriageways approximately mid-way between all interchanges
- b) each entry ramp, and
- c) each exit ramp.

A vehicle classification system may be co-located with a vehicle detection system site.

The vehicle classification system shall comply with the requirements of:

- a) TRUM Manual
- b) RP&D Manual Volume 5: ITS
- c) MRTS251 *Traffic Counter / Classifier*, and
- d) MRTS204 *Vehicle Detectors*.

Unless otherwise specified, vehicle classification systems shall be provided in accordance with the Austroads 12-bin classification scheme.

Each vehicle classification system in accordance with the Austroads 12-bin classification scheme shall be provided with the facilities to allow it to be connected to the TSNET and STREAMS through the ITS telecommunications network defined in Clause 11.6 to allow control and monitoring using TSDM.

Each vehicle classification system in accordance with the Austroads 4-bin classification scheme shall be provided with the facilities to allow it to be connected to the ITS telecommunications network defined in Clause 11.6 to allow control and monitoring by STREAMS.

11.4.4 CCTV cameras

11.4.4.1 Locations on motorways

CCTV cameras shall be located:

- a) Adjacent to the motorway at average spacing of 750 m (maximum 1000 m) so that together they are capable of providing complete video coverage of the following:
 - i. all traffic on the through motorway carriageways
 - ii. each help telephone
 - iii. each emergency stopping bay and associated help telephone
 - iv. each median cross over, and
 - v. weigh-in-motion (WiM) sites
- b) Average spacing between CCTV cameras shall be 500 m throughout each LUMS zone.
- c) Adjacent to each motorway interchange to provide complete coverage of traffic on each entry ramp and each exit ramp and
- d) At the intersections of the ramps with the local roads and at ramp queues.

- e) Adjacent to and / or within each heavy vehicle interception site on the motorway to provide complete coverage of vehicles exiting the through carriageway and entering the heavy vehicle interception site and to provide full coverage of the heavy vehicle interception site, including the Operations Building.
- f) The Transport and Main Roads project representative shall be consulted in the design phase as to the requirement for CCTV coverage to allow messages on all dynamic signs and operation of ramp signals lanterns to be clearly verified from the TMC.

11.4.4.2 Locations on other roadways

For other roadways, the CCTV cameras shall be located as defined in the Contract.

11.4.4.3 Camera requirements

All CCTV cameras shall include pan, tilt, and zoom facilities.

CCTV cameras shall be of the IP type and contain built-in encoding technology. Analog cameras with separate encoders will not be accepted.

CCTV cameras shall be installed on tilt steel poles unless otherwise defined in the Contract.

CCTV cameras, including associated equipment, shall comply with the requirements of:

- a) RP&D Manual Volume 5: ITS, and
- b) MRTS225 *Imaging*.

The CCTV cameras shall be provided with facilities to enable it to be connected to the ITS telecommunications network defined in Clause 11.6 to allow:

- a) Video images at full motion rate to be transmitted to the TMC and to allow control of the pan, tilt, and zoom facilities from the TMC, and
- b) Video images at full motion rate to be transmitted to the heavy vehicle inspection building and to allow control of the pan, tilt and zoom facilities from the heavy vehicle inspection building.

11.4.4.4 Video transmission/compression system

The video transmission / compression and the pan, tilt and zoom control shall be compatible with the video management system existing in the TMC.

Information on video management system can be obtained from the Transport and Main Roads Representative.

11.4.5 Road weather monitoring stations

Road weather monitoring stations shall be able to measure temperature, humidity, precipitation rate, and wind speed and direction.

Road weather monitoring station(s), including associated equipment, shall comply with the requirements of:

- a) RP&D Manual Volume 5: ITS, and
- b) MRTS231 *Provision of Road Weather Monitors*.

Each road weather monitoring station shall be provided with the facilities to allow it to be connected to the ITS telecommunications network defined in Clause 11.6 to allow control and monitoring using STREAMS.

