

**ROADS AND MARITIME SERVICES (RMS)**  
**RMS SPECIFICATION D&C TS916**  
**OMCS REQUIREMENTS –**  
**ELECTRONIC TOLL COLLECTION SYSTEM**

**NOTICE**

This document is a Roads and Maritime Services D&C Specification. It has been developed for use with Design & Construct roadworks and bridgeworks contracts let by Roads and Maritime Services. It is not suitable for any other purpose and must not be used for any other purpose or in any other context.

Copyright in this document belongs to Roads and Maritime Services.

**REVISION REGISTER**

<b>Ed/Rev Number</b>	<b>Clause Number</b>	<b>Description of Revision</b>	<b>Authorised By</b>	<b>Date</b>
Ed 1/Rev 0		First Issue	Manager Motorway Systems	14.09.16

## **GUIDE NOTES**

(Not Part of Deed Document)

### **Using Specification D&C TS916**

The OMCS specifications are intended for use in the project development, design and construction, of motorways throughout NSW. OMCS specifications describe the requirements to design, construct, operate and maintain various Traffic Management, Mechanical, Electrical, Fire and Safety systems.

Specification D&C TS916 “OMCS Requirements - Electronic Toll Collection System” for motorways and tunnels is part of the OMCS suite of specifications. This specification is also referred to as the Level 2 OMCS specification and describes and outlines the various requirements for Electronic Toll Collection System.

D&C TS901 “OMCS Overview and General Requirements” describes and outlines the scope of various specifications including this one as part of the OMCS specification suite. D&C TS901 sets out main overarching design objectives, system architecture and general requirements, including installation, testing, commissioning, and documentation requirements.



# OMCS REQUIREMENTS - ELECTRONIC TOLL COLLECTION SYSTEM

Copyright – Roads and Maritime Services  
IC-DC-TS916

VERSION FOR: DATE:
-----------------------



## CONTENTS

CLAUSE	PAGE
FOREWORD .....	ii
RMS Copyright and Use of this Document .....	ii
Base Specification .....	ii
1    GENERAL .....	1
1.1    Scope .....	1
1.2    Related Specifications .....	1
1.3    Structure of the Specification .....	2
1.4    Definitions and Acronyms .....	2
2    ELECTRONIC TOLL COLLECTION SYSTEM .....	5
2.1    General Requirements .....	5
2.2    ETCS Performance .....	6
2.3    Exempt Vehicles .....	6
2.4    Toll Charging Point Locations .....	6
2.5    Dedicated Short Range Communication (DSRC) Standards .....	6
2.6    ETCS Applications Interface Standards .....	6
2.7    Specification for Interoperability .....	7
2.8    Tollway Operators Memorandum of Understanding .....	7
3    ETCS FUNCTIONAL REQUIREMENTS .....	7
3.1    ETCS Arrangement .....	7
3.2    ETC Tag and ETC Reader System .....	8
3.3    ETC Roadside Controller .....	8
3.4    Vehicle Detection and Classification System .....	9
3.5    Video Enforcement System .....	10
4    CENTRAL COMPUTER SYSTEM REQUIREMENTS .....	11
4.1    ETCCS Requirments .....	11
4.2    Interface With External Tollway Operators .....	12
4.3    Computer Configuration Requirments .....	12
4.4    Workstations .....	13
5    DOCUMENTATION .....	14
ANNEXURES TS916/A AND TS916/B – (NOT USED) .....	15
ANNEXURE TS901/C – SCHEDULES OF HOLD POINTS AND IDENTIFIED RECORDS .....	15
C1    Schedule of Hold Points .....	15
C2    Schedule of Identified Records .....	15
ANNEXURES TS916/D TO TS916/L – (NOT USED) .....	15
ANNEXURE TS916/M – REFERENCED DOCUMENTS .....	16
LAST PAGE OF THIS DOCUMENT IS .....	17

## **FOREWORD**

### **RMS COPYRIGHT AND USE OF THIS DOCUMENT**

Copyright in this document belongs to the Roads and Maritime Services.

#### **When this document forms part of a deed**

This document should be read with all the documents forming the Deed.

#### **When this document does not form part of a deed**

This copy is not a controlled document. Observe the Notice that appears on the first page of the copy controlled by RMS. A full copy of the latest version of the document is available on the RMS Internet website: <http://www.rms.nsw.gov.au/business-industry/partners-suppliers/specifications/index.html>

### **BASE SPECIFICATION**

This is the first version.

# **RMS SPECIFICATION D&C TS916**

## **OMCS REQUIREMENTS - ELECTRONIC TOLL COLLECTION SYSTEM**

### **1 GENERAL**

#### **1.1 SCOPE**

The Electronic Toll Collection System (ETCS) must be a fully automated tolling system that:

- (i) identifies vehicles using the Motorway via their tag or licence plate number;
- (ii) debits authorised accounts;
- (iii) provides facilities for casual Motorway users; and
- (iv) facilitates prosecution of unauthorised users.

The ETCS must provide for variable toll charges based on different vehicle classification.

