EXHIBIT B: SCOPE OF WORK AND REQUIRMENTS

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SCOPE OF WORK AND REQUIREMENTS

Toll Lanes System Integrator Services for the I-405 Express Lanes and 91 Express Lanes

August 22, 2017

Ver. 0.6

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1 INTRODUCTION

The Orange County Transportation Authority ("OCTA" and "Authority") is developing an Express Lanes program which encompasses the existing 91 Express Lanes and the planned Interstate (I)-405 Express Lanes opening in 2023. The Express Lanes Electronic Toll and Traffic Management (ETTM) System Project (Project) is for the replacement of the existing 91 Express Lanes ETTM System and the implementation of a new ETTM System on the I-405 Express Lanes, as part of the I-405 Improvement Project. This Scope of Work includes the Project's technical requirements to be performed by the toll systems integrator (Contractor).

The 91 Express Lanes ETTM System project will focus on replacing the existing ETTM System. To minimize disruption to the current toll operations, close coordination will be required with the existing 91 Express Lanes toll operator. Currently, the 91 Express Lanes provide a dual gantry configuration with median access to the roadside toll equipment and communication systems. The 91 Express Lanes Anaheim Administration building, located adjacent to the State Route (SR)-91 near Weir Canyon Road, provides office space for ETTM System staff and storage for spare parts. Currently the ETTM System is monitored from this location with support staff on site.

The I-405 Improvement Project includes adding a general purpose lane in each direction and adding an additional lane in each direction that will be combined with the existing HOV lanes to create the I-405 Express Lanes High-Occupancy Vehicle (HOV) I-405. The Design Build (DB) contract was awarded in November 2016 to OC 405 Partners (Design-Builder) with construction to start in early 2018. Close coordination will be required with the Design-Builder during the design and construction phases to ensure a timely opening of the I-405 Express Lanes. To support this effort, office space will be provided to Contractor at the I-405 Construction Field Office after Contractor has been identified. After the I-405 Express Lanes open, the Agreement operations and maintenance functions will need to be conducted out of the I-405 Express Lanes Toll Operations Center.

The existing Back Office System (BOS) and Customer Service Center (CSC) support the existing 91 Express Lanes (for both Authority and Riverside County Transportation Commission ("RCTC")). The existing BOS/CSC contract ends June 2021 and a new BOS/CSC procurement, separate from this procurement, will occur prior to opening the I-405 Express Lanes. The new BOS/CSC will support the future I-405 Express Lanes and may support both the Authority and RCTC 91 Express Lanes depending on Authority and RCTC joint approvals. The new 91 Express Lanes ETTM System will initially be in operation with the Existing BOS. Contractor will support the planned transition from the Existing BOS to the New BOS with Authority and/or other agencies.

All definitions and acronyms for this Scope of Work and Requirements are in Exhibit A.

1.1 OCTA Express Lanes Projects

1.1.1 91 Express Lanes

The 91 Express Lanes is a four-lane, 18-mile tolled facility built in the median of California's Riverside Freeway (SR-91) between the Costa Mesa Freeway (SR-55) in Anaheim and Interstate 15 (I-15) interchange in Riverside to serve the booming population traveling between Inland

Empire and Orange County, see Figure 1. The OCTA 91 Express Lanes were built in 1995 and the RCTC 91 Express Lanes recently opened in 2017.

Authority operates the 91 Express Lanes from SR-55 to the Orange County/Riverside County line. RCTC operates the 91 Express Lanes that extend from the Orange County/Riverside County line to the I-15 interchange in Corona.

The 91 Express Lanes include an all-electronic toll collection (ETC) system at freeway speeds which does not accept cash on the road and requires all drivers to have a FasTrak® Transponder to pay for the toll. There is no entry/exit except at the endpoints, so there is only a single bi-directional toll station in the middle of the 91 Express Lanes. Each Toll Zone consists of two tolled lanes for vehicles carrying two or fewer persons and one lane for vehicles carrying three or more persons. Vehicles on the 91 Express Lanes with three or more persons are required to access a dedicated HOV toll lane at the Toll Zones to receive free or discounted tolls.

Vehicles on the 91 Express Lanes with three or more persons can use the facility toll free (although they still are required to have a Transponder), except when traveling eastbound on Monday through Friday between the hours of 4:00 PM and 6:00 PM. During that peak time, 3+ drivers receive a 50 percent discount on the posted toll. The discount policy also applies to zero emission vehicles, motorcycles, vehicles with disabled plates and disabled veterans plates.

The existing BOS/CSC supports both the OCTA 91 Express Lanes and RCTC 91 Express Lanes and are managed by the same toll operator making the entire SR-91 Express Lanes a seamless facility to the user. Contractor shall coordinate with the Existing BOS Contractor, and at times RCTC, but it is not envisioned that Contractor will be providing services directly to RCTC.

Access Points provide access to the OCTA 91 Express Lanes to Single Occupancy Vehicle (SOV) and HOV vehicles. The following three points are provided:

1. SR-91 eastbound west of the SR-55 junction, by a direct connector;
2. SR-55 northbound west of the SR-91 junction, by a direct connector; and
3. SR-91 westbound at the Orange/Riverside County line area, by an at-grade access.