Road weather monitoring station shall be mounted on tilt poles with minimum mounting height of eight metres above the existing road surface and in a position that maximises the likelihood of correct operation in all weather conditions.

11.4.6 Help telephones

Help telephones shall comply with the following:

- a) RP&D Manual Volume 5: ITS
- b) TRUM Manual, Volume 1, Part 9, Supplement 6.1.6-2 *Help Telephones*, and
- c) MRTS221 *Help Phones*.

For other roadways other than motorways, the help telephones shall be provided as defined in the Contract.

Each help telephone shall be connected to the TMC via a leased telephone service or ITS network which shall comply with Clause 11.2 of MRTS201 *General Equipment Requirements*.

11.4.7 Weigh-in-Motions systems

Weigh-in-Motion systems shall comply with the requirements of:

- a) RP&D Manual Volume 5: ITS
- b) TRUM Manual
- c) MRTS203 *Provision of Weigh-in-Motion System*.

Each WiM system shall include:

- a) WiM sensors in the roadway in each traffic lane, which shall be capable of measuring axle weights and configurations, and
- b) Processing equipment to record, store, and process the measured axle weights and configurations.

Each WiM system shall:

- a) include the installation of an Automatic Number Plate Recognition (ANPR) system as defined in Clause 11.4.8, and
- b) be able to be controlled and monitored from the roadside ITS telecommunications
- c) cabinet housing the processing equipment, and
- d) be provided with the facilities to allow it to be connected to the ITS Telecommunications Network defined in Clause 11.6 to allow control and monitoring using TSDM.

11.4.8 Automatic Number Plate Recognition (ANPR) systems

ANPR devices shall comply with the requirements of:

- a) RP&D Manual Volume 5: ITS
- b) TRUM Manual, and
- c) MRTS250 *Provision of Automatic Number Plate Recognition System*.

The ANPR cameras and field illuminators on carriageways with three or more lanes shall be installed on an overhead gantry.

Where mounted over a roadway, the vertical clearance from the road surface to the lowest point of the ANPR, including mounting structures, shall comply with clearance requirements defined in the Contract.

One camera and one illuminator shall be installed over each lane to read the front number plate of each vehicle in that lane.

In all cases, including when installed in association with a WiM system site, the ANPR devices for each traffic lane shall be installed such that the front number plate of a vehicle can be read as the vehicle passes over the WiM sensors located in the pavement.

Each ANPR system shall be provided with the facilities to allow it to be connected to the ITS telecommunications network defined in Clause 11.6 to allow control and monitoring using TSDM.

11.5 Heavy Vehicle Management systems

Heavy Vehicle Management systems comprise:

- a) A WiM system(s) complying with Clause 11.4.7, including the associated ANPR system complying with Clause 11.4.8
- b) Changeable message signs (CMS) complying with Clause 11.3.2 on the approaches to the heavy vehicle interception site complying with Clause 11.3.2
- c) A heavy vehicle interception site, including the Operations Building and weighing platform
- d) CCTV cameras complying with Clause 11.4.4
- e) Vehicle detection systems for the exit and entry ramps of the heavy vehicle interception site complying with Clause 11.4, and
- f) workstation (by others) with connection to TSDM.

The locations and sign faces of the CMS and all associated static signs shall comply with Section 1.18 of the TRUM Manual.

CMS shall have one blank face and two faces for displaying the sign message. The blank face shall be the default display.

All devices associated with the heavy vehicle interception site shall be provided with the facilities to allow them to be connected to the ITS Telecommunications Network, defined in Clause 11.6, to allow control and monitoring using TSDM at the TMC and the Heavy Vehicle Operations Building.

11.6 ITS telecommunications network

11.6.1 General requirements

The ITS telecommunications network will be an extension / expansion of the Transport and Main Roads wider ITS telecommunications network. This network shall form an integral part of Transport and Main Roads ITS telecommunication network used to operate the Principal's ITS, including the Permanent ITS.