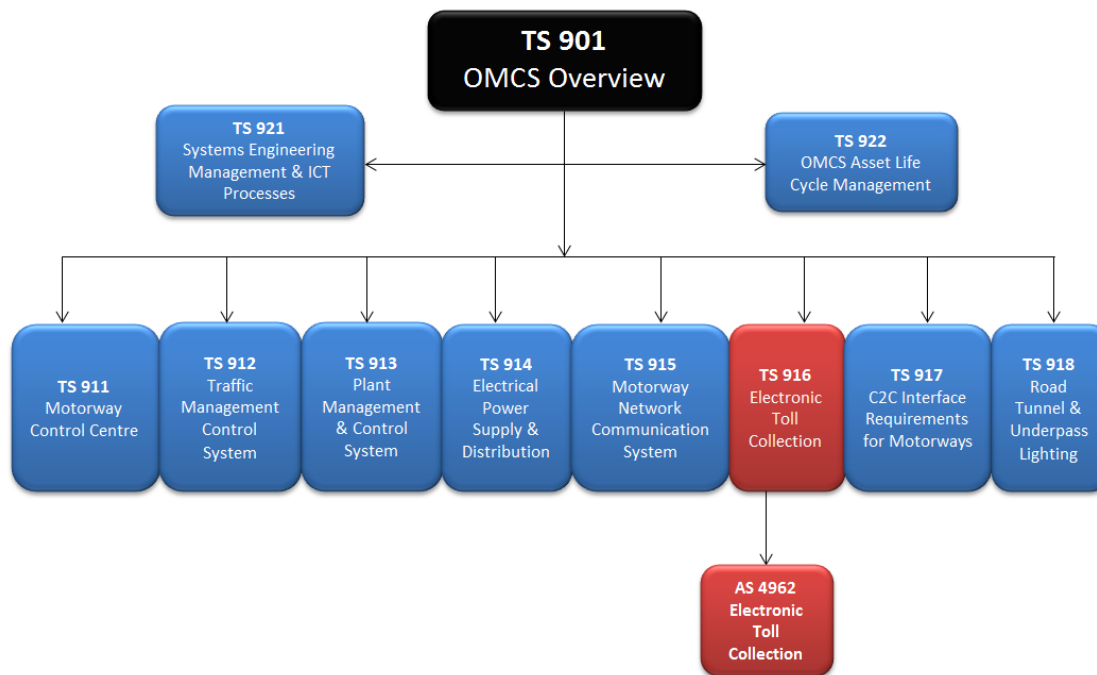
The ETCS must be capable of operating different tolling methods including distance based, time of day and fixed or combinations thereof, in accordance with the Deed. This capability must support tolling operations where contra-flow lane arrangements exist.

The ETCS must be compatible with the existing computer systems, equipment and communication networks used in the RMS OMCS for tunnels, including tunnels in motorways, and long underpasses. The ETCS must be designed with adequate redundancy to ensure that any failure of the ETCS does not adversely impact the operation of the OMCS.

#### **1.2 RELATED SPECIFICATIONS**

This Specification forms part of the RMS OMCS Level 2 document suite that contains the requirements and specifications that determine the operational performance and management of various systems and devices commissioned on motorways and tunnel infrastructure in NSW.

The ETCS defines the functional and performance requirements of the Operations Management and Control System (OMCS) in conjunction with the following Level 2 specification documents.



### 1.3 STRUCTURE OF THE SPECIFICATION

This Specification includes a series of annexures that detail additional requirements.

#### 1.3.1 (Not Used)

#### 1.3.2 (Not Used)

#### 1.3.3 Schedules of HOLD POINTS and Identified Records

The schedules in Annexure TS916/C list the **HOLD POINTS** that must be observed. Refer to Specification RMS D&C Q6 for the definition of **HOLD POINTS**.

The records listed in Annexure TS916/C are **Identified Records** for the purposes of RMS D&C Q6 Annexure Q/E.

#### 1.3.4 (Not Used)

#### 1.3.5 (Not Used)

#### 1.3.6 Referenced Documents

Standards, specifications and test methods are referred to in abbreviated form (e.g. AS 2350). For convenience, the full titles are given in Annexure TS916/M.

### 1.4 DEFINITIONS AND ACRONYMS

#### 1.4.1 Definitions

The terms “you” and “your” mean “the Contractor” and “the Contractor’s” respectively.



The following definitions apply to this Specification:

<b>Detection Zone</b>	An area in which vehicles are identified and classified. Within each Detection Zone there may be one or more trafficable lanes plus a shoulder (or shoulders) and medians as determined by the road geometry.
<b>ETC Tag/ Electronic Tag (E- Tag)</b>	An electronic device which can be mounted in a vehicle for the purpose of identifying the tag issuer and associated account to be charge for the vehicle passing through a tolling point. Also referred to as OBE or OBU.
<b>ETC Central System (ETCCS)/Tolling Back Office</b>	A computer system which manages the aggregation of all ETCS data, also known as the Tolling Back Office.
<b>ETC Roadside Controllers (ETCRC)/Roadside System (RSS)</b>	Roadside operations computer system integrating the Roadside Equipment functionality
<b>Integrity</b>	The property that data has not been altered or destroyed in an unauthorized manner ([SOURCE: ISO/TS 17574])
<b>Interoperable/ Interoperability'</b>	Ability of systems to exchange information and to make mutual use of the information that has been exchanged [SOURCE: ISO/IEC/TR 10000-1, 3.2.1]
<b>On-Board Equipment (OBE) / On-Board Unit (OBU)</b>	Equipment located on-board a vehicle including nomadic devices with the function of exchanging information with external systems  The OBE does not need to include payment means.[SOURCE: EN ISO 14906, 3.13]  Minimum component of an O, whose functionality always includes at least the support of the DSRC interface. [SOURCE: EN ISO 14906, 3.14]
<b>Roadside Equipment (RSE)</b>	Equipment located along the road, either fixed or mobile, including ETC readers; Vehicle Detection and Classification System (VDCS); Video Enforcement System (VES); ETC Roadside Controllers (ETCRC) and associated power and communications infrastructure.
<b>Toll Point (TP)</b>	The contiguous area that fully encompasses the gantry foundations, equipment bases and maintenance access infrastructure for the Roadside Equipment.
<b>Transaction</b>	Whole of the exchange of information between two physically separated communication facilities [SOURCE: EN ISO 14906, 3.24]

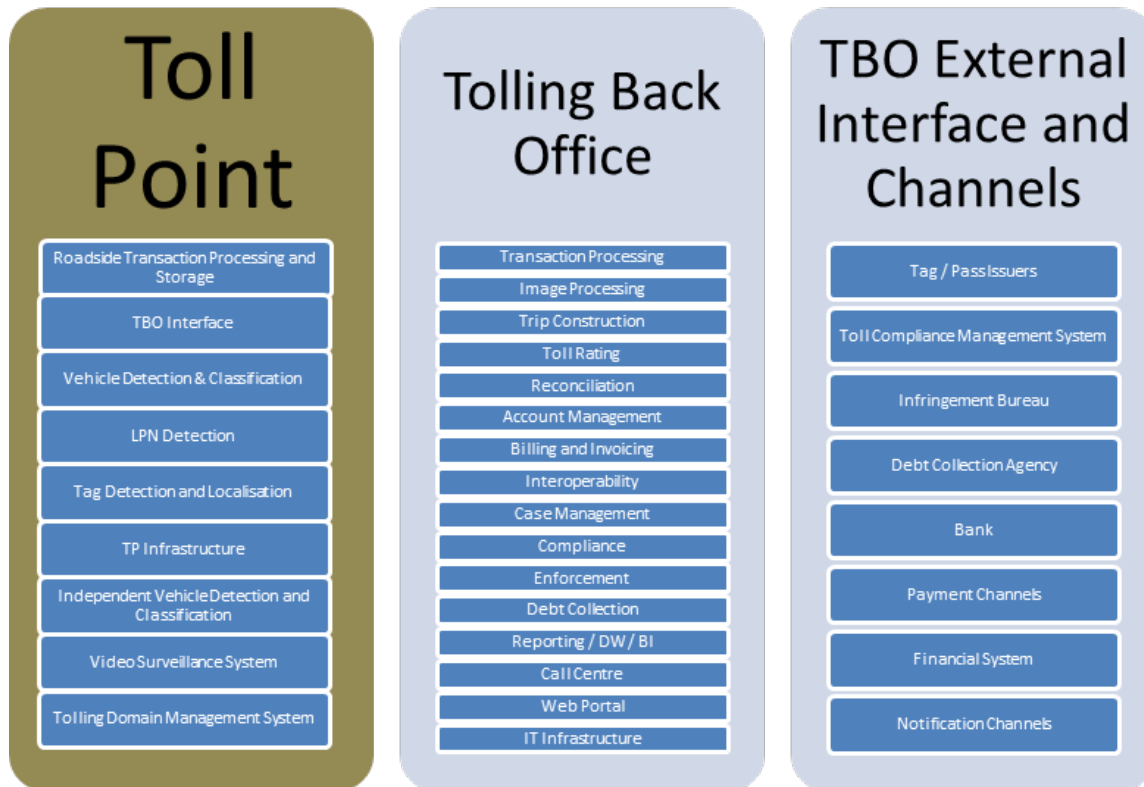


Figure TS916.1 End to End Tolling Functional Context Diagram

### 1.4.2 Acronyms

The following acronyms apply to this Specification:

<b>AS</b>	Australian Standard
<b>AVI</b>	Automatic Vehicle Identification
<b>CEN</b>	European Committee for Standardisation
<b>CPU</b>	Central Processing Unit
<b>DSRC</b>	Dedicated Short Range Communications
<b>DTR</b>	Draft Technical Report
<b>EFC</b>	Electronic Fee Collection
<b>EN</b>	European Standards
<b>ETC</b>	Electronic Toll Collection
<b>ETCCS</b>	ETC Central System
<b>ETCRC</b>	ETC Roadside Controllers
<b>ETCRS</b>	ETC Reader Systems