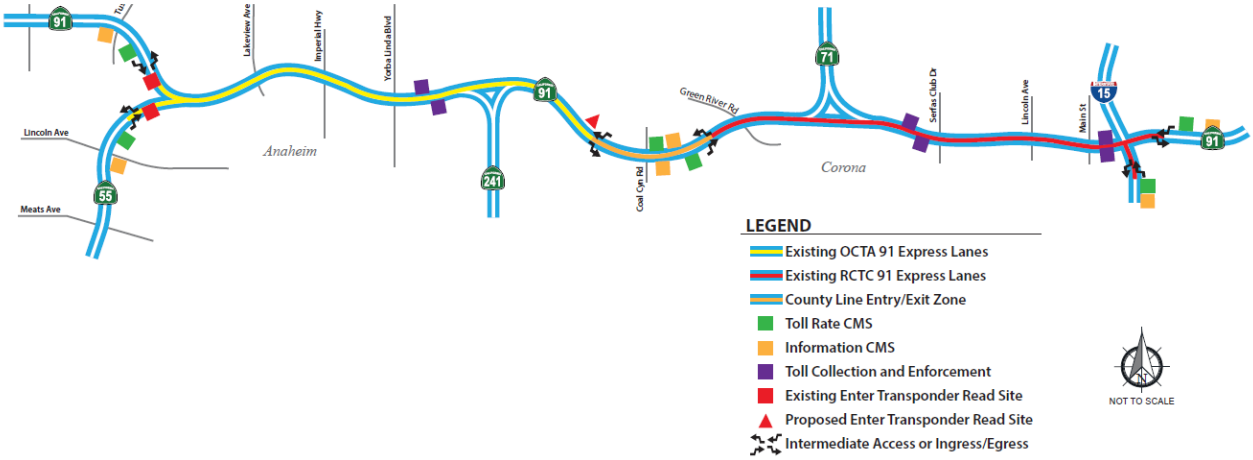
Transition Areas are access points where Express Lanes begin or end. The OCTA 91 Express Lanes will begin and end at three locations:

1. On SR-91 at the Orange/Riverside County line area;
2. On SR-55 west at the SR-91 interchange; and
3. On SR-91 at the SR-55 interchange;

Contractor shall be aware that the Transportation Corridor Agencies (TCA) is proposing to add a direct connector linking SR-241 northbound to the eastbound 91 Express Lane and a direct connector linking the westbound 91 Express Lane to southbound SR-241. Both direct connectors would be configured to originate in the median of the 91 Express Lanes. While it is not anticipated that the SR-241 direct connectors would require changes to the ETTM System, it is anticipated Contractor will need to coordinate the 91 Express Lane operations with the SR-241 direct connect civil contractor.

Figure 1-1: 91 Express Lanes Conceptual Tolling Layout identifies the entry/exit and Toll Zone locations for the 91 Express Lanes and the RCTC Extension.

Figure 1-1. 91 Express Lanes Conceptual Tolling Layout



1.1.2 I-405 Express Lanes

The I-405 Improvement Project will add one general purpose lane in each direction on I-405 from Euclid Street to the I-605 interchange and add a tolled Express Lane in each direction of I-405 from SR-73 to SR-22 East. From SR-73 to I-605, the tolled Express Lane and the existing HOV lanes will be managed jointly as a tolled Express Lanes facility with two lanes in each direction. From SR-22 to I-605, the existing HOV lane and the second HOV lane that was completed in 2014 will become part of the tolled Express Lanes facility. The Express Lanes facility will be in the center of the freeway and be the leftmost lanes of travel in each direction.

The current intention is to open the I-405 Express Lanes with HOV2+ free during non-peak hours, retaining the flexibility to adjust to HOV3+ free with HOV2 tolled or discounted based on consideration of factors such as adjacent HOV/High-Occupancy Toll (HOT) facility occupancy requirements, available capacity after HOV2+ vehicles are allowed into the lanes, and revenue requirements to cover debt service, operations, and maintenance of the I-405 Express Lanes.

Operating the I-405 Express Lanes with HOV2+ free while maintaining speeds more than 55 miles per hour (mph) depends on HOV2+ volumes not exceeding Express Lanes capacity. The degraded condition of the HOV lanes within the Corridor in 2011 indicated that HOV lane demand is either very close to or exceeds the capacity of the single HOV lane in each direction.

Access Points will provide access to the Express Lanes to SOV and HOV vehicles. The following access points are provided:

