

TRANSPORT FOR NSW (TfNSW)
TfNSW SPECIFICATION D&C TS916
MOTORWAY SYSTEMS –
ELECTRONIC TOLL COLLECTION SYSTEM

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REVISION REGISTER

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Ed 2/Rev 0		Spec title changed. New edition, completely rewritten. Descriptions of changes to previous versions are no longer relevant, and are not listed.	DCS	04.03.20
Ed 2/Rev 1	Global	References to “Roads and Maritime Services” or “RMS” changed to “Transport for NSW” or “TfNSW” respectively. References to “RMS Representative” changed to “Principal”.	DCS	22.06.20

GUIDE NOTES

(Not Part of Deed)

Using Specification D&C TS916

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

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

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



MOTORWAY SYSTEMS - ELECTRONIC TOLL COLLECTION SYSTEM

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VERSION FOR: DATE:

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FOREWORD

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REVISIONS TO PREVIOUS VERSION

This document has been revised from Specification TfNSW D&C TS916 Edition 2 Revision 0.

TfNSW SPECIFICATION D&C TS916

MOTORWAY SYSTEMS - ELECTRONIC TOLL COLLECTION SYSTEM

1 GENERAL

1.1 SCOPE

1.1.1 General

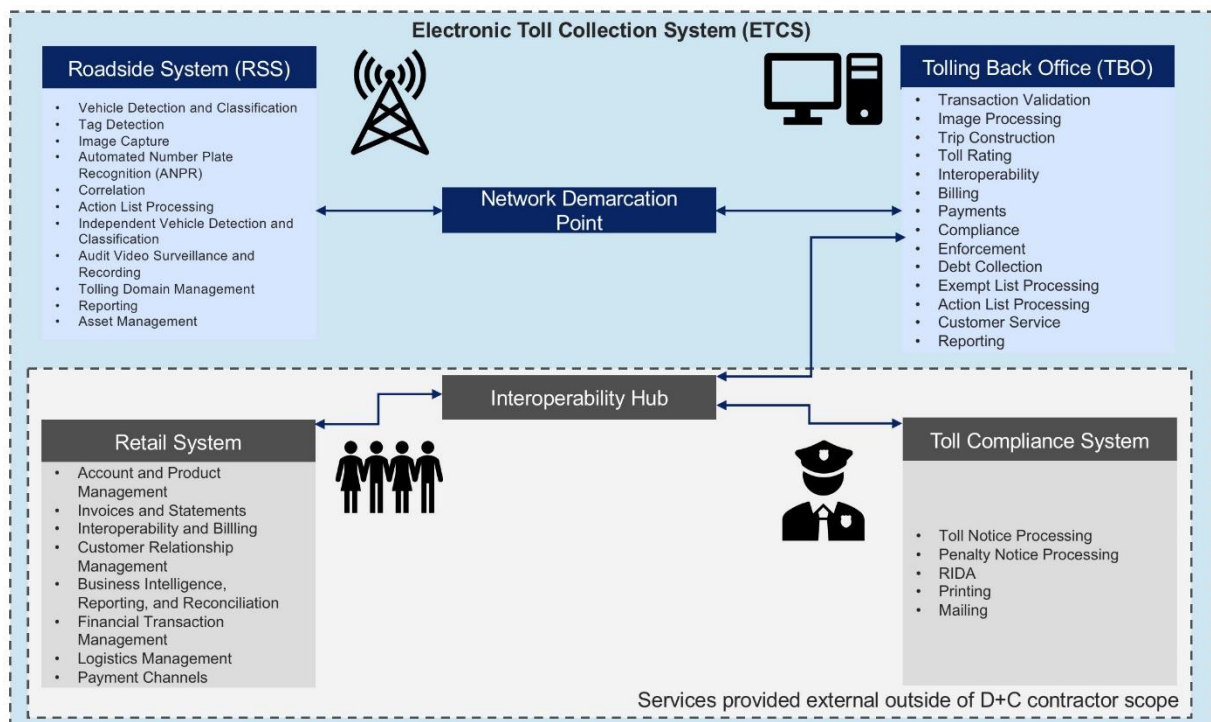
The Electronic Toll Collection System (ETCS) must be a fully automated tolling system that:

- (a) identifies vehicles using the Motorway, which can include identification via tag, licence plate number or other means as gazetted at the time;
- (b) collects fees for use of the Motorway from those with a Valid Arrangement;
- (c) collects fees for use of the Motorway for No Arrangement Trips.

The ETCS must provide for variable toll charges based on different tolling schemes such as discrete toll points or “closed” distance-based systems and is based on vehicle classification, distance, time of day, and fixed tolls or combinations thereof, in accordance with the Deed.

1.1.2 Context Overview

The following illustration depicts the different logical systems that comprise the ETCS and external interfacing systems.



The Electronic Toll Collection System (ETCS) enables the electronic collection of fees for use of Motorway by means of electronic equipment mounted on the roadside and in vehicles.

The ETCS comprise the following components:

- (a) Roadside System (RSS), comprising all equipment and associated power and communications infrastructure located along the road, either fixed or mobile, that enables downstream fee collection from vehicles travelling on the Motorway. This includes equipment used to detect vehicles, classify vehicles, communicate with tags, capture images, and aggregate data to enable fee collection by the TBO.
- (b) Tolling Back Office (TBO), which processes data collected from the roadside to apply the associated fee(s) for a Trip and collect payment for the fee.
- (c) Retail System, which issues an account to a motorist and is responsible for all commercial and customer relationship dealings with the motorist to whom it has issued an account. The account is used to be pay fees for travel on the Motorway. The account may be linked to a Tag or Pass.
- (d) Toll Compliance System (TCS), which issues notices under applicable legislation in relation to the liability of persons to pay Tolls and Administration Charges in respect of any use of the Motorway.

The ETCS uses logical and physical demarcation points to interface between components as follows:

- (i) Network Demarcation Point. The RSS provider is responsible for the carriage of data from the RSS to the telecommunications boundary between the RSS and TBO provider. The TBO provider must ensure the Network Demarcation Point is available to receive data from the RSS and must ensure that such data when made available is transmitted to the TBO and vice versa.
- (ii) Interoperability Hub. This is a secure data transfer gateway which acts as a communications hub enabling secure transfer of data between operators.

1.1.3 Retail System Context

Retail System are provided by others and are not part of the Contract. For context, Retail System include the following functions:

- (a) Account and Product Management, which has the capability to issue customers with accounts and products to enable payment of fees for travel on the Motorway. This may include tag or pass based products.
- (b) Invoices and Statements issuance, which has the capability to configure, generate, and render invoices and statements for accounts.
- (c) Interoperability and Billing, with the ability to generate interoperable list and billing files in compliance with the MoU and settle financial payments of bills with tollroad operators.
- (d) Customer Relationship Management, providing the contact management functionality for all contact from Customers and non-Customers, and functionality for the management of resolution of these contacts including support for multiple contact channels such as phone, email, web, and post.
- (e) Business Intelligence, Reporting, and Reconciliation, with the capability to collect, classify and retain all data processed to enable comprehensive analysis of customer and system processing over time.
- (f) Financial Transaction Management, responsible for generating financial transaction records for each financial event and support journal creation, and mapping to corporate general ledger

systems.

- (g) Logistics Management, with the capability to manage the supply chain for Tags, brackets, vouchers, and external correspondence.
- (h) Payment Channels, with the capability to provide customers with electronic payment channels to accept through multiple forms of cash (e.g. credit card, direct debit, BPay, etc).