<b>ETCS</b>	Electronic Toll Collection System
<b>ETSI</b>	European Telecommunications Standards Institute
<b>GUI</b>	Graphical User Interface
<b>IDCN</b>	Independent Data Communication Network
<b>I/O</b>	Inputs/Outputs
<b>ISO</b>	International Organization for Standardization
<b>MAC</b>	Message Authentication Codes
<b>MoU</b>	Memorandum of Understanding
<b>OMCS</b>	Operations Management and Control System
<b>RMS</b>	Roads and Maritime Services
<b>RTTT</b>	Race To The Top
<b>TfNSW</b>	Transport for New South Wales
<b>VDCS</b>	Vehicle Detection and Classification System
<b>VES</b>	Video Enforcement System

## **2 ELECTRONIC TOLL COLLECTION SYSTEM**

### **2.1 GENERAL REQUIREMENTS**

- (a) The ETCS must comply with the Australian DSRC-EFC Specification for Interoperability AS 4962 (Int) – 2005, and the tollway operators' Memorandum of Understanding (MoU).
- (b) The ETCS infrastructure must include:
  - (i) electronic toll readers at each toll charging point to interrogate the tags and read tag data as the vehicles pass through the Detection Zones;
  - (ii) a vehicle detection system to detect and classify vehicles and, where multi-lane free flow tolling is provided, to spatially locate vehicles;
  - (iii) an ETCS video enforcement system, comprising electronic video devices to record registration data of vehicles which do not have a valid tag in image format, and a central processing facility;
  - (iv) facilities for transmission of tag and video data to an ETCS toll processing system which:
    - (A) debits the toll to the vehicle owner's account; and
    - (B) identifies vehicles passing through the Detection Zones without a valid tolling arrangement and transmits data to Roads and Maritime Services (RMS) in a form acceptable to RMS to enable RMS to initiate enforcement action.
  - (v) facilities to enable users not in possession of a tag the opportunity to use the Motorway.

- (c) There must be no impediment to the flow of traffic at any speed up to the posted speed limit arising from the ETCS operation.

## **2.2 ETCS PERFORMANCE**

- (a) The ETCS must have a high level of accuracy and reliability, with vehicles travelling at any speed up to 160 km/h. The accuracy and reliability of the ETCS must be better than or equal to the performance measures specified in this document.
- (b) Infringement data must not be generated on non-violating vehicles.
- (c) Casual user processes must be customer focussed and user efficient.
- (d) The Contractor must provide protective measures for the ETCS against:
  - (i) lightning strikes;
  - (ii) floods;
  - (iii) loss of power;
  - (iv) vehicle accidents;
  - (v) vandalism; and
  - (vi) any other event that would disrupt tolling operations.

## **2.3 EXEMPT VEHICLES**

The ETCS must accommodate exempt vehicles by:

- (a) Identifying the passage of all exempt vehicles, by Electronic Toll Collection (ETC) tag, video or another means;
- (b) Logging the passage as an exempt vehicle category;
- (c) Charging tolls in accordance with the requirements of the Deed.

## **2.4 TOLL CHARGING POINT LOCATIONS**

Toll Charging Points (Toll Points) must provide full coverage of the Motorway traffic as well as vehicles entering and exiting.

Toll Points must allow for operation of the Motorway's tolling method (distance based, time of day or fixed or combination thereof) in accordance with the Deed.

## **2.5 DEDICATED SHORT RANGE COMMUNICATION (DSRC) STANDARDS**

The ETCS must comply with the DSRC Standards (which are European CEN standards and one ETSI standard) listed in Annexure TS916/M.

## **2.6 ETCS APPLICATIONS INTERFACE STANDARDS**

The ETCS must comply with the ETCS applications interface standards listed in Annexure TS916/M.

## **2.7 SPECIFICATION FOR INTEROPERABILITY**

The ETCS must comply with the Australian DSRC-EFC Specification for Interoperability AS 4962 (Int) – 2005, which sets out the specific parameters and data elements forming the basis for national interoperability amongst all Australian tollway operators.

## **2.8 TOLLWAY OPERATORS MEMORANDUM OF UNDERSTANDING**

In relation to interoperation between tollway operators and addressing issues of association, common policies for interoperation, data security management, clearing transactions and the like, the Contractor must abide by the agreements contained in the tollway operators' Memorandum of Understanding.

# **3 ETCS FUNCTIONAL REQUIREMENTS**

## **3.1 ETCS ARRANGEMENT**

- (a) The ETCS must comprise the following system elements:
  - (i) ETC tags and ETC readers;
  - (ii) Vehicle Detection and Classification System (VDCS);
  - (iii) Video Enforcement System (VES);
  - (iv) ETC Roadside Controllers (ETCRC);
  - (v) ETC Central System (ETCCS); and
  - (vi) Independent Data Communication Network (IDCN).
- (b) The ETC tag and ETC Reader Systems (ETCRS) must exchange data between the tag and the reader, in accordance with this Specification.
- (c) The VDCS must detect, classify and, where multi-lane free flow tolling operates, spatially locate (including the lane the vehicle is travelling in) every vehicle passing the toll charging points and identify them in accordance with the vehicle classifications defined in AS 4962 Appendix E1.2 (Vehicle classification in NSW).