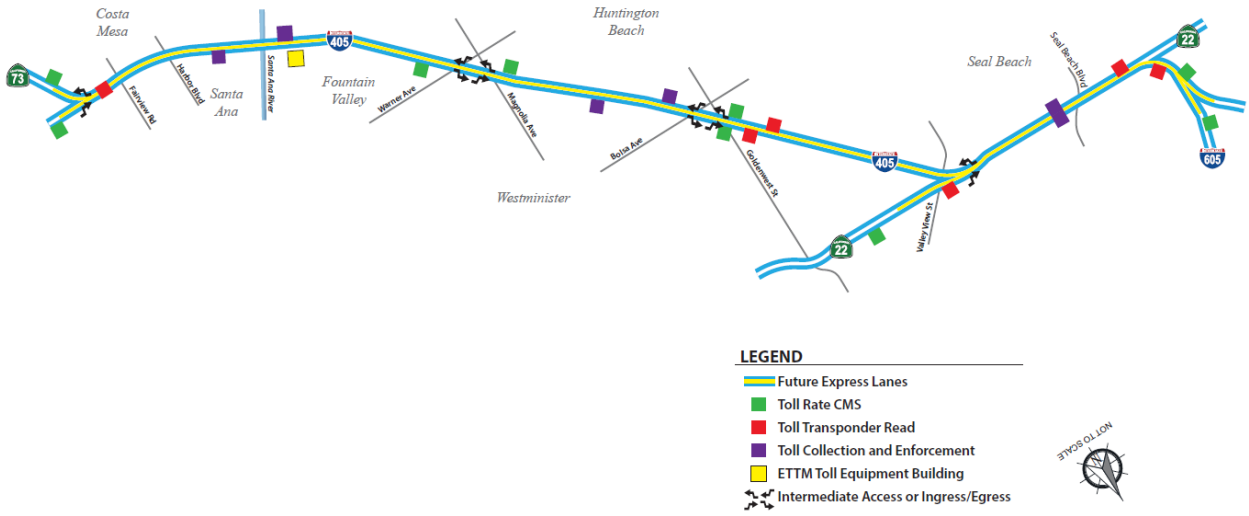
1. I-405 northbound south of the SR-73 junction, by an at-grade access;
2. I-405 northbound and southbound at the Magnolia Street/Warner Avenue area, by an at-grade access;
3. I-405 northbound and southbound at the Bolsa Avenue/Goldenwest Street area, by an at-grade access;
4. I-405 northbound from SR 22 westbound, by a direct connector;

Transition Areas are access points where Express Lanes begin or end. The Express Lanes will begin and end at five locations:

1. On SR-73 at the I-405 interchange;
2. On I-405 at the SR-73 interchange;
3. On SR-22 East at the I-405 interchange;
4. On I-605 at the I-405 interchange; and
5. On I-405 at the I-605 interchange.

Figure 1-2: I-405 Express Lanes Conceptual Tolling Layout identifies the entry/exit and Toll Zone locations.

Figure 1-2. I-405 Express Lanes Conceptual Tolling Layout



1.1.3 Future Express Lanes

Based on the options exercised throughout the Agreement, new Authority Express Lanes Corridors and Toll Zones may require Contractor to implement the ETTM System at Authority's direction and based on the pricing provided. It is assumed that the ETTM System Infrastructure will be designed to accommodate Contractor's Approved I-405 Express Lanes ETTM System. Any modifications to the design must be Approved by Authority. The pricing instructions provide guidance for ETTM System and ETTM System Infrastructure responsibilities between Contractor and the civil contractor.

1.1.4 Planned OCTA Express Lanes Toll Procurements

This procurement will be followed up by the BOS/CSC procurement. This by the BOS/CSC procurement will procure the BOS Contractor that will operate the future I-405 Express Lanes once they open in 2023 and may operate the current 91 Express Lanes.

Authority has established a preliminary timeline for the ETTM System and BOS/CSC procurements. This preliminary timeline is not intended to include all Project milestones, but is intended to present planned major milestones and to allow Contractor to have sufficient detail to develop a meaningful Preliminary Implementation Schedule.

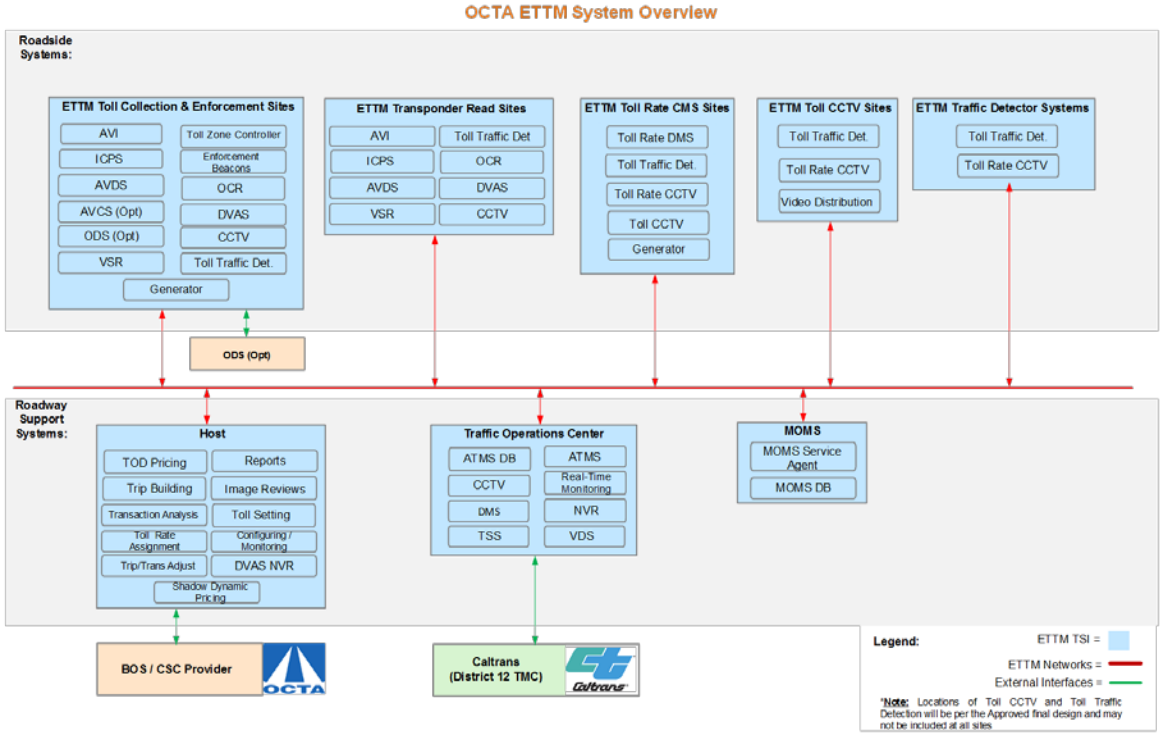
1.2 OCTA Express Lanes Electronic Toll and Traffic Management (ETTM)