1.2 RELATED SPECIFICATIONS

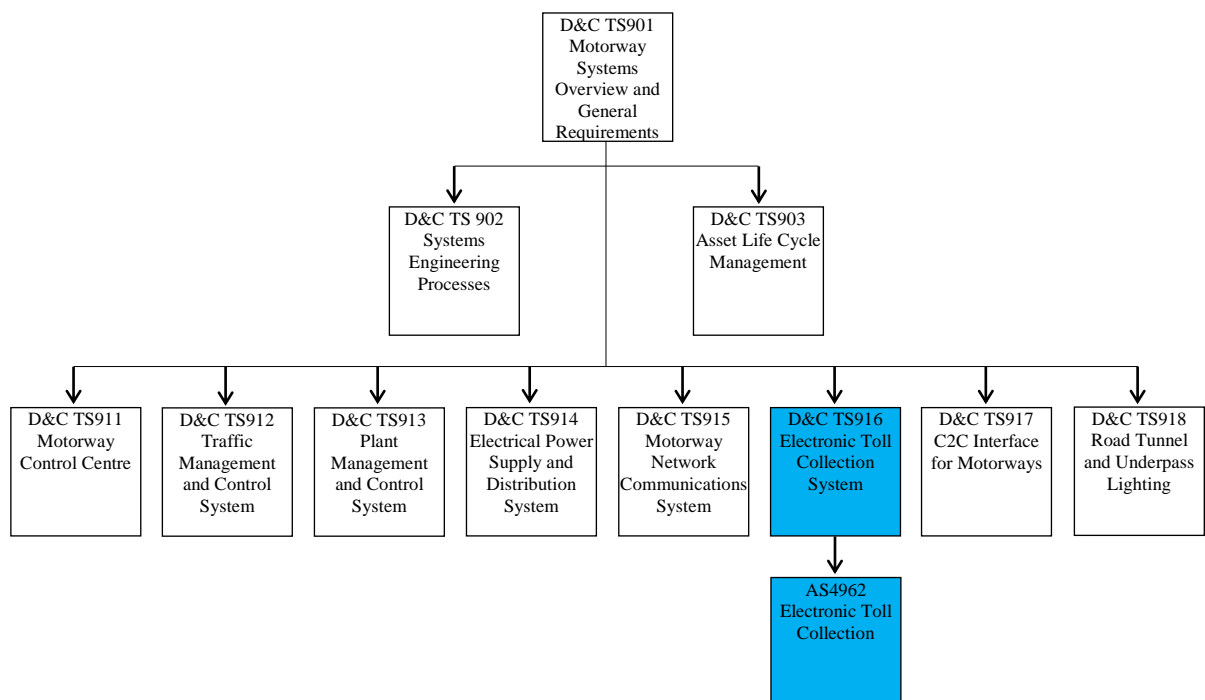
This Specification is a Level 2 document which forms part of the suite of TfNSW specification documents for Motorway Systems (see figure of documentation tree below). Other documents within the suite are:

Level 1

- D&C TS901 “Motorway Systems Overview and General Requirements”.

Level 2

- D&C TS902 “Systems Engineering Processes”.
- D&C TS911 “Motorway Systems - Motorway Control Centre”;
- D&C TS912 “Motorway Systems - Traffic Management and Control System”;
- D&C TS913 “Motorway Systems - Plant Management and Control System”;
- D&C TS914 “Motorway Systems - Electrical Power Supply and Distribution System”;
- D&C TS915 “Motorway Systems - Motorway Network Communications System”;
- D&C TS917 “Motorway Systems - C2C Interface for Motorways”;
- D&C TS918 “Motorway Systems - Road Tunnel and Underpass Lighting”.



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 TfNSW D&C Q6 for the definition of **HOLD POINTS**.

The records listed in Annexure TS916/C are **Identified Records** for the purposes of TfNSW 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.

References to “Memorandum of Understanding” or “MoU” means the “Tollroad Owners Memorandum of Understanding for Electronic Toll Collection”.

“Interoperability” and “interoperable” as used in this Specification mean:

- (a) the RSS must be able to complete a transaction with any other On-board Equipment from an issuer within Australia, where that tag has been produced in compliance with the standards and specifications which are referenced in Annexure TS916/M ;
- (b) the RSS must be able to accommodate and be interoperable with the implementation of DSRC standards and ETCS applications interface standards in all other ETCSs operating in Australia as specify in AS 4962 (and referenced in Appendix B of the MoU).

The following definitions apply to this Specification:

Action Lists Category of lists that elicit a specific action when processing Trips with vehicles / tags on the list. This includes the Blacklist and Orange List.

Automated Vehicle Identification Processes used to establish the identity of a vehicle (including LPI and vehicle class) from images and measured characteristics captured for the vehicle without intervention by an operator.

AVI Reference Data	Information concerning a previously identified vehicle stored in the system and applied to enable the automated identification of the vehicle.
Blacklist	A source of information for identifying invalid Tags in order to assist processes for the recovery of the toll by means other than the associated account.
Detection Zone	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.
Entry Transaction	A Transaction corresponding to the entry of a vehicle on to the tollroad.
ETC Tag / Electronic Tag	An electronic device which can be mounted in a vehicle for the purpose of identifying the tag issuer and associated account to be charged for the vehicle passing through a Detection Zone. Also referred to as On-board Equipment.
ETC System / Tolling Back Office	A computer system which processes tolling data supplied by the RSS for the purpose of fee collection. Also known as the Tolling Back Office.
Exempt Vehicle	A vehicle exempt from tolls on tollroads in NSW.
Exit Transaction	A Transaction corresponding to the exit of a vehicle from the tollroad.
Home Tollroad	In respect of a Party means each tollroad operated by that Party and in respect of which the Party is entitled to collect tolls.
Image-based Processing	Where a Transaction is processed primarily according to information extracted from images of the detected vehicle.
Image Processing Fee	A fee that may be applied to a Trip made by a vehicle travelling without a Valid Tag.
Integrity	The property that data has not been altered or destroyed in an unauthorized manner (source: ISO/TS 17574).
Interoperability Hub	An internet connected communications hub enabling secure transfer of encrypted data between operators.
Invalid Tag	A Tag for which either: <ul style="list-style-type: none">(a) the RSS is unable to detect the Tag; or(b) the issuer of the Tag is not configured in the RSS as being able to accept transactions at the time of travel; or(c) the RSS knows that the Tag is invalid, typically on the basis of inclusion of the Tag on a Blacklist of invalid tags.
License Plate Information	License Plate Information consists of License Plate Number and State of Registration.
Manual Consolidation Screen	Application screen(s) by which an operator can manually identify a detected vehicle.

No Arrangement Trip	A Trip on a tollroad that is not subject to a valid (tolling) arrangement.
On-board Equipment	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.
Operator	The provider of an electronic toll collection service, i.e. the organisational entity that issues and accepts payment means for the right to use certain infrastructure.
Orange List	List of Tags maintained by a Tag Issuer, which are connected to accounts where the account balance is below the threshold, used by the Tag Issuer as a reminder to top-up the account.
Orphan Trip	Trip with only one Transaction, being an entry Transaction or an exit Transaction.
Pass Issuer	An entity which, on the basis of Roaming Agreements covering Pass user products with current operating tollroads, establishes a Pass with a Customer and is responsible for all commercial and customer relationship dealings with that Customer with whom it has entered into a Pass User Agreement.
Roadside System	All equipment and associated power and communications infrastructure located along the road, either fixed or mobile, that enables downstream fee collection from vehicles travelling on the Motorway. This includes systems used to detect vehicles, classify vehicles, communicate with tags, capture images and aggregate data to enable fee collection by the TBO.
Roaming Agreement	An agreement between two Parties which contains terms and conditions relating to the Interoperability of Tags / Passes on their respective Home Tollroads.
Tag	Refers to an ETC Tag.
Tag Issuer	An entity which, demonstrating an Interoperable capability with all existing tollroads, issues to a Customer a Tag and with whom the Customer has entered into an Electronic Tolling Agreement. The Tag Issuer is responsible for all commercial and customer relationship dealings with the Customers with whom they have entered into an Electronic Tolling Agreement.
Tag-Based Processing	Where a Transaction is processed primarily according to information acquired from a Tag in the context of the transaction.
Toll Compliance Services	Issuing of notices under applicable laws in relation to the liability of persons to pay Tolls and Administration Charges in respect of any use of the Motorway, and the taking of certain enforcement proceedings in respect of such notices under applicable laws.
Toll Notice	A Notice issued to a motorist, directing payment of a toll and possible an administration fee, following non-payment of a toll after passing a toll point.
Toll Point	The contiguous area that fully encompasses one or more Detection Zones, the gantry foundations, equipment bases and maintenance access infrastructure for the Roadside Equipment.

Transaction	Set of records captured by the system that arise from single passage of a vehicle through a Detection Zone, including records captured for all Tags carried by the vehicle, records captured concerning the detection and classification of the vehicle and images captured of the vehicle.
Trip	A passage of a vehicle past a Toll Point or series of Toll Points on a given tollroad.
Valid Arrangement	An active account or arrangement between a road user and a toll operator or retail operator (excluding any account or arrangement that is in suspension) that is supported by a Roaming Agreement (where applicable).
Valid Tag	A tag which is not an Invalid Tag.
Write-off Processing	Occurs where there is insufficient information acquired for the Transaction to be able to recover the toll for the road usage.