<b>Vehicle Classification</b>	<b>Description of Vehicle</b>
Class 1:	Motorbikes, including sidecars
Class 2:	Cars
Class 3:	Not used.
Class 4:	Heavy Vehicles, where a vehicle is larger than a Car, Class 2 vehicle.
Class 5:	Buses

- (d) The VES must capture the image and specific related vehicle data sufficient for video tolling or for enforcement action against every vehicle without a valid tolling arrangement.
- (e) The ETCRC must integrate the operations of the ETCRS, the VDCS and the VES to determine the toll charge based on the vehicle classification and communicate the transaction data, traffic data and enforcement data to the ETCCS.

- (f) The ETCCS must record transactions received from the ETCRC and process those transactions for tolling or enforcement purpose. The ETCCS must be capable of receiving alerts and alarms from the ETCRC for management of this network. The ETCCS may be provided as a dedicated system or as a shared service located outside of the Project Site.
- (g) The central VES processing system must be either included in the ETCCS or in a separate VES central processing system, interconnected with the ETCCS.
- (h) The Independent Data Communications Network must ensure that ETCS data is transmitted on the ETCS network between all components of the ETCS. No other applications must be permitted to use the ETCS data network. The ETCS data network must be secured such that only approved parties can gain access.

### **3.2 ETC TAG AND ETC READER SYSTEM**

- (a) Tolling of Motorway users can be performed by the ETCS, which enables tag identification data to be read from the vehicle mounted ETC tag by fixed roadside ETC equipment.
- (b) The ETC reader must operate continuously to receive data from ETC tags within a defined vehicle Detection Zones at the toll charging points to complete a tolling transaction.
- (c) The ETC tag and the ETC reader operation must be interoperable with all other ETC tags and ETC readers operating to the standards and specifications which are referenced in Section 2. For avoidance of doubt, “interoperability” and “interoperable” as used in this Specification mean:
  - (i) the ETCRS must complete a transaction with any other ETC tag from another tollway operator within Australia, where that tollway operator has installed ETCS equipment in compliance with the standards and specifications which are referenced in Section 2; and
  - (ii) ETC readers and the ETCRS must accommodate and be interoperable with all implementations of the DSRC standards and ETCS applications interfaces in all other ETCS systems operating in Australia.
- (d) The ETCRS must be designed and configured for multi-lane free flow ETCS tolling. The reader must be capable of completing a transaction with every working tag on every type of vehicle located anywhere in the Detection Zones between the carriageway kerb boundaries while oriented towards the ETCRS. The ETCRS must be capable of transacting with ETC tags installed on two narrow vehicles, such as motorcycles, travelling side by side in a single lane.
- (e) The ETCRS must be designed and configured for correct association of the tag with the vehicle in which the tag is located in the multi-lane free flow environment.
- (f) The ETCRS hardware must be suitable for the local Sydney ambient environment (including temperature and enclosure ratings) as well as all other issues affecting the reliability of the ETCS.

### **3.3 ETC ROADSIDE CONTROLLER**

- (a) The ETCRC must be a high performance rated and specified computer system capable of the real-time processing necessary to manage dual and single lane constrained free flow, and where provided, multilane free flow vehicle detection and tolling at speeds up to 160 km/h.
- (b) The ETCRC must be capable, as a minimum, of managing an ETC tag list comprising 10,000,000 tags registered on Australian tollways. Operational tags must be validated by the ETCRC within five milliseconds during the passage of a vehicle through the Detection Zones at any speed up to 160 km/h. The ETCRC must provide the means to regularly automatically update the ETC tag list at a maximum interval of once every 24 hours but configurable to more frequent intervals.

- (c) The ETCRC must incorporate lane control and system management to detect vehicles and transact through the ETCRS with a tag or more than one tag, simultaneously as well as capture vehicle image data if necessary. The ETCRC must match the tag with the corresponding detected and classified vehicle in the Vehicle Detection System to determine the correct toll based on the vehicle classification and to allow positive identification of vehicles without tags or without working tags.
- (d) The ETCRC must incorporate redundancy operation to prevent loss of transactions.
- (e) The ETCRC must be capable of standalone operation for a minimum period of 15 days in the event of failure of communications links to the ETCCS. Under such conditions, the ETCRC must store all the ETCS transactions, traffic data, enforcement action data and images for the period during which communication links have failed. On restoration of communications, the data must be uploaded to the ETCCS with no loss of stored data.
- (f) The ETCRC must incorporate local monitoring facilities and software to allow monitoring and diagnostic operations in every aspect of ETCRC and ETCRS operation.
- (g) The ETCRC must supply the data requirements for the ETCCS to record every ETCS transaction, potential enforcement action and traffic statistics as required. A comprehensive fault management system must be included for every device locally controlled by the ETCRC.