1.2.1 Project Overview

The Electronic Toll and Traffic Management (ETTM) System will electronically collect all transactions and data needed for collecting toll revenue on the 91 Express Lanes and the I-405 Express Lanes. The Contractor will provide a Toll Operations Center (TOC) and staff to monitor the I-405 Express Lanes traffic conditions and react to incidents. In addition, the Contractor shall provide staff to perform manual image review services and maintenance of the ETTM System for both Express Lanes projects. Authority is seeking best-in-class and cost effective solutions for all aspects of toll services and operations. The ETTM System (***Figure 1-3: ETTM System Overview***) consists of the following Roadside Systems: ETTM Toll Collection and Enforcement, ETTM Transponder Read, I-405 ETTM Toll Rate CMS, ETTM Toll CCTV Camera, and ETTM Traffic Detection System Sites. Contractor will also be required to provide Roadway Support System (RSS) for the collection and processing of the transactions and data collected by the Roadside Systems. These RSS include a Host System (Host), Toll Operations Center (TOC) and Maintenance Online Management System (MOMS).

Authority is also interested in Occupancy Detection System (ODS) technology. The ODS would provide images and analytics to determine if the occupancy declared by the driver, either by driving through the self-declaration lane on the 91 Express Lanes or by enabling the Transponder Occupancy Setting on the I-405 Express Lanes, is accurate. This technology may be procured as part of the Project, or through a separate procurement. Contractor will be required to support the ODS interface, processing and correlation of the occupancy detected by the system to the toll transaction at selected ETTM Toll Collection and Enforcement Sites.

Figure 1-3. ETTM System Overview



1.2.2 Roadside Systems

Contractor will provide the systems and equipment located on or adjacent to the roadway that support the electronic collection of tolls, traffic management, and Express Lanes operations. Contractor will design, furnish, install, and maintain the Equipment, Hardware, and Software necessary for these various ETTM Sites.

91 Express Lanes - There will be five (5) Toll Zones, which includes three (3) ETTM Transponder Read Sites and two (2) ETTM Toll Collection and Enforcement Sites.

I-405 Express Lanes - There will be twelve (12) Toll Zones, which includes six (6) ETTM Transponder Read Sites and six (6) ETTM Toll Collection and Enforcement Sites.

The ETTMS Toll Collection and Enforcement Sites and ETTM Transponder Read Sites locations are provided in ***Attachment 2: 91 EL ETTM System Information*** and ***Attachment 3: I-405 EL ETTM System Locations***.

1.2.2.1 ETTM Toll Collection and Enforcement Sites

Toll transactions will be collected along the Corridors at the ETTM Toll Collection and Enforcement Sites. These sites will be equipped to read both Transponders, license plates and provide additional enforcement technology. These site locations are adjacent to enforcement areas.

1.2.2.2 ETTM Transponder Read Sites

The ETTM Transponder Read Sites provide information regarding the “where” and “when” a vehicle enters or exits the Express Lanes. These sites are located just after the entry and exit points on the Express Lanes and will be equipped to read both Transponders and license plates.

1.2.2.3 Toll Rate CMS

For the I-405 Corridor project, Contractor will be responsible for the installation, oversight, management and maintenance of the Toll Rate CMSs. There are nine (9) Toll Rate CMS sites on the I-405 Express Lanes project, which include locations on SR-73, SR-22 and I-605. The full-color, full-matrix signs will display pricing and toll eligibility information and have a static sign portion affixed to the top that will be supplied by the Design-Builder to achieve MUTCD compliance.

The 91 Express Lanes Toll Rate CMS in Orange County were recently installed as part of the OCTA 91 Express Lanes Pavement Rehabilitation Project. These existing 91 Toll Rate CMSs are under a maintenance contract with RCTC in coordination with the Existing BOS. Contractor will not be responsible for maintaining the existing 91 Express Lanes Toll Rate CMSs, but will need to coordinate with the BOS if issues are identified.

1.2.2.4 ETTM CCTV Cameras

Contractor shall procure, install, test and maintain all ETTM CCTV cameras on the 91 Express Lanes and I-405 Express Lanes. Contractor will work with the Design-Builder to ensure full unobstructed coverage of the I-405 Express Lanes. The 91 Express Lanes will require the

replacement of the existing Toll CCTV cameras, excluding CCTV cameras used for monitoring CMS. Proposed locations and quantities for the Toll CCTV cameras are provided in ***Attachment 2: 91 EL ETTM System Information*** and ***Attachment 3: I-405 EL ETTM System Locations***.

1.2.2.5 ETTM Traffic Detection System

Contractor shall install an ETTM Traffic Detection System (TDS) equipped with new vehicle detection equipment on the I-405 Express Lanes to track and record traffic data on the facility. The current 91 Express Lanes do not have a TDS and there are no plans to add one. Proposed locations and quantities for the TDS are provided in ***Attachment 3: I-405 EL ETTM System Locations***.

1.2.3 Roadway Support Systems

The Roadway Support Systems (RSS) supports the ETTM Roadside Systems functions and includes the Host System, TOC, and MOMS as primary subsystems.