The ITS telecommunications network shall consist of:

- a) A field network consisting of a full duplex, bi-directional, backbone ring with a number of network nodes to allow the transfer of data over the backbone between the field equipment sub-network(s) and a TMC LAN, and
- b) A number of field equipment sub-networks each consisting of a full duplex, bi-directional ring and connect to a number of telecommunications field cabinets to allow the transfer of data between field equipment in a localised area (either via a field processor or directly) and a TMC LAN via the field network.
- c) The project shall design and document the proposed communication connection points in detail, including the location and type of connecting Ethernet equipment.

The ITS telecommunications network shall comply with:

- a) MRTS201 *General Equipment Requirements*; and
- b) MRTS245 *ITS Telecommunication Network (ITS TN)*.

11.6.2 ITS Telecommunication cables

Fibre cores used in each segment of a ring shall be provided and installed in separate conduits to those fibres used in other segments of that ring. Cables used in each ITS Telecommunications Network ring shall contain the same number of fibre cores throughout.

In addition to the fibre cores required by the ITS Telecommunication Network design, a minimum of 24 spare fibre cores shall be installed in each ring segment of the ITS Telecommunications Network and allocated for future use by Transport and Main Roads. These spare fibre cores shall be provided in at least two separate 12-core bundles within the same cable.

Copper cabling shall be provided to supplement the optic fibre cable where necessary as defined in the design documentation.

All copper and optic fibre cables shall comply with MRTS234 *Communication Cables*.

Optic fibre cables shall not be installed longitudinally in concrete barriers unless for new busway infrastructure or within tunnels.

Optic fibres shall only be installed underground, except where they are installed in a bridge parapet or within motorway concrete barriers.

All optic fibres shall be spliced in a network node cabinet, telecommunications field cabinet or a pit located in the verge.

All ITS Telecommunications Network cables shall have a non-metallic armoured vermin-resistant sheath. Refer to MRTS234 for requirements for all communications cables.

11.6.3 Conduit network

11.6.3.1 General

A conduit network for all ITS Telecommunications Network cables, including the optic fibre cable, shall be provided.

The cable conduit network shall comply with MRTS91 *Conduits and Pits*.

The conduit network shall be designed to:

- a) Allow installation of additional cables in future without disrupting traffic flow and / or without requiring traffic control, and
- b) Accommodate the number of cables required by the design, plus an additional 100% of the number of cables required by the design by providing:
 - i. sufficient straws in the conduits where blown fibre technology is used, and / or
 - ii. sufficient sub-ducts (with draw ropes) where blown fibre technology is not used, and/or
 - iii. additional empty conduits (with draw ropes) where blown fibre technology is not used.

The design of the conduit network shall be integrated with the road design and the design of all structures.

11.6.3.2 Longitudinal backbone conduits

The longitudinal backbone network shall consist of conduits installed in any or all of the following locations:

- a) underground
- b) aboveground in concrete barriers
- c) in bridge parapets, and
- d) in cable trays.

At least one power (100 mm diameter orange) conduit and one communications (100 mm diameter white) conduit shall be provided in each parapet of all new bridge structures and widening of existing bridge structures.

For motorways, longitudinal conduits consisting of at least two power (100 mm diameter orange) conduits and two communication (100 mm diameter white) conduits shall be installed in:

- a) both outer verges
- b) all concrete barriers in accordance with the Transport and Main Roads Standard Drawings, and
- c) along each entry and exit ramp, with connections to longitudinal (backbone) conduits.

11.6.3.3 Crossroad conduits

As a minimum, cross road conduits under the through carriageway consisting of at least two power (100 mm diameter orange) conduits and two communication (100 mm diameter white) conduits shall be provided at:

- a) all vehicle detector sites

- b) at all bridge abutments, and
- c) help phones

Cross road conduits under exit ramps and entry ramps shall include at least one power (100 mm diameter orange) conduit and one communication (100 mm diameter white) conduit.

11.6.3.4 Pits

All pits associated with communications (white) and longitudinal (backbone) conduits shall be no smaller than a No. 7 pit or circular pit as defined in MRTS91. The Contractor shall seek written approval as to the minimum size and type of pits required on the project from the Transport and Main Roads project representative.