1.4.2 Acronyms

The following acronyms apply to this Specification:

AIS	Asset Information System
AVI	Automatic Vehicle Identification
ANPR	Automatic Number Plate Recognition
CPU	Central Processing Unit
DSRC	Dedicated Short Range Communication
EFC	Electronic Fee Collection
E Tag	ETC Tag or Electronic Tag
ETC	Electronic Toll Collection
ETCS	Electronic Toll Collection System
GUI	Graphical User Interface
IDCN	Independent Data Communication Network
I/O	Input / Output
IVDCS	Independent Vehicle Detection and Classification System
LPI	License Plate Information
LPN	License Plate Number
MAC	Message Authentication Code
MNCS	Motorway Network Communications System
MoU	Memorandum of Understanding
NAT	No Arrangement Trip
OBE	On-board Equipment
TfNSW	Transport for NSW
RSS	Roadside System
RTTT	Road Transport and Traffic Telematics

SoR	State of Registration
TBO	Tolling Back Office System
TfNSW	Transport for New South Wales
TP	Toll Point
VDCS	Vehicle Detection and Classification System
WAE	Work-As-Executed

2 ELECTRONIC TOLL COLLECTION SYSTEM

2.1 GENERAL REQUIREMENTS

- (a) The ETCS and its components are described in Clause 1.1.2.
- (b) The key functional requirements for the RSS are described below:
 - (i) **Vehicle Detection and Classification** – Detect vehicles travelling on the tollroad, classify the vehicle class, and transmit the relevant data to the TBO for the purpose of fee collection.
 - (ii) **Tag Detection** – Communicate with the tag mounted on vehicles to extract the relevant data for the purpose of fee collection. Also advise the status of the tag or account to enable audible “beeps” for the customer to be alerted to the status of their account.
 - (iii) **Image Capture** – Capture and process images of the vehicle for the purpose of fee collection.
 - (iv) **Automated Number Plate Recognition** – Attempt to automatically capture the Licence Plate Information (LPI) details for each vehicle passing through the tolling gantry.
 - (v) **Correlation** – Accurately correlate vehicle, tag, and image data records to produce a vehicle passage for fee collection.
 - (vi) **Action List Processing** – Receive and store Blacklist and Orange List to enable communication with the tag of the tag or accounts status.
 - (vii) **Independent Audit Systems** – Independent mechanism for assessing the RSS detection, tracking, measurement, and classification capability including video surveillance and recording.
 - (viii) **Tolling Domain Management** – Enable maintenance, monitoring, configuration, logging, and management of the RSS.
 - (ix) **Reporting** – Provide reporting on the RSS performance for the purpose of auditing and reconciliation with the TBO.
 - (x) **Asset Management** – Allow end-to-end lifecycle asset management of all RSS assets including planned and reactive maintenance.
- (c) The key functional requirements for the TBO are described below:

- (i) **Transaction Validation** – Validate Transactions to ensure customers are not charged multiple times and to maximise fee collection.
 - (ii) **Identify and Classify Vehicles** – Allow for automatic and manual processing of vehicles detected and assignment of the vehicle class.
 - (iii) **Image Processing** – Allow for automatic and manual determination of the vehicles LPI.
 - (iv) **Trip Construction** – Allow for assignment of separate Transactions belonging to the same vehicle to be formed as a unique Trip.
 - (v) **Toll Rating** – Apply a toll rating to a Trip to cover the different rating strategies including distance-based, time of day, and class-based tolling.
 - (vi) **Interoperability** – Comply with the MoU to facilitate fee collection with multiple Tag / Pass Issuers with multiple Tag / Pass Issuers and No Arrangement Trips.
 - (vii) **Billing** – Invoice Tag / Pass Issuers for Trips made by their customers on the tollroad.
 - (viii) **Compliance and Enforcement** – Issue Toll Notices and Penalty Notices for No Arrangement Trips (NAT).
 - (ix) **Payments** – Collect payment from Tag / Pass Issuers and customers for toll notices.
 - (x) **Debt Collection** – Provision of data to allow pursuit of outstanding debt through civil debt recovery actions as an alternative to issuing a penalty notice by the State Debt Recovery Office.
 - (xi) **Exempt List Processing** - Exempt specific vehicles / tags from fees such as Police or Ambulance.
 - (xii) **Action List Processing** – Transmit the Blacklist and Orange List files to the RSS in order for the RSS equipment to provide the appropriate audible tag “beep” in vehicles advising the status of the customer’s account.
 - (xiii) **Customer Service** – Provision of screens and functionality to support customer queries and complaints.
 - (xiv) **Reporting** – Reporting functionality to effectively support the operations of the tollroad.
- (d) Time synchronisation management across the ETCS network (synchronised to Motorway network time, i.e. via Motorway Network Communications System (MNCS) Network Time Protocol Server), to within one second, that is consistent and accurate and is audited for accuracy.

2.2 KEY STANDARDS

- (a) The ETCS must comply with AS 4962, which sets out the specific parameters and data elements forming the basis for national interoperability amongst all Australian tollway operators.
- (b) The ETCS must comply with the other Standards for ETC listed in Annexure TS916/M.
- (c) 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 MoU.

- (d) In relation to interoperation between tollway operators and Tag / Pass Issuers, the Contractor must abide by the agreements in the agreed Roaming Agreements.
- (e) The ETCS must comply with the Registration Information Disclosure Agreement including Business Rules for the Automated Release of Information, in order to obtain registration information of owner of the vehicle that performed the Trip to pursue outstanding toll notice debt through civil debt recovery.
- (f) The ETCS must comply with the Protection of Cardholder Information Data Security Standard when taking payments card related payments.
- (g) In relation to security, the ETCS must comply with AS/NZS ISO/IEC 27001 and AS/NZS ISO/IEC 27002.
- (h) The development and delivery of ETCS must comply with Specification TfNSW D&C TS921.

3 ROADSIDE SYSTEM (RSS)

3.1 GENERAL

- (a) Toll Points (TP) must provide full coverage of the Motorway traffic as well as vehicles entering and exiting.
- (b) TPs must allow for operation of the Motorway's tolling method (whether distance based, time of day or fixed, or combination thereof) in accordance with the Contract.
- (c) The RSS must be capable of the real-time processing necessary to manage constrained, or multi-lane free flow vehicle detection and tolling at speeds up to 160 km/h.
- (d) The RSS must incorporate lane control and system management to detect vehicles and transact through the tag reader with a tag, or more than one tag, simultaneously as well as capture vehicle image data if necessary. The tag reader must match the tag with the corresponding detected and classified vehicle to determine the correct toll based on the vehicle classification and to allow positive identification of vehicles without tags or without working tags.
- (e) The RSS must perform a graceful shutdown of all equipment when:
 - (i) UPS capacity is near depletion and there is no power supply available (whether from mains or generator); or
 - (ii) there is a high or over-temperature alarm for the ambient temperature inside any equipment enclosure.

3.2 FUNCTIONAL REQUIREMENTS

The RSS must comprise the functions listed under Clauses 3.2.1 to 3.2.11.

3.2.1 Vehicle Detection and Classification

- (a) The RSS 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 Specification;
 - (iii) transmit vehicle detection classification and spatial data (where available), to the Tolling Back Office (TBO).
 - (iv) detect all vehicles travelling at all speeds up to 160 km/h through the Detection Zones;
 - (v) 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;
 - (vi) detect all vehicles with trailers and articulated vehicles as a single vehicle unit;
 - (vii) 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 inter-vehicle spacing of 100 mm for every 10 km/h of vehicle speed above the posted speed limit;
 - (viii) 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.
- (b) The RSS must operate reliably in all weather conditions and ambient light conditions, from both natural and man-made sources, experienced at every toll charging point.
 - (c) The operation of the RSS must not distract drivers. In case of optical vehicle detection and classification, the artificial illumination required must be less than the ambient artificial illumination levels or preferably use invisible illumination such as infrared.
 - (d) The RSS must transmit data at a rate which supports the correlation of the vehicle position with tag position in the lane and the RSS must process the location data in real-time.
 - (e) The RSS 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%

- (f) The RSS must detect, classify and, where multi-lane free flow tolling operates, spatially locate every vehicle passing the TP (including the lane in which the vehicle is travelling) and identify them in accordance with the vehicle classifications defined in AS 4962 Appendix E1.2 “Vehicle classification in NSW”.

3.2.2 Tag Detection

- (c) Tolling of Motorway users can be performed by the RSS, which enables tag detection and identification data to be read from the vehicle mounted On-board Equipment (OBE) by fixed roadside tag readers.
- (d) The RSS must operate continuously to receive data from an OBE within a defined vehicle Detection Zone at the toll charging points to complete a tolling transaction.
- (e) The RSS operation must be interoperable with all other OBE operating to the standards and specifications which are referenced in Annexure TS916/M. (Refer Clause 1.4.1 for meaning of interoperable / interoperability.)

- (f) The RSS 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 on-coming vehicle. The RSS must be capable of transacting with ETC tags installed on two narrow vehicles, such as motorcycles, travelling side by side in a single lane.
- (g) The RSS must be designed and configured for correct association of the tag with the vehicle in which the tag is located, within the multi-lane free flow environment.
- (h) The RSS hardware must be suitable for the local ambient environment (including temperature and enclosure ratings) as well as all other issues affecting the reliability of the ETCS.