1.2.3.1 Host

Contractor shall procure, install, test and maintain a complete, functioning, state-of-the-art Host System to combine toll transactions to determine a vehicle's path through the Express Lanes and the toll amount to charge the user's account. A vehicle's Transponder and/or license plate image will be used to match individual toll transactions to create trip transactions. In cases where a license plate image review is required to properly identify a vehicle, Contractor will perform manual image review services to determine the license plate number.

Fully formed trip transactions will be automatically identified and sent to the 91 Express Lanes BOS for payment processing. The new ETTM System for the 91 Express Lanes will connect with the Existing BOS that supports both the 91 Express Lanes and RCTC 91 Extension. The BOS will provide the ETTM System with updated tag and license plate status files from regional toll agencies. Contractor shall ensure secure, mission-critical, high availability systems and disaster recovery to support the collections of toll revenue for both the 91 and I-405 Express Lanes.

1.2.3.2 MOMS

The Agreement shall provide a MOMS application for the ETTM System that provides a fully integrated maintenance and inventory control system. MOMS shall be capable of providing fully automated means of creating, tracking, updating and reporting ETTM health, alarms and failures for equipment, Software applications, network devices and connections, and interfaces. The application shall be capable of scheduling and tracking maintenance activities (routine, preventative and emergency), tracking tasks that are reoccurring or that need to be performed, generating work orders and notifying the appropriate staff assigned to task types. Contractor shall provide alarms, monitoring and tracking of access to the roadside cabinets and other secure locations, which includes server racks and cabinets at the client or remote locations.

1.2.3.3 Toll Operations Centers (TOCs)

A new I-405 Express Lanes TOC shall be established and operated by Contractor to monitor and report on traffic conditions on this facility 24/7. Contractor shall be responsible for furnishing and commissioning the I-405 Express Lanes TOC; installing, testing and maintaining an Advanced Traffic Management System (ATMS) for managing data and video from the I-405 Roadside

System; and for providing TOC staff to monitor and respond to changing traffic conditions. The ATMS will allow secondary sharing of video and data with third parties. The I-405 Experss Lane TOC will be located at the OCTA Santa Ana Base 1 building at 4123-4199 MacArthur Boulevard, Santa Ana, CA. A separate OCTA contractor will build out this facility, and Contractor shall procure and install the Equipment, video wall, workstations, desks and other peripheries for TOC staff. All systems and equipment will be maintained by Contractor. The I-405 Express Lanes TOC will be staffed 24/7 to coordinate with Caltrans, roadside assistance, and other agencies to address changing conditions and incidents.

The existing 91 Expresss Lane TOC that supports both Authority and RCTC traffic operations will remain. Contractor shall be responsible for integrating the new 91 ETTM CCTV cameras installed on the 91 Express Lanes to the existing system. Contractor will be responsible to coordinate with the BOS related to 91 ETTM CCTV cameras and any identified issues, but Contractor will not be responsible for any additional functions related to the 91 Express Lanes TOC.

1.2.4 Communications

Managing multiple express lane Corridors requires a complex network of communications and interfaces for transferring data between the various toll and traffic systems. Contractor shall use and assume maintenance of the existing communications infrastructure of the ETTM System for the 91 Express Lanes. The Design-Builder will install the communications infrastructure for the I-405 Express Lanes Roadside Systems provided by Contractor. The existing Caltrans D12 Fiber Network can be utilized along with leased or installed communications to support the ETTM System operations for both 91 Express Lanes and I-405 Express Lanes. This includes support to the external interfaces, such as the Existing BOS, New BOS, and other transportation agencies.

During design, the communications interfaces will be developed by Contractor per the Scope and Requirements. Communications will be tested and operated in close coordination with the BOS and other transportation agencies. When the BOS/CSC is procured, Contractor will work with the selected New BOS Contractor to test and validate the 91 Express Lanes and the launch of the I-405 Express Lanes in 2023.

To better understand the responsibilities between the Authority and the other third party contractors (Design-Builder, other civil contractors, and BOS/CSC), see ***Attachment 10 – I-405 EL ETTM System Responsibility Matrix - Design-Builder and TSI*** and ***Attachment 11 – 91 EL ETTM System Responsibility Matrix - Authority and TSI***

1.2.5 Project Phases

The Implementation Phase will include the following sub-phases, which could be concurrent:

- Design and Development;
- Testing;
- Installation and Commissioning;
- Transition;
- Training;
- Go-Live; and
- Post Go-Live Operational Acceptance Testing.

The Operations and Maintenance Phase commences upon the Go-Live Date and includes the following Operations and Maintenance Services:

- Toll Operations;
- System Maintenance; and
- Software Maintenance and warranty.

1.3 Express Lanes Operations

Consideration will be given to adopting operating/business rules, toll structure, and violation enforcement processes consistent for both OCTA Express Lanes.