### **3.4 VEHICLE DETECTION AND CLASSIFICATION SYSTEM**

- (a) The Vehicle Detection and Classification System (VDCS) must:
  - (i) detect every vehicle passing through the Detection Zones, and spatially track every vehicle where multi-lane free flow is provided;
  - (ii) classify detected vehicles into the classes defined in this document, and
  - (iii) transmit vehicle detection classification and spatial data (where available), to the ETCRC system.
- (b) The VDCS must:
  - (i) detect all vehicles travelling at all speeds up to 160 km/h through the Detection Zones;
  - (ii) detect all vehicles located anywhere in the Motorway lanes and between either side kerb boundary of the carriageways in the Motorway within the Detection Zones;
  - (iii) detect all vehicles with trailers and articulated vehicles as a single vehicle unit;
  - (iv) detect all vehicles where an inter-vehicle spacing of 400 mm or more exists at the time of detection up to the posted speed limit, with an allowable increase in the inter-vehicle spacing of 100 mm for every 10 km/h of vehicle speed above the posted speed limit; and
  - (v) measure length, width and height of detected vehicles to an accuracy of +/- 100 mm, where the height of a vehicle is the maximum height above ground level of the vehicle body, excluding radio aerials and similar minor protuberances.
- (c) The VDCS must operate reliably in all weather conditions and ambient light conditions, from both natural and man made sources, experienced at every ETCS toll charging point.
- (d) The operation of the VDCS must not distract drivers. In case of optical VDCS, the artificial illumination required must be less than the ambient artificial illumination levels or preferably use invisible illumination such as Infrared.
- (e) The VDCS must transmit data to the ETCRC at a rate which supports the high speed application in the ETCRC to match vehicle position with tag position in the lane and the ETCRC must process the location data in real-time.

- (f) The VDCS must achieve at least the following performance under operating conditions, measured over not less than 40,000 vehicle passages.

Vehicle Count error	Less than 0.1%
Vehicle classification error	Less than 2.0%

### **3.5 VIDEO ENFORCEMENT SYSTEM**

- (a) The VES must capture clear and detailed images of those vehicles in the Detection Zones that do not have a valid tolling arrangement. The VES must associate, without error, the appropriate enforcement data with an image to initiate an enforcement action, if required.
- (b) The VES must use toll cameras that are gazetted in accordance with Clause 250A of the NSW Roads Act 1993.
- (c) The VES must provide vehicle identification and trip data required by Clause 250A of the NSW Roads Act 1993.
- (d) The VES must use high quality, high resolution digital video cameras and lenses to produce images under all ambient lighting conditions, including night time, which:
- (i) are acceptable as evidence presented in a court to support prosecution and are in a form consistent with that of other approved cameras in use in NSW;
  - (ii) consist of a pixel resolution enabling the unambiguous reading of the licence plate text, the identity of the state issuing the licence plate, the make and model of the vehicle. The Contractor must state in its submission of the finalised concepts in stage 1 of its design development the resolution in terms of pixels per square inch of that portion of the image that includes the licence plate and must demonstrate that this is adequate for unambiguous identification;
  - (iii) contain the rear view image of the vehicle and the front view vehicle image, the front image must not show the image of the driver or passengers where a licence plate has been detected;
  - (iv) provide a black/white or monochromatic image of the front and rear of the vehicle clearly showing the licence plate for identification purposes; and
  - (v) provide a colour image of the rear of the vehicle showing the rear licence plate and colour of the vehicle to facilitate vehicle identification process..
- (d) The VES must attach:
- (i) the date and time of the violation within an accuracy of 1.0 second relative to the Motorway time reference source;
  - (ii) toll charging point including lane and direction of travel;
  - (iii) toll operator/motorway identification; and
  - (iv) a unique reference identification data for the enforcement records, to an enforcement image to provide a complete enforcement record.
- (e) The VES must capture enforcement images with the violating vehicle in a consistent location on the carriageway at each toll charging point including where the toll charging point spans multiple lanes.
- (f) The VES must strictly match the enforcement image and the enforcement data block in each enforcement action.
- (g) The VES enforcement images that are related to issuance of a penalty notice or a fine must be retained for a period of 10 years after the last action.



- (h) The VES must be capable of capturing and storing images of 60 vehicles per minute per traffic lane for a period of up to 1 minute, travelling at any speed up to 160 km/h and spread over two lanes without loss of data.
- (i) The VES must generate a digital data security certificate authenticator over the entire enforcement image and data block to provide confirmation that the enforcement data is not corrupted or tampered with. The authenticator must be produced immediately at the time of image capture, be associated with the progress of the enforcement data and be stored in the ETCCS where it will form part of the enforcement record and be available for reference to prove authenticity of the enforcement record when required. The Contractor must maintain a system of secret keys upon which the data authenticator is based, to protect the security and integrity of the data authentication process. If authentication keys are revealed to any unauthorised party, the Contractor must immediately implement a new generation of authentication security keys.
- (j) The VES must operate to the following performance measures:

(i)	Detection Rate of Violating Vehicles:	>98%
(ii)	False Detection Rate of Non-Violating Vehicles:	0.0%
(iii)	Minimum Enforcement Capture Rate:	Less than 1.5 secs to complete an enforcement capture sequence.
(iv)	Operating Ambient Temperature:	0 - 50 deg C