3.2.3 Image Capture

- (a) The RSS must capture clear and detailed images of all vehicles in the Detection Zones. The RSS must associate, without error, the appropriate enforcement data with an image to initiate enforcement action, if required.
- (b) The RSS must use toll cameras that are gazetted in accordance with section 250A of the *Roads Act 1993 (NSW)*.
- (c) The RSS must provide vehicle identification and Trip data as required by section 250A of the *Roads Act 1993 (NSW)*.
- (d) The RSS 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, model and colour of the vehicle.
 - (iii) contain the top, rear view and the front view vehicle images. The image used for enforcement must not show the driver and passenger. The front view vehicle image may show the image windshield for visual determination of OBE placement.
 - (iv) provide a black-and-white or monochromatic image of the front of the vehicle clearly showing the licence plate for identification purposes.
 - (v) provide a black-and-white or monochromatic image and/or colour image of the rear of the vehicle showing the rear licence plate and colour of the vehicle to facilitate vehicle identification process.
 - (vi) provide a black-and-white or monochromatic image of the top of the vehicle clearly to assist with vehicle class assessment and identification of trailers.
- (e) The RSS must show:
 - (i) the date and time of the image within an accuracy of 1.0 second relative to the Motorway time reference source;
 - (ii) Toll Point (TP), including lane and direction of travel;

- (iii) tollway operator or Motorway identification;
- (iv) a unique reference identification data for vehicle records, to an image to provide a complete vehicle record.
- (f) The RSS must capture images with the vehicle in a consistent location on the carriageway at each TP, including where the TP spans multiple lanes.
- (g) The RSS must in all cases clearly identify the subject vehicle within all captured images.
- (h) The RSS must strictly match the image and the data block in each image record.
- (i) The RSS 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.
- (j) The RSS must generate a digital data security certificate authenticator over the entire image and data block to provide confirmation that the image 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 image data and be stored in the TBO 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.

- (k) Any light sources required at the TP to fulfil the requirements of this specification must not result in an adverse visual impact to the surrounding environment; nor impact the safe operation of oncoming vehicles.
- (l) The image capture cameras must be certified at least every 90 days by personnel authorised to install and inspect approved toll cameras in accordance with section 250A of the *Roads Act 1993 (NSW)*.
- (m) The RSS function must record the images required by this specification irrespective of the vehicle position within the lane boundaries including instances where the target vehicle is straddling the two lanes. It is acceptable to record multiple image file sets under these circumstances.
- (n) Images must be captured for at least 99.95 percent of all vehicle detections.
- (o) The RSS must retain all image sets for a period of at least 7 days.
- (p) Partial image set capture (where the images required by this specification are not all captured but the rear colour scene image is included) must not occur for more than 0.1 percent of all vehicle detections.

3.2.4 Automated Number Plate Recognition

- (a) An Automated Number Plate Recognition (ANPR) result must be captured for each vehicle passing through the tolling gantry. Each ANPR result must include:
 - (i) vehicle license plate number (LPN);

- (ii) confidence level for each character detected within the LPN;
 - (iii) confidence level for entire LPN ANPR result;
 - (iv) vehicle state of registration (SoR);
 - (v) confidence level for SoR OCR result.
- (b) The ANPR system must support all Australian LPN formats and SoR.
- (c) The image processing at RSS level must not preclude further image processing e.g. Automatic Number Plate Recognition (ANPR) at TBO. As such, a TBO image must be provided in an uncompressed format.

3.2.5 Correlation

- (a) The RSS must perform all functions required to accurately correlate vehicle, tag, and image data records to produce a vehicle passage record, or vehicle passage record set, in accordance with this Specification for all vehicles.
- (b) Image capture data must be generated for vehicles to allow for determination of toll infringements in the TBO.
- (c) Irrespective of the RSS correlation outcomes, all vehicle detection, tag transaction, and image set records must be stored at each TP and forwarded for processing and storage by the TBO.
- (d) The RSS must provide reconciliation processes and reports between all subsystems and the TBO to account for all records and resolution of records into valid vehicle passage records. Contiguous numbering of all messages and a mechanism for automatic retrieval of all missing messages are together considered sufficient to meet this requirement.
- (e) The RSS must correlate at least 99.90 per cent of all tag transactions for vehicles with a correctly fitted tag.

3.2.6 Action List Processing

- (a) The RSS must receive and store Blacklists and Orange Lists received from the TBO.
- (b) The RSS must communicate with and set the correct Man Machine Interface command code for all detected OBE in accordance with the Blacklists and Orange Lists”.
- (c) The RSS must be capable, as a minimum, of managing an Action List comprising 10,000,000 tags registered on Australian tollways. Operational tags must be validated by the RSS within 5 milliseconds during the passage of a vehicle through the Detection Zone at any speed up to 160 km/h.
- (d) The RSS must provide the means to regularly and automatically update the Blacklists and Orange Lists at a maximum interval of once every 24 hours, but configurable to more frequent intervals.

3.2.7 Independent Audit Systems

- (a) Independent vehicle detection and classification must be installed as part of an audit system to provide accurate traffic detection, tracking, measurement and classification of all vehicles travelling under the tolling gantries.
- (b) The audit system must operate independently of the RSS.

- (c) Individual vehicle and consolidated traffic data captured by the audit system must be kept for audit purposes.
- (d) Video surveillance must be installed as part of the audit system to continuously record all vehicles passing under the tolling gantries.
- (e) The video surveillance must provide clear passage video where the LPN of each vehicle is visible and readable.
- (f) The video surveillance must be provided as a complement to the RSS vehicle detection and classification and the audit system vehicle detection and classification, for use in auditing the detection rate and accuracy of the RSS.
- (g) The video recording must be retained for a minimum of 7 days.

3.2.8 Tolling Domain Management

- (a) The RSS must provide the following functionality:
 - (i) display of passage data from selected TPs on request. Passage data must include video, vehicle detection and classification and tag data captured at each Detection Zone;
 - (ii) extended search functions on tag issuer ID, Contract Serial Number, LPN, Detection Zone ID and time of passage;
 - (iii) image zooming capability;
 - (iv) management of RSS alarm subscriptions and email / SMS notification;
 - (v) collection, storage, and presentation of system status messages, quality indicators and alarm messages;
 - (vi) configuration management of RSS;
 - (vii) remote diagnostics of all RSS equipment;
 - (viii) management of the remote download, local storage and deployment of new software applications and releases;
 - (ix) collection and presentation of logs and reports for each DZ;
 - (x) provision of remote access to near real-time (where there is a maximum of five second latency between actual detection and display at each TP);
 - (xi) display of RSS transactional data and equipment health status.
- (b) When a temporarily isolated TP reconnects to the RSS, all unsent data, including alarms / status messages, configuration data and parameter data, must be uploaded automatically.
- (c) Security changes, configuration changes and log on/off performed by all users on the RSS affecting RSS functions or RSS generated data must have a complete audit trail.
- (d) All RSS component configuration data must be available for display and updating.
- (e) Configuration data must also be available for editing at the TP; i.e. from the technical shelter.

- (f) If configuration are modified at the TP, these data must immediately, data communications permitting, be uploaded to the RSS.

3.2.9 Reporting

- (a) Each TP must, on a periodic (configurable) basis, report on the following Detection Zone values to the RSS the number of:
 - (i) vehicle detections;
 - (ii) tag transactions;
 - (iii) LPN images captured;
 - (iv) IVDCS vehicle detections.
- (b) The reporting period must be configurable for each Detection Zone within a TP.
- (c) All reports must be available to be exported for auditing and reconciliation purposes with the TBO.

3.2.10 Asset Management

- (a) The RSS asset management must be integrated with the Asset Information System (AIS) to allow the configurable delivery of RSS asset and asset status information to the AIS.
- (b) System assets and configuration parameters must be version controlled in a sequential number series.
- (c) The asset management function must contain a comprehensive set of RSS operations, maintenance and support documentation (refer Clause 6) in electronic format.
- (d) The asset management function must maintain a full history of all maintenance / inspection history including asset condition details. This must include:
 - (i) performance characteristics (if relevant);
 - (ii) faults, failures, degraded performance and the reasons for them;
 - (iii) maintenance undertaken;
 - (iv) spare parts used;
 - (v) location reference;
 - (vi) configuration management.
- (e) The asset management function must provide scheduling of all RSS preventative maintenance and inspection activities and associated documentation.
- (f) The asset management function must retain a historical record of all the data and information and that data and information must be made available for remote access and data / report extraction by TfNSW.

3.2.11 RSS Monitoring

- (a) The RSS Monitoring must be integrated with the AIS to allow the configurable delivery of RSS alarms and alerts to the AIS.
- (b) The RSS must support remote alarm configuration.