Subject to change in the discretion of the Authority as provided in the Contract, other high level Express Lanes operating requirements include:

- Express Lanes operate 24 hours per day, 7 days per week. Enforcement approach uses a combination of manual and automated approaches with occupancy enforcement related to any HOV discounts enforced by visual CHP inspection.
- Large trucks (over 10,000 pounds) and towed trailers are prohibited.
- In service transit vehicles, emergency vehicles, and law enforcement vehicles use the Express Lanes free per the Authority Toll Policy.
- Transponder is required of all vehicles using the Express Lanes (support for Title 21, 6C and future national interoperability transponder standard).
- HOV3+ use the Express Lanes free at all times, with the exception of eastbound, Monday through Friday 4 to 6 p.m., 91 Express Lanes has a self-declaration lane where the I-405 Express Lanes will leverage switchable Transponders.
- For I-405 Express Lanes, HOV2s use the Express Lanes free during non-peak hours and pay the full toll during peak hours for the first 3.5 years of operation. Thereafter, HOV2s pay the full toll.
- Motorcycles and vehicles with disable or disabled veteran license plates are permitted to ride free in the I-405 Express Lanes during all hours.
- Clean air vehicles (CAV) with a Transponder are permitted to ride free or at a discount in the Express Lanes during all hours consistent with state law, which is subject to change, the Authority Toll Policy and any potential cap on the number of free CAV granted by the state.
- Prices displayed to motorists approaching entrances to the Express Lanes are guaranteed.
- For the I-405 Express Lanes, the I-605 and I-405 interchanges and I-405 at the SR-73 interchanges will be separately tolled using pricing to maintain the desired traffic splits.

The goal is for the 91 Express Lanes and I-405 Express Lanes to have similar policies, but there will be some differences between the two Express Lanes facilities which are identified in the detailed requirement sections of this Scope of Work and Requirements.

1.4 Express Lanes Toll Policy

In 2003, Authority adopted a Toll Policy for the 91 Express Lanes based on the concept of congestion management pricing. A similar policy will be adopted for the I-405 Express Lanes, ensuring a relatively consistent Toll Policy for both Express Lanes facilities.

The policy is designed to optimize traffic flow at free-flow speeds. To implement the Toll Policy, Authority monitors hourly traffic volumes. Tolls are adjusted when traffic volumes consistently reach a trigger point where traffic flow can become unstable. These are known as “super peak” hours. Given the capacity constraints during these hours, pricing is used to manage demand. Once an hourly toll is adjusted, it is frozen for a period of time, currently six months. This approach balances traffic engineering with good public policy. Other (non-super peak) toll prices are adjusted annually by inflation.

The Toll Policy goals are to:

- Provide customers a safe, reliable, predictable commute;
- Optimize throughput at free-flow speeds;
- Increase average vehicle occupancy;
- Balance capacity and demand, thereby serving both full-pay customers and carpoolers with three or more people who are offered discounted tolls; and
- Generate sufficient revenue to sustain the financial viability of the 91 and I-405 Express Lanes.

Further information on the Toll Policy can be found on the 91 Express Lanes website, http://www.octa.net/uploadedFiles/MainSite/Content/Express_Lanes/RevFinalTollPolicy7-30-03_v7.pdf.

1.5 General Requirements

1	Contractor shall provide all resources, personnel, Equipment, Hardware, Software and supplies necessary to perform the Services. Contractor shall provide the Services described herein in a competent and professional manner, in conformance with the highest industry standards, to the satisfaction of the Authority. The Authority shall be entitled to full and prompt cooperation by Contractor in all aspects of the Services. The Authority shall have the right to inspect the performance of such Services at any time, and Contractor shall fully and promptly cooperate with the Authority in the execution of such inspections.
2	Contractor recognizes the paramount importance of the successful operation of the System for which the Services are sought. Inasmuch as the Services are provided for the convenience and benefit of the public, Contractor acknowledges that the quality and timeliness of Contractor's Services are the essence of this Agreement.
3	If in order to provide the Services Contractor must make an external connection to the Authority's data communications infrastructure and/or access Authority information systems, Contractor shall in all respects comply with all the Authority policies and procedures regarding such connections and information systems access and undertake whatever actions are necessary in the discretion of the Authority to ensure such compliance. Contractor shall be responsible for all costs associated with ensuring that its own network security measures comply with all policies and procedures regarding external connections.

1.6 Staffing and Key Team Personnel

Contractor is responsible for maintaining and assigning a sufficient number of competent and qualified professionals to meet the terms and conditions of the Agreement and in accordance with the Approved Baseline Implementation Schedule.

4	Contractor shall maintain and assign a sufficient number of competent and qualified professionals with strong verbal and written communications skills to meet the terms and conditions of the Agreement.
5	Contractor shall ensure Key Personnel are readily accessible to Authority during Contractor's performance of this Agreement. All Key Personnel for this Project and are subject to the Approval, replacement and removal Requirements of Authority for Key Team Personnel as set forth in the Agreement.
6	Key Personnel shall include a Project Principal responsible for overall management responsibility for the Agreement, and responsible for oversight of Contractor Project Manager and Contractor Project staff. The Project Principal shall be Contractor's point of contact for any escalated Project issues that cannot be resolved by Contractor Project Manager. The Project Principal shall meet or exceed the preferred minimum experience:
	• Full-time employee of the Proposer or its parent company for at least one year at the time of Proposal submission;
	• Ten years' experience in the toll industry;
	• Five years of senior management responsibility for major projects in roadway toll systems; and
	• Senior management responsibility for at least one project of $10 million or more in value.
7	Key Personnel shall include a Contractor Project Manager responsible for the Day-to-Day Services, shall be Contractor's Day-to-Day contact person for all Project matters, and shall be responsible for the overall management and delivery of the Deliverables. The Contractor Project Manager shall meet or exceed the preferred minimum experience:
	• Seven years' experience in the toll industry;
	• Five years' experience as a project manager in the toll industry;
	• Project Manager for at least one project of $10 million or more in value; and
	• Project management certification such as PMP is desired.
8	Key Personnel shall include a Deputy Project Manager responsible to support the Project Manager in delivery of the Services. The Deputy Project Manager shall meet or exceed the preferred minimum experience:
	• Five years' experience in the toll industry on projects of similar scope to the Services on this Project;