## **4 CENTRAL COMPUTER SYSTEM REQUIREMENTS**

### **4.1 ETCCS REQUIREMENTS**

- (a) The ETC Central System (ETCCS) is a computer system which manages the aggregation of all ETCS data. The configuration of computers and computer networks comprising the ETCCS may be distributed or centralised, and may be provided as a dedicated system or as a shared service located outside of the Project Site.
- (b) The ETCCS interfaces with several external channels such as tag issuers, toll compliance enforcement services and corporate financial systems
- (b) The ETCCS must support all the ETCS processes from a computer system for the Motorway's ETCS customers.
- (c) The ETCCS must provide all facilities needed to manage the ETCS and to supply data to the ETCRC and the ETCCS workstations. Distribution of data between the ETCCS and ETCRC and ETCCS workstations must occur at speeds demanded by the application requirements to ensure integrity of the process.
- (d) The ETCCS must be capable of performing the following functions as a minimum:
- (i) life-cycle management to service customer needs, revenue security and information to be transmitted to other ETCS tolling agencies;
  - (ii) toll fee management to register and record all ETC tag transactions and manage the accumulated data, including fee tables for the Motorway and for other tollroad operators with reciprocal tolling arrangements, administration fees and audit trails to verify all invoices forwarded to other tollroad operators for payment. Transaction records must include data on date and time, lane number, plaza identifier, transaction vehicle class and toll charge;

- (iii) customer service call centre and help desk, using specific system interrogation routines, to provide assistance to all potential and current customers on issues that relate to the use of the Motorway;
  - (iv) time synchronisation management across the ETCS network (synchronised to Motorway network time i.e. via MNCS Network Time Protocol Server), to within one second, that is consistent and accurate and is audited for accuracy;
  - (v) interface and management operations with lane computers (ETCRS), including realtime data transfer;
  - (vi) interface and management operations with external tolling agencies, covering all transactions to be conducted between agencies, security and authentication of transactions and the provision of suitable and adequate message types between agencies;
  - (vii) interface with the Contractor's accounting system, including statements of all ETCS financial transactions;
  - (viii) interface and VES operations with the ETCS enforcement system to exchange information in the event that a violation has been detected and the transfer of VES data to the agency managing toll infringement and recovery processes;
  - (ix) ETCS administration (supervisor and operator functions) including access management and financial and technical reporting functions;
  - (x) ETCS management (technical support); and
  - (xi) ETCS fault management, including reporting the occurrence of ETCS faults and the initiation of repairs to faulty equipment.
- (e) The ETCCS must achieve the following performance requirements:
- (i) Tag status updates to the ETCRC must be issued in accordance with the toll operators' Memorandum of Understanding; and
  - (ii) workstation based queries on the database must be completed in less than 3 seconds for current period data and in less than 12 seconds for data not current and being older than one calendar month.

## **4.2 INTERFACE WITH EXTERNAL TOLLWAY OPERATORS**

- (a) The interface with external tollway operators by the ETCCS must be in accordance with the toll operators' Memorandum of Understanding.
- (b) The external toll operator interface must provide data exchange for:
  - (i) individual ETCS transactions;
  - (ii) claims for payment - settlement;
  - (iii) advice of payment against a claim; and
  - (iv) summary report – enforcement.

## **4.3 COMPUTER CONFIGURATION REQUIRMENTS**

- (a) A suitable and robust computer system must be available for the ETCCS instation host applications. All components of the ETCCS instation computer system must be duplicated for redundancy unless otherwise specified.
- (b) Rigorous analysis of the potential risks of ETCS failure and risk mitigation strategies must be undertaken and must demonstrate that the selected ETCCS design and provision of service meet the availability criteria set out below.

- (c) The ETCCS must be configured for high availability including full redundancy and a controlled changeover from duty to standby operation performed in a seamless manner. For avoidance of doubt, a changeover must be achieved without:
  - (i) disruption to the ETCS tolling operations;
  - (ii) the need to reboot the standby computer; and
  - (iii) the need to copy or upload data to disk drives.
- (d) Mirroring of all ETCCS data must be provided.
- (e) All the ETCCS software applications must be configured for automatic recovery upon the onset of program crash or halting.
- (f) The ETCCS design and configuration must be scalable to meet any future and short-term demand for additional functionality, scope and dimensions of the ETCCS functions. For avoidance of doubt, scalable means that the capacity of the ETCCS can be increased in terms of:
  - (i) performance and speed of CPUs;
  - (ii) main memory capacity;
  - (iii) disk memory capacity;
  - (iv) I/O capacity;
  - (v) networking capacity; and
  - (vi) task capacity (new tasks, applications, increase in existing tasks).
- (g) The ETCCS Central Computer System must provide for long-term data downloading for periodic archiving of historical traffic data and its later retrieval.

#### **4.4 WORKSTATIONS**

- (a) Operators' workstations for the ETCS must provide the operators with a clear and unambiguous Graphical User Interface (GUI) to the whole of the ETCCS.
- (b) The ETCCS GUI must provide for the specified ETCS functionality set out in Clauses 4.1 and 4.2, and must include:
  - (i) realtime status window showing all current ETCS transaction activity and immediate past activity for every toll charging point. The status display must include traffic data counts and ETCS transaction counts, displayed by vehicle category and in total, and toll violation;
  - (ii) command and control screens to operate and monitor all components of the ETCCS using icons and pull down menus to navigate the toll system; and
  - (iii) management of the financial operations on a day to day basis and the production of necessary reports.
- (c) ETCCS workstations must be selected from computer and monitor hardware that provides reliable operation and high-resolution graphical images. Workstation screen monitors must be not less than 21 inch (nominal) in size, with a minimum resolution capacity of 1280 x 1024 pixels.