- (c) The internal illumination of technical shelters must be:
 - (i) automatically switched on during maintenance activities and switched off when the room is unattended;
 - (ii) able to be monitored and controlled remotely through the RSS.
- (d) Technical shelter fire detection system alerts must be logged through the RSS.
- (e) Change in status of the technical shelter door limit switch must be detected and an alert raised and logged through the RSS.
- (f) Alarm SMS and email notification subscription must be configurable.
- (g) Alarm display priority, filter, grouping, hierarchy and colour scheme must be configurable.
- (h) Status updates on alarms must be automatically updated in the alarms display without the need for a screen refresh.
- (i) It must be possible to suppress recurring alarms, and reactivate a suppressed alarm.
- (j) Alarms must be removed from the alarm display when the situation has been cleared and/or the alarm has disappeared.
- (k) Alarm subscription must be configurable with respect to:
 - (i) days in week and start time / end time for alarm reporting;
 - (ii) location (i.e. selected TP);
 - (iii) source (i.e. selected RSS component and ID);
 - (iv) alarm priority.
- (l) Alarm messages must contain at least the following information:
 - (i) date and time of alarm;
 - (ii) location (i.e. TP);
 - (iii) source (i.e. RSS component and ID);
 - (iv) alarm priority;
 - (v) explanatory text.
- (m) Functionality must be available to suppress alarms from the user interface for given TPs and/or equipment types for a given period of time.
- (n) It must be possible to acknowledge alarms from the user interface.
- (o) It must be easy for operators to visually discriminate between acknowledged and unacknowledged alarms.
- (p) The RSS must provide the following logging functions:
 - (i) All changes to system configuration parameters, events and alarms must be logged chronologically in a dedicated log with a time stamp and the appropriate user ID.
 - (ii) All interactions with the alarm system must be logged with a time stamp and the appropriate user ID.

- (iii) All interactions with the RSS equipment must be logged with a time stamp and the appropriate user ID.
 - (iv) The RSS must record all system process running history in electronic log files.
 - (v) The RSS must provide the ability for the manual setting of logging levels for each process.
 - (vi) Upon request, system log files must be made available the next day and must be selected and presented for viewing and investigation.
- (q) The RSS must provide a report generating capability including the following:
- (i) The RSS must support online report configuration and editing.
 - (ii) The report generating function must support filtering and search functions on the specific data elements available in each case.
 - (iii) Invocation of report generation must be possible by a time controlled report scheduler.
 - (iv) Invocation of report generation must be possible manually by dedicated command.
- (r) The RSS must include the monitoring of network communications systems, network equipment and all links into the RSS.

3.3 NON-FUNCTIONAL REQUIREMENTS

3.3.1 General

- (a) The RSS must incorporate sufficient redundancy to prevent loss of Transactions.
- (b) The RSS must support a seamless failover transition within 15 minutes after failure has been detected in a main unit.
- (c) The RSS must be capable of standalone operation for a minimum period of 15 days in the event of failure of communications links to the TBO. Under such conditions, the RSS 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 TBO with no loss of stored data.
- (d) Protective measures must be provided for the ETCS against:
 - (i) lightning strikes;
 - (ii) floods;
 - (iii) loss of power;
 - (iv) vehicle accidents;
 - (v) vandalism;
 - (vi) any other event that would disrupt tolling operations.
- (e) All functions of the RSS must be available or provided in a standalone manner and not be dependent on remote hosts or Motorway Network Communications System up links.
- (f) The RSS design and architecture must be scalable to support additional TPs.
- (g) The RSS must be designed to support local data storage of all system parameters, configuration data, and alarms for at least 12 months.

- (h) It must be possible to upload Transaction data by way of a portable digital storage device.
- (i) All electrical works must comply with D&C TS914.
- (j) RSS availability must be not less than 99.995%.

3.3.2 Information Security

- (a) The RSS must provide secure storage of information associated with enforcement events and enforcement evidence, ensuring that unauthorised access and use is blocked and that any tampering with the source document can be identified. (Refer to *Roads Act 1993 (NSW)* and *Roads Regulation 2008 (NSW)*.)
- (b) The RSS must have the capability to provide:
 - (i) availability of proof that evidence associated with an enforceable event has not been altered or tampered with;
 - (ii) reliable detection of any event where evidence collected in relation to an enforcement event has been tampered with.
- (c) Where personally identifying information is used or stored, the system must comply with the *Privacy and Personal Information Protection Act 1998 (NSW)* and relevant legislation regarding individual privacy and breaches of privacy.
- (d) The security architecture must be designed and implemented in accordance with the requirements in Appendix C of the MoU for the management of data security arrangements appropriate for the interoperation of ETC tolling between tolling operators.
- (e) The RSS must facilitate the loading of security keys remotely or locally through the use of Secure Access Modules where the secure data is virtually inaccessible and is only installed through a dedicated Interface with the RSS.
- (f) The RSS must ensure that the security key which is resident in the RSS is specifically protected from unauthorised or accidental discovery.

3.3.3 Backup and Archiving

- (a) All RSS Transaction data must be backed up and stored on local storage within the RSS for a minimum of 7 days.
- (b) The RSS must provide capability for backup of system logs, video, image, database and environment (excluding tolling tag transaction and image dataset) to an external device.
- (c) The RSS must provide capability for database and environmental restore. To avoid confusion, this includes restoring into an existing environment and restoring into a new environment e.g. to create a new environment.
- (d) The schedule set for all backup activities must be configurable by any single or combination of parameters, each satisfying a single value or range of values, including but not limited to:
 - (i) backup mode,
 - (ii) start time,
 - (iii) day of week, and day of month,
 - (iv) disk drives,

- (v) files, tables or datasets.
- (e) All backup data must be restricted from unauthorised access.
- (f) All backup activities must be recorded in a log.
- (g) All failures that occur during any backup process must trigger an alert and report the failure to the RSS.
- (h) The RSS must retain and archive data to comply with:
 - (i) all applicable New South Wales legislative requirements (such as *State Records Act 1998 (NSW)* and *Government Information (Public Access) Act 2009 (NSW)*);
 - (ii) applicable New South Wales legislative requirements for data relevant to enforcement;
 - (iii) the *Privacy and Personal Information Protection Act 1998 (NSW)* and relevant federal legislation regarding individual privacy and breaches of privacy.

3.3.4 Network Arrangement

- (a) The RSS must be connected to the Motorway Network Communication System (MNCS) in accordance with D&C TS915.

4 TOLLING BACK OFFICE (TBO)

4.1 FUNCTIONAL REQUIREMENTS

4.1.1 Validate Transactions

- (a) The TBO must be able to detect duplicate Transactions and process these Transactions such that customers are not charged multiple times for the same Transaction.
- (b) The TBO must be able to detect Tag Transactions that cannot be confidently correlated with a detected vehicle and process these Transactions such that fee collection is maximised without charging customers multiple times for the same Transaction.

4.1.2 Identify and Classify Vehicles

- (a) The TBO must be able to identify each vehicle detected passing through a Detection Zone through a range of identification strategies that must include:
 - (i) automatic and/or manual identification of the vehicle by analysis of images and measured characteristics of the vehicle;
 - (ii) automatic identification of the vehicle by use of information provided in a tag transaction for a Valid Tag being carried in the vehicle.
- (b) The system must include:
 - (i) Tag-Based Processing, where the Transaction is processed primarily according to information acquired from a Tag in the context of the Transaction.
 - (ii) Image-Based Processing, where the Transaction is processed primarily according to information extracted from images of the detected vehicle.

- (iii) Write-off Processing, where there is insufficient information acquired for the Transaction to be able to recover the fee or where the operator determines the Transaction is otherwise not chargeable.
- (c) The TBO must automatically submit to Image-Based Processing any Transaction where the only Tag correlated by the RSS to the vehicle detected in the context of the Transaction is any one of the following:
 - (i) a Tag included in a Blacklist; or
 - (ii) a Tag flagged as being “of interest”; or
 - (iii) a Tag that failed to successfully verify its identity within the context of the Transaction.
- (d) The TBO must maintain a configurable list of vehicle classes available to be assigned to a Transaction.
- (e) The vehicle classes maintained in the system, as a minimum, must contain those specified in the AS 4962.
- (f) The TBO must assign the appropriate vehicle class by considering the measured vehicle class by the RSS and/or the tag class detected by the RSS.
- (g) The TBO must be able to process any mismatch in measured vehicle class and tag vehicle class or an unrecognised vehicle class with the intent of minimising overcharging to the customer and reducing manual processing. Processing strategies can include:
 - (i) automatic submission to Image-Based Processing;
 - (ii) automatic assignment of the Transaction to the measured vehicle class by the RSS;
 - (iii) automatic assignment of the class for the Transaction to whichever the claimed or measured class is smaller.
- (h) The TBO must not apply an Image Processing Fee in the case where a tag associated to the Transaction has been detected even though the Transaction is submitted to Image-Based Processing. This can include events where:
 - (i) the Tag has been flagged as being “of interest”;
 - (ii) the tag class and the measured vehicle class at the RSS differs;
 - (iii) the RSS was unable to determine the measured vehicle class at the RSS.
- (i) Following vehicle identification and classification, the TBO must store sufficient information to enable billing for each Transaction. As a minimum, this should include:
 - (i) the date, time, tollroad, Detection Zone (or TP and Lane) where the Transaction occurred;
 - (ii) any information used to identify the vehicle including:
 - Licence Plate Information (i.e. LPN and SoR);
 - vehicle class;
 - Tag information;
 - (iii) link(s) to all images retrieved from the RSS;
 - (iv) link(s) to all image referenced data used for automated identification of the vehicle.