9	Key Personnel shall include a Quality Control/Assurance Manager responsible for consistent quality and adherence to the Approved QA/QC plan throughout the design, development, testing, and implementation. The Quality Control/Assurance Manager shall meet or exceed the preferred minimum experience:
	• Five years as Quality Control/Assurance Manager on projects of a similar scope to the Services on this Project.
10	Key Personnel shall include a Civil/Mechanical/Electrical Engineering Manager responsible for Contractor's civil, mechanical, and electrical engineering Services on the Project and shall ensure all documents that require a professional engineer (PE) approval are signed and sealed by a PE in the appropriate discipline with a State of California license. The Civil/Mechanical/Electrical Engineering Manager may also serve as the I-405 ETTM System Infrastructure Lead. The Civil/Mechanical/Electrical Engineering Manager shall meet or exceed the preferred minimum experience:
	• Five years as Civil/Mechanical/Electrical Engineering Manager on projects of a similar scope to the Services on this Project.
11	Key Personnel shall include a ETTM System Infrastructure Lead responsible for Contractor's civil, communications and electrical engineering inputs to the Design-Builder. The ETTM System Infrastructure Lead is responsible for coordination of all Design activities and for review and comment on all ETTM System Infrastructure Plans. The ETTM System Infrastructure Lead shall be collocated with the Design-Builder in the I-405 Construction Field Office from NTP1 until Approval of the ETTM System Infrastructure Design Plans. The ETTM System Infrastructure Lead may also serve as the Civil/Mechanical/Electrical Engineering Manager. The ETTM System Infrastructure Lead shall meet or exceed the preferred minimum experience:
	• Five years as Engineering Lead on projects of a similar scope to the Services on this Project.
12	Key Personnel shall include a System Design Engineer responsible for the design and development of the roadside toll system solution and shall be directly responsible for the team of Software, Hardware and systems engineers working on Contractor's solution. The System Design Engineer shall meet or exceed the preferred minimum experience:
	• Five years as System Design Engineer on projects of a similar scope to the Services on this Project.
13	Key Personnel shall include a Lead Test Engineer responsible for the planning, execution and reporting of the testing program. The Lead Test Engineer shall meet or exceed the preferred minimum experience:
	• Two years as a Lead Test Engineer on projects of a similar scope to the Services on this Project.
14	Key Personnel shall include an Installation and Commissioning Manager responsible for all installation and Commissioning Services for the Project. Installation and Commissioning Manager may also serve as the Operations and Maintenance Manager. The Installation and Commissioning Manager shall meet or exceed the preferred minimum experience:
	• Five years of experience in the installation, of roadway toll systems, including lane and Host Systems, configuration of servers, systems and networks in a data center environment; and

	• Two years' experience in a responsible installation role on projects of a similar scope to the Services on this Project.
15	Key Personnel shall include an Operations and Maintenance Manager responsible for all of Contractor's operations and maintenance activities. The Operations and Maintenance Manager may also serve as the Installation and Commissioning Manager. The Operations and Maintenance Manager shall meet or exceed the preferred minimum experience:
	• Five years of experience in operating and maintaining roadway toll systems; and
	• Two years of experience as the maintenance manager of toll systems of a similar scope to the Services on this Project.
16	Contractor shall assign Key Team Personnel to manage all aspects of the Services in a quality, timely, and effective manner, and shall work with Authority in a cohesive, seamless manner.

2 SCOPE OF WORK AND REQUIREMENTS

The following subsections describe this Scope of Work and the Requirements for the ETTM System. These Requirements are numbered to track contractual obligations and any changes which may occur during the Project. Many of the requirements contain underlying lists of specific items and required database fields. The intent of these "including but not limited to" lists is to indicate to Contractor the intent and scope of the requirement. During design, the naming and number of items and fields will vary; however, all items and fields shall be addressed by the ETTM System unless Contractor is formally relieved of the requirement by Authority.

2.1 ETTM System Scope of Work

The Project includes the design, development, testing, and installation of a complete and integrated ETTM System that meets the requirements of the Express Lanes as specified in this Scope of Work. This includes the provision of an in-lane Roadside Systems with all required equipment and the RSS that transmit fully formed trips (requiring Contractor image processing and manual image review) to the BOS for processing. The Project also includes maintenance services on the installed system and any identified existing equipment on the 91 Express Lanes.

The 91 Express Lanes shall use the existing ETTM System Infrastructure as identified in ***Attachment 1: Equipment for Re-Use*** and I-405 Express Lanes shall use the ETTM System Infrastructure provided by the I-405 Design-Builder.

The quantities and locations of all sites are provided in the ***Attachment 2: 91 EL ETTM System Information*** and ***Attachment 3: I-405 EL ETTM System Locations***.