## **5 DOCUMENTATION**

The Contractor must include the following information, in the form of Design Documentation drawings and written descriptions, in the Substantial Detailed Design Documents:

- (a) ETCS block diagrams;
- (b) ETC roadside equipment and gantry design drawings and specification;
- (c) ETCS supplier technical data for all ETCS components, (readers, ETCRS, ETCRC, VES, VDCS);
- (d) ETCS software architecture;
- (e) ETCS interoperability specification compliance certification;
- (f) ETCS data communications network design diagrams.

The Contractor must submit the Developed Detailed Design Documentation prior to the actual construction or manufacture of the ETCS components. The Developed Detailed Design Documentation must specify the functional, performance, and software and hardware characteristics of the ETCS systems and sub-systems.

As a minimum, work-as-executed documentation for the ETCS must include:

- (i) final detailed design documentation;
- (ii) all equipment specifications;
- (iii) ETCS work-as-executed drawings;
- (iv) cable schedules for the ETCS; and
- (v) all test/commissioning procedures and reports for the ETCS.

### **HOLD POINT**

Process Held:	Design and Testing Stages
Submission Details:	All the Design and Test documentation to demonstrate that the ETCS meets or exceeds the requirements outlined in this Specification
Release of Hold Point:	The Nominated Authority will consider the submitted documents and will verify the test results prior to authorising the release of the Hold Point.

**ANNEXURES TS916/A AND TS916/B – (NOT USED)**

**ANNEXURE TS901/C – SCHEDULES OF HOLD POINTS AND IDENTIFIED RECORDS**

Refer to Clause 1.3.3.

**C1 SCHEDULE OF HOLD POINTS**

<b>Clause</b>	<b>Description</b>
5	All the Design and Test documentation to demonstrate that the ETCS meets or exceeds the requirements outlined in this Specification

**C2 SCHEDULE OF IDENTIFIED RECORDS**

The records listed below are Identified Records for the purposes of RMS D&C Q6 Annexure Q/E.

<b>Clause</b>	<b>Description of Identified Record</b>
5	List of the documentation that must be delivered as part of delivery of the ETCS

**ANNEXURES TS916/D TO TS916/L – (NOT USED)**

## **ANNEXURE TS916/M – REFERENCED DOCUMENTS**

Refer to Clause 1.3.6.

### **RMS Specifications**

RMS D&C Q6	Quality Management System (Type 6)
RMS D&C TS901	OMCS Overview and General Requirements
RMS D&C TS911	OMCS Requirements - Motorway Control Centre
RMS D&C TS912	OMCS Requirements - Traffic Management and Control System
RMS D&C TS913	OMCS Requirements - Plant Management and Control System
RMS D&C TS914	OMCS Requirements - Electrical Power Supply and Distribution System
RMS D&C TS915	OMCS Requirements - Motorway Network Communications System
RMS D&C TS917	OMCS Requirements - C2C Interface for Motorways
RMS D&C TS918	OMCS Requirements - Road Tunnel and Underpass Lighting
RMS D&C TS921	Systems Engineering Management and ICT Processes
RMS D&C TS922	Operations and Maintenance

### **Australian Standards**

AS 4962 (Int)	Electronic Toll Collection
---------------	----------------------------

### **Dedicated Short Range Communication (DSRC) Standards**

CEN EN(V) 12253	RTTT, DSRC Physical Layer, CEN Central Secretariat, Brussels
CEN EN(V) 12795	RTTT, DSRC Data Link Layer, CEN Central Secretariat, Brussels
CEN EN(V) 12834	RTTT, DSRC Application Layer, CEN Central Secretariat, Brussels
EN(V) 13372	RTTT, DSRC Profiles, CEN Central Secretariat, Brussels
EN 300 674	ERM; RTTT; Technical characteristics and test methods for DSRC transmission equipment operating in the 5,8 GHz ISM band, ETSI

### **ETCS Applications Interface Standard**

CEN ENV ISO 14816	RTTT, AVI, Numbering and Data Structures, CEN Central Secretariat, Brussels
ENV ISO 14906	RTTT, Electronic Fee Collection, Application Interface Definition for Dedicated Short Range Communication, CEN Central Secretariat, Brussels
ENV ISO 14907-1	RTTT, Electronic Fee Collection, Test procedures for user and fixed equipment – Part 1: Description of test procedures (ISO/DTR 14907-1:1999), CEN Central Secretariat, Brussels
ISO 3166	Codes for the representation of names of countries
ISO 9797-1	Information Technology – Security Techniques – Message Authentication Codes (MAC). Part 1: Mechanisms using a block cipher

ISO/IEC/TR 10000-1 Information technology – Framework and taxonomy of International Standardized Profiles – Part 1 – General principles and documentation framework

ISO/TS 17574 Electronic fee collection – Guidelines for security protection profiles

**Legislation**

Roads Act 1993 (NSW)