4.1.3 Image Processing

- (a) The TBO must be able to automatically identify vehicles from images captured as part of a Transaction created from a detected vehicle passage.
- (b) When automatically identifying a vehicle from images, the TBO must determine and record the confidence level in the accuracy of vehicle identification (LPN and SoR) for the vehicle.
- (c) The TBO must provide a screen(s) (referred to here as the Manual Consolidation Screen) through which an operator can manually identify a detected vehicle.
- (d) The TBO must ensure that an operator is unable to change any information for the vehicle as sent from the RSS including images.
- (e) The Manual Consolidation Screen must present to the operator all associated images of the vehicle (e.g. front, rear, and rear colour images) to assist in identifying the vehicle.
- (f) The Manual Consolidation Screen must provide the operator with data entry fields for the operator to manually enter each of LPN, SoR, and Registration Plate Type for the vehicle.
- (g) The Manual Consolidation Screen must enable the operator to identify a vehicle as being an Exempt Vehicle. Examples of Exempt Vehicles include marked police cars and ambulances.
- (h) The TBO must enable the operator to enhance the readability of each image presented on the Manual Consolidation Screen by altering readability parameters such as colour, brightness, contrast, image contrast bit shift, and zoom.
- (i) The TBO must enable the operator to save the vehicle identification information from the Manual Consolidation Screen (termed an accepted manual consolidation).
- (j) The TBO must enable the operator of the Manual Consolidation Screen to assess that the vehicle is unable to be identified confidently from the available information (termed a rejected manual consolidation).
- (k) The TBO must enable an operator to maintain the list of reasons that are to be used for nominating the reason for rejecting a vehicle based on Manual Image Processing, where the configuration for each reason for rejection must include whether that reason arises either from a failure of the RSS or from an Unavoidable Unidentifiable Licence Plate.

Examples of reasons that may be used are Obscured Licence Plate, Unreadable Licence Plate, and Sun Glare.
- (l) The TBO must require that an operator making a rejected manual consolidation provide a reason for the rejection by selection from the configurable list of reasons maintained within the system.
- (m) The TBO must provide options for processing of rejected manual consolidations such as:
 - (i) automatic write-off as a technical loss;
 - (ii) referral to another operator specifically for the purpose of verifying rejected manual consolidations;
 - (iii) processing of the Transaction through Tag-Based Processing in the event a Valid Tag is present in the Transaction.
- (n) The TBO must provide screen(s) by which an operator is presented with the information relating to a rejected manual consolidation and through which the operator confirm the rejection or enter the correct Licence Plate Information.

4.1.4 Trip Construction

- (a) The TBO must provide for the assignment of Transactions to Trips in which a pair of sequential entry and exit Transactions performed by the same vehicle is identified as a unique Trip.
- (b) The TBO must create Trips from entry-exit pairs of Transactions with the intent of only constructing logical Trips minimising multiple charges to customers for a single Trip. As a minimum, entry-exit pairs may be matched where:
 - (i) the same vehicle must be identified as participating in each of the paired Transactions;
 - (ii) the entry Transaction must be earlier in time than the exit Transaction;
 - (iii) the combination of entry and exit Transactions must form a logical path in accordance with the topology of the tollroad;
 - (iv) at the time of Trip construction, there must be no Transaction known to the system involving the same vehicle and which falls in time between the entry Transaction and exit Transaction;
 - (v) the elapsed time between the Entry and Exit Transactions must not exceed a configuration period in accordance with tollroad topology.
- (c) The Trip construction process must consider appropriate time delays before finalisation of a constructed Trip to accommodate for:
 - (i) Tag-based Transactions that are unable to pair with a corresponding Entry / Exit Transaction are re-processed as an Image-based Transaction.
 - (ii) Image-based Transactions that are unable to be paired with a corresponding Entry / Exit Transaction to form a Trip are re-processed as an Orphan Trip.
 - (iii) Selecting the best fitting Transaction where another Entry / Exit Transaction may have already been incorporated into an existing Trip.
- (d) The TBO must, as a minimum, store the following information with respect of each Trip constructed:
 - (i) the entry Transaction for the Trip (if known);
 - (ii) the exit Transaction for the Trip (if known);
 - (iii) the vehicle identified as making the Trip;
 - (iv) the Tag identified for the Trip;
 - (v) each fee charged for the Trip.

4.1.5 Toll Rating

- (a) The TBO must be able to apply a configurable toll rating to a Trip where the toll can be based on:
 - (i) distance, or a specific combination of entry and exit Toll Points including situations where either entry or exit of a Trip is unknown;
 - (ii) time of day;
 - (iii) day of week;
 - (iv) vehicle class;
 - (v) special events (e.g. on Anzac Day, there is a toll free period on the Sydney Harbour Bridge and Tunnel).

- (b) The TBO must be able to support changes in toll rates. This is to accommodate for increases (or decreases) in fees such as annual or quarterly fee increases.
- (c) The TBO must be able to apply a configurable set of fees as agreed in Roaming Agreements and compliant with the MoU. Examples of such fees include image processing fees and toll notice transfer fees.

4.1.6 Interoperability

- (a) The TBO must comply with the MoU in relation to interoperability requirements.
- (b) The TBO must comply with the Motorway's established Roaming Agreement(s) with Retail Provider(s) in relation to interoperability requirements.

4.1.7 Billing

- (a) The TBO must comply with the Motorway's established Roaming Agreement(s) with Tag / Pass Issuer(s) in relation to billing requirements.
- (b) The TBO must integrate with the organisation's corporate financial system to record revenue.

4.1.8 Compliance and Enforcement

- (a) The TBO must comply with the MoU in regards to compliance and enforcement requirements.
- (b) The TBO must be able to provide supporting evidence of a nominated Trip to be submitted for any disputes regarding Penalty Notices.

4.1.9 Payments

- (a) The TBO must comply with the Motorway's established Roaming Agreement(s) with Tag / Pass Issuer(s) in relation to payment requirements.
- (b) The TBO must be able to reconcile payments made by Tag / Pass Issuer(s) and must allow for manual or automatic integration with the organisation's corporate financial system.
- (c) The TBO must provide payment channels to allow customers to pay for toll notices. The payment channels may include:
 - (i) online;
 - (ii) mail;
 - (iii) telephone.
- (d) The TBO must accept multiple methods of payment such as credit card, BPAY, cheque, cash, and tag account.
- (e) The TBO must provide appropriate access to operators to support customer queries and complaints regarding enforcement documents.
- (f) All payments must integrate with the Home Tollroads corporate banking and financial systems to enable recording of the payment and reconciliation or transfer of funds to bank accounts.

4.1.10 Debt Collection

- (a) The TBO must support an operator in obtaining details of repetitive toll violators to request their details from TfNSW to allow recovery of unpaid tolls through civil debt recovery action instead of the State Infringement Notice process in accordance with section 250A of the *Roads Act 1993 (NSW)*.
- (b) In providing data to allow pursuing a civil debt recovery action, the TBO must comply with the Registration Information Disclosure Agreement including Business Rules for the Automated Release of Information, in order to obtain registration information of owner of the vehicle that performed the Trip.

4.1.11 Exempt List Processing

- (a) The TBO must accommodate exempt vehicles by:
 - (i) identifying the passage of all exempt vehicles, by tag, video or another means;
 - (ii) logging the passage as an exempt vehicle category;
 - (iii) not charging tolls in accordance with the requirements of the Deed.
- (b) The TBO must allow registration of exempt vehicle and categories via manual and bulk upload of Licence Plate Information (LPI), tag, and associated categories.

4.1.12 Action List Processing

- (a) Action Lists received from tag issuers must be transmitted to the RSS in order for the roadside to provide the appropriate audible tag “beep” in vehicles advising of the status of the customer’s account.

4.1.13 Customer Service

- (a) The TBO must provide appropriate access to operators to support customer queries and complaints regarding the use of the Motorway including:
 - (i) Trips;
 - (ii) image processing;
 - (iii) enforcement;
 - (iv) billing;
 - (v) payments;
 - (vi) interoperability.

4.1.14 Reporting

- (a) The TBO must collect, classify and retain data processed through all components of the system in order to enable comprehensive analysis of road user and system behaviours over time for each tollroad.

The data must be provided as an integrated repository incorporating information concerning all significant events processed through the system and all significant dimensions relating to each of those events (e.g. Transactions and trips by reporting period, vehicle classification, automated image processing, and issuance of interoperability files).

- (b) The TBO must include a suite of standard reports and interactive analytical datasets to meet the reporting and analytical requirements of the Home Tollroad.