All pits associated with electrical power (orange) and longitudinal (backbone) conduits shall be no smaller than a No. 7 pit or circular pit as defined in MRTS91. The Contractor shall seek written approval as to the minimum size and type of pits required on the project from the Transport and Main Roads project representative.

All conduits not used for the installation of any type of cable shall be terminated in a pit no smaller than a No. 4 pit.

Maximum distance between adjacent communications pits had been reduced from 250 m to 240 m.
Maximum distance between power pits remained at 120 m.

Intermediate pits between road crossings shall be installed at a spacing of a maximum of 240 m for communications conduits and 120 m for power conduits.

All pits installed in the verge shall be located such that they do not need to be relocated when future widening is constructed.

Each longitudinal (backbone) conduit shall be terminated in pits at the limit of works and shall be sealed to prevent the ingress of moisture and foreign materials.

11.6.4 Network node enclosures

The locations of the network node enclosures shall permit easy connection of mains power and leased telecommunication services to the enclosures.

The final locations of the network node enclosures shall be submitted for acceptance by the Transport and Main Roads Representative.

The network node enclosures shall be used to terminate the main fibre optic cables and shall be suitable for accommodating telecommunications equipment necessary for connecting the network node enclosures to Transport and Main Roads wider ITS Telecommunications Network.

Sufficient space shall be provided in each network node enclosure for the fibre termination panels and all necessary telecommunications equipment. If an existing network node cabinet does not contain sufficient rack space to accommodate the ITS telecommunications equipment provided under these works, the cabinet shall be replaced.

Where a ground mounted cabinet is used as the network node enclosure, the cabinet shall comply with MRTS226 *Telecommunications Field Cabinets*.

11.7 Access to all ITS components

Access to all ITS components and associated facilities shall be provided to:

- a) minimise the cost of carrying out future inspection and maintenance activities
- b) maximise worker and public safety
- c) minimise traffic and public disruption, and
- d) achieve an equitable balance between current construction costs and future maintenance costs.

The integrated design shall provide for the efficient maintenance of ITS equipment and all other facilities (including landscaping, bridges, other structures, and so on) by providing safe, efficient and cost effective access. The design of the location of all ITS Components shall consider access for maintenance such that maintenance can be carried out during daylight hours with no disruption to traffic flow and without the need for lane closures or other forms of traffic control. This shall be achieved by locating the field equipment to enable access for maintenance from service roads, emergency stopping bays, or pedestrian / cycle paths where these are provided.

The Contractor shall:

- a) Install all network node cabinets in positions that provide access by maintenance personnel at all times without the need to implement any form of traffic control or lane closures
- b) Provide an area to park a service vehicle (small truck) within 30 m of all network node cabinets that is:
 - i. safe to use without the need to implement any form of traffic control or lane closures
 - ii. not within the standard road shoulder width (providing additional shoulder widening is acceptable)
 - iii. accessible during all weather conditions
 - iv. hard stand or paved with adequate room to access equipment on the service vehicle.
- c) Provide a maintenance platform where required in accordance with MRTS61 *Mounting Structures for ITS Devices*
- d) Locate pits for ITS clear of the through carriageways and ensure clearance zones are met for barriers / shoulders
- e) Provide economical access without the need for highly specialised access equipment to all ITS infrastructure (including provision for future ITS infrastructure) that is located under or within structures
- f) Provide vehicle access to ITS infrastructure placed in locations that cannot be easily accessed from a road pavement, and
- g) Design and install landscaping to not impede functionality of, access to, or damage ITS infrastructure at any stage throughout its life.

11.8 Security of cabinets

Access to all ITS cabinets shall be achieved through the application of a secure locking system.

The Transport and Main Roads project representative shall be consulted as the selection of any cabinet locking mechanism.

Transport and Main Roads type approved secure locking mechanisms and associated components shall be utilised if such exist at the time of selection.

Any removable section on an ITS cabinet shall be adequately secured.