4.2 NON-FUNCTIONAL REQUIREMENTS

4.2.1 General

- (a) A suitable and robust computer system must be available for the TBO in-station host applications. All components of the TBO in-station computer system must be duplicated for redundancy.
- (b) Rigorous analysis of the potential risks of TBO failure and risk mitigation strategies must be undertaken and must demonstrate that the selected TBO design and provision of service meet the availability criteria requirements.
- (c) TBO design and configuration must be scalable to meet a 50% increase in future and short-term demand for additional functionality, scope and dimensions of the TBO functions. “Scalable” here means that the capacity of the TBO can be increased in terms of:
- (i) performance and speed of central processing units (CPUs);
 - (ii) main memory capacity;
 - (iii) disk memory capacity;
 - (iv) Input / Output (I/O) capacity;
 - (v) networking capacity;
 - (vi) task capacity (e.g. new tasks, applications, and increase in existing tasks).
- (d) The TBO must be capable of performing each function in a reasonable time when operating under full operational load.
- (e) Operators’ workstations for the TBO must provide the operators with a clear and unambiguous Graphical User Interface (GUI) to the whole of the TBO.
- (f) TBO workstations must be selected from computer and monitor hardware that provides a reliable operation and high-resolution graphical images.

4.2.2 Design Life

- (a) All computer server, storage and communications hardware components must have a design life of not less than 7 years.

4.2.3 Performance

- (a) The TBO must be capable of performing each TBO function in a reasonable time when operating under full operational load, including the following:
- (i) Completion of user interface tasks such that:
 - entering or changing a field value occurs within 0.5 seconds in 95% of cases;
 - committing a change to data occurs within 2 seconds in 95% of cases;
 - retrieving the next record for Manual Image Processing by an operator occurs within 0.5 seconds in 95% of cases;
 - retrieving the next record to be processed by an operator occurs within 2 seconds in 95% of cases.

- (ii) Other daily batch file processing to be completed without the TBO being put in backlog in 99% of cases.
 - (iii) Completion of a full system backup within 8 hours in 99% of cases.
 - (iv) Completion of archiving and data deletion processing within 8 hours in 99% of cases.
- (b) The TBO must be able to clear a backlog of unprocessed Transactions representing 72 hours of operations under full operational load within 48 hours whilst operating concurrently under full operational load while the backlog is being cleared. At the end of the 48 hours, the TBO must no longer be in backlog.
- (c) The availability of the TBO must be at least 99.9% in any 1-month period.
- (d) The TBO must have sufficient storage capacity to store on-line at least three years of data based on full operational load including all images captured of vehicles in the three year period based on 100% image capture of passing vehicles and one each of front, rear and rear colour image captured per passing vehicle.
- (e) The TBO must:
- (i) Achieve a manual image viewing time (being elapsed time from display of one image to display of the next image) of less than 0.5 seconds in 95% of cases under the following conditions:
 - The operator makes no change in the licence plate details presented by the TBO.
 - The TBO is operating under full operational load.
 - Manual image viewing is performed by a well-trained and experienced operator.
 - The operator is using a workstation that conforms to the minimum specification for operator workstations defined by the Supplier.
 - (ii) Achieve a manual image viewing time (being elapsed time from display of one image to display of the next image) of less than 6 seconds in 95% of cases under the following conditions:
 - The operator changes the full licence number, SoR and vehicle class details from those presented by the TBO.
 - The TBO is operating under full operational load.
 - Manual image viewing is performed by a well-trained and experienced operator.
 - The operator is using a workstation that conforms to the minimum specification for operator workstations defined by the supplier.
- (f) TBO must retrieve and display to an operator the information for historical Transaction and Trip information in less than 10 seconds in 95% of cases after a request has been submitted by the operator under the following conditions:
- (i) The TBO is operating under full operational load.
 - (ii) The operator is using a workstation that conforms to the minimum specification for operator workstations defined by the supplier.
- (g) The TBO must retrieve and display to an operator the information requested in any report supplied for image processing in less than 30 seconds in 95% of cases after a request has been submitted by the operator under the following conditions:
- (i) The TBO is operating under full operational load.
 - (ii) The operator is using a workstation that conforms to the minimum specification for operator workstations defined by the supplier.

- (h) Where not otherwise specified, the TBO must enable all operator tasks to be performed in timeframes consistent with industry standards for reasonably skilled operators performing comparable tasks.
- (i) The TBO must completely and accurately transmit every Blacklist and Orange List to every TP of the RSS within 30 minutes in 99.9% of cases.
- (j) The ETCS must provide all facilities needed to manage the ETCS and to supply data to the RSS and the TBO. Distribution of data between the RSS and TBO (and with individual TBO workstations) must occur at speeds demanded by application requirements to ensure integrity of the process.
- (k) Workstation based single event 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.
- (l) All screens designed for manual Image Processing must be designed to maximise the accuracy and efficiency of experienced operators.
- (m) The Manual Consolidation Screens must be able to display any image provided by the RSS.
- (n) Where not otherwise specified in this document, the system must enable all operator tasks to be performed in timeframes consistent with industry standards for reasonable skilled operators performing comparable tasks.
- (o) The proportion of Transactions that are automatically identified by the system where the AVI confidence level is equal to or greater than the agreed optimum AVI confidence level must be equal or greater than 75% as a minimum.
- (p) No more than 0.1% of those vehicles automatically identified by the system with an AVI confidence level equal or greater than the agreed optimum AVI confidence level are incorrectly identified.
- (q) The timing for issuance of interoperability files must comply with the Roaming Agreement(s) set with the Home Tollroad and the MoU.
- (r) The timing for Blacklist and Orange List updates to the RSS must be issued in accordance with the MoU.

4.2.4 Data Back-up

- (a) The TBO's storage architecture shall include support for an extensive back-up regime in accordance with industry best practice.
- (b) The TBO must provide a configurable, automated backup of TBO data.
- (c) The TBO must provide a configurable, automated backup of system logs, video files, image files, configuration files and environment settings.
- (d) All backups must be able to be captured directly to online storage media within the local network.
- (e) All backup data must be restricted from unauthorised access.
- (f) The TBO must enable both full and incremental backups to be performed.

- (g) The schedule set for all backup activities must be configurable by any single or combination of parameters, each satisfying a single value or range of values, including but not limited to: backup mode (whether full or incremental), start time, day of week, day of month, disk drives, files, tables or datasets.
- (h) The TBO must be capable of backing up the data while the TBO is online and operational.
- (i) The backup must operate in such a manner as to not adversely impact on the ability of the TBO to perform any operational function at a required performance level specified elsewhere in this Specification.
- (j) The TBO must provide notifications of the status of the backup, and in particular all failures that occur during any backup process must trigger an alert and report the failure to the maintenance operator.
- (k) The TBO must be capable of completing a full system backup within 8 hours when operating under full operational load.
- (l) The TBO must be capable of being restored from both TBO data and environmental backups to an environment nominated by the Operator. To avoid confusion, this includes restoring into any existing environment (whether production, test or development) and restoring into a new environment.
- (m) It must be possible to restore the TBO from a full system backup taken when the TBO was operating under full operational load and return the TBO to an operational state under full operational load within 16 hours.

4.2.5 Data Retention and Archival

- (a) The TBO must provide for long term data downloading for periodic archiving of historical traffic data and its later retrieval.
- (b) The TBO must retain and archive data to comply with:
 - (i) applicable New South Wales legislative requirements for data relevant to enforcement;
 - (ii) applicable Australian and NSW legislation, standards and best practice with respect to privacy;
 - (iii) applicable Australian accounting standards and best practice with respect to financial information within the TBO.
- (c) The TBO must maintain all data used by the functions of the TBO in a manner that ensures the consistency and integrity of the data between the various modules of the TBO at all times.
- (d) The TBO must store all information using a robust storage architecture that will not result in the corruption or loss of data in the event of a failure of any single element or sub-component.
- (e) The TBO must ensure on-line access to each data record until such time as the data record has been archived.
- (f) The TBO must implement archiving on a configurable periodic basis.
- (g) The TBO must enable archived data to be easily accessed or restored to the TBO as required.
- (h) The TBO must ensure data integrity is maintained between its operational components and the archive component.

- (i) The TBO must verify data in the archive component prior to removing data from the operational components of the system.
- (j) The TBO must enable an operator to easily retrieve and view archived image data.
- (k) Archiving must operate in such a manner as to not adversely impact on the performance of any operational function of the TBO.
- (l) The TBO must provide access to archived data records for at least 7 years.
- (m) The TBO must be capable of managing the archiving of data to an independent archive component through a configurable process (termed the Archive Process) and parameters which must as a minimum include criteria of:
 - (i) the type of information;
 - (ii) the Transaction / workflow state of the information;
 - (iii) for records and images relating to Transactions, the processing status of the Trip containing the Transaction;
 - (iv) for records and images relating to Trips, the processing status of the Trip;
 - (v) the age of the information.
- (n) As a minimum, the system must archive and retain data based on timeframes specified below:

Data Type	Archiving Time	Retention Time
Images associated with valid Tag based Transactions	30 days	Not required
Images associated with Vehicle based Transactions that are charged to an Account	180 days	7 years
Images associated with unpaid Toll Notices	7 years	7 years
Images associated with paid Toll Notices	90 days after payment	7 years
Images related to issuance of a penalty notice	10 years after the last action	10 years
Records documenting individual journeys where payment is made at point of Trip or within the required time frame such as: <ul style="list-style-type: none"> (a) Trip construction data for complex Trips over multiple tollways, Trip rating data, Trip capping data, and class based tolling data. (b) No Arrangements Trips where arrangement is made within 3 days of the Trip. (c) Third party data used as part of the Interoperability Data Exchange to provide for tolling interoperability in the Australian marketplace and interoperability action list data. 	2 years	7 years
Records relating to the issue of notices for tolls not paid at the point of travel and for management of breaches and infringements by vehicle owners and operators.	2 years	7 years

Note: “Archiving Time” and “Retention Time” are concurrent, not sequential.

4.2.6 Disaster Recovery

- (a) The TBO must be configured for high availability, including full redundancy and a controlled changeover from duty to standby operation performed in a seamless manner. A changeover must be achieved without:
 - (i) disruption to TBO tolling operations;
 - (ii) the need to reboot the standby computer;
 - (iii) the need to copy or upload data to disk drives.
- (b) Mirroring of all TBO data must be provided.
- (c) In the event of a failure of the primary or standby systems, the TBO must demonstrate recovery of the primary and standby systems within a maximum time of 48 hours.

4.2.7 Security

- (a) The TBO must comply with the AS/NZS ISO/IEC 27001 and AS/NZS ISO/IEC 27002.
- (b) The TBO must comply with the Protection of Cardholder Information Data Security Standard when taking payment card related payments.
- (c) The TBO must comply with the *Privacy and Personal Information Protection Act 1998 (NSW)* and relevant federal legislation regarding individual privacy and breaches of privacy.
- (d) The TBO must comply with all other applicable New South Wales legislative requirements (such as *State Records Act 1998 (NSW)* and *Government Information (Public Access) Act 2009 (NSW)*).
- (e) The TBO must comply with applicable New South Wales legislative requirements for data relevant to enforcement.
- (f) The TBO must, at all times, ensure the accurate and reliable recording of all Transactions and data into the database(s) supporting the TBO.
- (g) The TBO must maintain the integrity and security of all electronic data, audit trails, system and application error and run time log files at all times.
- (h) The TBO must ensure that sensitive data remains confidential and secure from unauthorised access.
- (i) The TBO must require that all users are positively identified to a standard at least as strong as username and pass phrase prior to allowing access to the functions of the TBO.
- (j) The TBO must support single sign-on (SSO) access using the directory services architecture used by the operator.
- (k) The TBO must use the username as the means to provide an audit trail and log of activities performed by each operator.
- (l) The TBO must maintain a configurable directory of user roles.
- (m) The TBO must not limit the number of roles or users that are permitted to use the TBO other than as imposed by licencing requirements for commercial off-the-shelf software.

- (n) The TBO must enable an operator to assign users to user roles.
- (o) The TBO must not limit the number of roles that can be assigned to a user.
- (p) The TBO must positively assign user roles to the ability to execute functions within the TBO.
- (q) The TBO must only permit a function to be executed by a user if that user has been assigned to a role with permission to execute the function.
- (r) For each component of the TBO, the TBO must have defined at all times at least one role allocated permissions for the administration of that component.
- (s) The TBO must ensure that all information is secured from unauthorised access.
- (t) The TBO must positively assign user roles with the authority to access specific classes of information held within the TBO.

5 INTEGRATION

5.1 RSS AND TBO

- (a) The integration of the RSS and TBO must allow vehicles captured at the RSS to be processed and charged accordingly at the TBO.
- (b) The RSS and TBO functions must connect at physical or logical network demarcation point.
- (c) The RSS provider is responsible for the carriage of data from the RSS to the telecommunications boundary between the RSS and TBO provider.
- (d) The TBO provider must ensure the Network Demarcation Point is available to receive data from the RSS and must ensure that such data when made available is transmitted to the TBO and *vice versa*.
- (e) Interface between the RSS and TBO must be clearly defined and adhered to by both the RSS and TBO provider, should they belong to different parties.
- (f) RSS provider and TBO provider must support each other in End to End testing of ETCS.
- (g) The development of data exchange requirements for all data required from the TBO must include:
 - (i) vehicle detection and classification data;
 - (ii) tag detection data;
 - (iii) image sets;
 - (iv) Automated Number Plate Recognition data;
 - (v) correlated Transactional data based on (i) to (iv) above;
 - (vi) RSS alarms and statistical data.
- (h) The development of data exchange requirements for all data required from the RSS must include:
 - (i) Tag Status List;

- (ii) Request or Set Commands.
- (i) All data exchange must include unique identifiers for all records transferred between the RSS and TBO.
- (j) An acknowledgement must be recorded for all data sent between the RSS and TBO.
- (k) Tag Status List updates to the RSS must be issued in accordance with the MoU.

5.2 TBO AND TOLLING INDUSTRY

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

6 DOCUMENTATION

- (a) The Contractor must include the following information, in the form of Design Documentation drawings and written descriptions, in the Substantial Detailed Design Documents:
 - (i) ETCS block diagrams;
 - (ii) ETC roadside equipment and gantry design drawings and specification;
 - (iii) ETCS supplier technical data for all RSS components, (Tag Detection, Vehicle Detection and Classification, Image Capture, ANPR, IVDCS, VSS, Roadside System Monitoring and Asset Management);
 - (iv) ETCS software architecture;
 - (v) ETCS interoperability specification compliance certification;
 - (vi) ETCS data communications network design diagrams.
- (b) The Contractor must submit Detailed Design Documentation prior to the manufacture of ETCS components. Detailed Design Documentation must specify the functional, performance, and software and hardware characteristics of the ETC systems and subsystems.
- (c) As a minimum, work-as-executed (WAE) documentation for the ETCS must include:
 - (i) final detailed design documentation;
 - (ii) all equipment specifications;
 - (iii) ETCS WAE drawings;
 - (iv) cable schedules for the ETCS;
 - (v) all testing / commissioning procedures and reports for the ETCS.

HOLD POINT

Process Held: Transition of ETCS into operation.

Submission Details: All 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

Clause	Description
6	Submission of all Design and Test documentation to demonstrate that 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 TfNSW D&C Q6 Annexure Q/E.

Clause	Description of Identified Record
6	Documentation to 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.

TfNSW Specifications

TfNSW D&C Q6	Quality Management System (Type 6)
TfNSW D&C TS901	Motorway Systems Overview and General Requirements
TfNSW D&C TS902	Systems Engineering Processes
TfNSW D&C TS911	Motorway Systems - Motorway Control Centre
TfNSW D&C TS912	Motorway Systems - Traffic Management and Control System
TfNSW D&C TS913	Motorway Systems - Plant Management and Control System
TfNSW D&C TS914	Motorway Systems - Electrical Power Supply and Distribution System
TfNSW D&C TS915	Motorway Systems - Motorway Network Communications System
TfNSW D&C TS917	Motorway Systems - C2C Interface for Motorways
TfNSW D&C TS918	Motorway Systems - Road Tunnel and Underpass Lighting

Australian Standards

AS 4962	Electronic toll collection - Transaction specification for Australian interoperability on the DSRC link
AS ISO 14906	Road transport and traffic telematics - Electronic fee collection - Application interface definition for dedicated short-range communication
AS/NZS ISO/IEC 27001	Information technology - Security techniques - Information security management systems - Requirements
AS/NZS ISO/IEC 27002	Information technology - Security techniques - Code of practice for information security management

European Standards

CSN EN 12253	Road transport and traffic telematics - Dedicated short-range communication - Physical layer using microwave at 5,8 GHz
CSN EN 12795	Road transport and traffic telematics - Dedicated Short Range Communication (DSRC) - DSRC data link layer: medium access and logical link control
CSN EN 12834	Road transport and traffic telematics - Dedicated Short Range Communication (DSRC) - DSRC application layer
CSN EN 13372	Road Transport and Traffic Telematics (RTTT) - Dedicated short-range communication - Profiles for RTTT applications
ETSI EN 300 674-1	Electromagnetic compatibility and Radio spectrum Matters (ERM); Road Transport and Traffic Telematics (RTTT); Dedicated Short Range Communication (DSRC) transmission equipment (500 kbit/s / 250 kbit/s) operating in the 5,8 GHz Industrial, Scientific and Medical (ISM) band

International Standards

ISO 3166	Codes for the representation of names of countries and their subdivisions
ISO/IEC 9797-1	Information technology - Security techniques - Message Authentication Codes (MACs). Part 1: Mechanisms using a block cipher
ISO 14816	Road transport and traffic telematics - Automatic vehicle and equipment identification - Numbering and data structures
ISO/TS 14907-1	Electronic fee collection - Test procedures for user and fixed equipment - Part 1: Description of test procedures
ISO/TS 17574	Electronic fee collection - Guidelines for security protection profiles

NSW Legislation

Government Information (Public Access) Act 2009
Privacy and Personal Information Protection Act 1998
Roads Act 1993
State Records Act 1998