The ETTM System and services which will be provided and maintained by the Contractor include but are not limited to the following:

- ETTM Toll Collection and Enforcement Sites, including but not limited to:
    - Automatic Vehicle Identification (AVI) System;
    - Image Capture and Processing System (ICPS);
    - Automatic Vehicle Detection (AVD) System;
    - Automatic Vehicle Classification (AVC) System (Optional);
    - Occupancy Detection System (ODS) (Optional);
    - Enforcement Beacon;
    - Optical Character Recognition (OCR) / Automatic License Plate Recognition (ALPR);
    - Vehicle Signature Recognition (VSR);
    - Digital Video Audit System (DVAS);
    - Toll closed circuit television (CCTV) cameras (per design to meet requirements);
    - Toll traffic detectors (per design to meet requirements);
    - Roadside toll cabinets (Primary cabinet is provided by Contractor and installed by the Design-Builder);
    - Individual toll equipment specific cabinets and conduits; and
    - Roadside UPS and Roadside Generator.

- ETTM Transponder Read Sites, including but not limited to:
    - Automatic Vehicle Identification (AVI) System;
    - Image Capture and Processing System (ICPS);

  - Automatic Vehicle Detection (AVD) System;
  - Automatic Vehicle Classification (AVC) System (Optional);
  - Optical Character Recognition (OCR) / Automatic License Plate Recognition (ALPR);
  - Vehicle Signature Recognition (VSR);
  - Digital Video Audit System (DVAS);
  - Toll CCTV cameras (per design to meet requirements);
  - Toll traffic detectors (per design to meet requirements);
  - Roadside toll cabinets (Primary cabinet is provided by Contractor and installed by the Design-Builder);
  - Individual toll equipment specific cabinets and conduits; and
  - Roadside UPS

- ETTM Toll Rate CMS Sites (I-405 EL only)
  - Toll Rate CMS;
  - Toll Rate CCTV cameras;
  - Toll CCTV cameras (per design to meet requirements);
  - Toll traffic detectors (per design to meet requirements);
  - Roadside toll cabinets (Primary cabinet is provided by Contractor and installed by the Design-Builder);
  - Individual toll equipment specific cabinets and conduits; and
  - Roadside UPS and Roadside Generator.

- ETTM Toll CCTV Camera Site
  - Toll CCTV cameras;
  - Toll traffic detectors (per design to meet requirements);
  - Video distribution;
  - Roadside toll cabinets (Primary cabinet is provided by Contractor and installed by the Design-Builder);
  - Individual toll equipment specific cabinets and conduits; and
  - Roadside UPS.

- ETTM Toll Traffic Detection System Site (I-405 EL only)
  - Toll traffic detectors;
  - Toll CCTV cameras (per design to meet requirements);
  - Roadside toll cabinets (Primary cabinet is provided by Contractor and installed by the Design-Builder);
  - Individual toll equipment specific cabinets and conduits; and
  - Roadside UPS.

- Roadway Support Systems
  - Time of Day (TOD) Pricing System;
  - Shadow Dynamic Pricing System;
  - Transaction Pre-processing and trip building;
  - Image/trip Review;
  - Trip/Transaction Adjustment;
  - Dashboard/Real-Time Monitoring;
  - Maintenance Online Management Systems (MOMS);

  - Express Lane User Queries and Reports;
  - Advanced Traffic Management System (Optional);
  - Traffic Simulator and Modeling (I-405 Express Lanes only);
  - Digital Video Audit System; and
  - UPS and Generator.

- ETTM System Operations
- Toll Operations Center (TOC) Operations
- Manual Image Review Services
- ETTM System Maintenance

In addition to providing, operating, and maintaining the systems and services listed above, the Contractor will also interface the ETTM System with the following entities/systems:

- 91 Express Lanes ATMS
- BOS
- Occupancy Detection System
- Existing Corridor servers (only during transition)
- 91 Express Lanes Toll Rate CMS (electronic file interface only)

During the Operations and Maintenance Phase, Contractor may be directed by Authority to facilitate the maintenance of the 91 Express Lanes CMSs. The CMSs will be under a third-party maintenance contract and Contractor's responsibility will be limited to contacting, coordination and oversight with regards to maintenance and repairs with the third-party.

The services procured under this Agreement ***do not*** include:

- A BOS and CSC Operations services. The required BOS and CSC Operations services will be provided under a separate contract; however, the vendor is expected to interface to the BOS and provide the necessary coordination with BOS and CSC operations vendor sufficient to properly integrate, test and operate the interface; and
- ETTM System Infrastructure, as defined in this Scope of Work and Requirements, will be retained and re-used on the 91 Express Lanes and provided and installed by the I-405 Express Lanes Design-Builder.

2.2 Roadside System – Functional Requirements

2.2.1 Hardware and Software General Requirements

17	All Hardware, Equipment, and Software supplied under this Agreement shall be new and certified to have a ten (10) year minimum service life and shall not be approaching end-of-life. Materials and products that have been previously used for development work or Contractor's internal testing, factory testing or items that have been salvaged or rebuilt shall not be permitted to be used in connection with this Agreement.
18	All components, supplies and materials furnished under this Agreement for the ETTM System shall be new, Commercial Off-the-Shelf (COTS) and field proven in revenue Operations.
19	All components procured, furnished, and installed by Contractor shall be available through multiple sources identified by Contractor and the names of such sources shall be included in the bill of materials (BOM) and readily available to Authority, unless otherwise Approved by Authority during Design.
20	All Hardware and Software provided under this Agreement shall be supported by their manufacturers, and shall be replaceable; Upgradeable; maintained; Updated; patched and secured throughout the Agreement Term.
21	Proof of purchase in the form of purchase orders, dated invoices and shipping bills shall be retained by Contractor and furnished to Authority in accordance with the terms and conditions of the Agreement.
22	All directory services provided as part of the ETTM System shall be dedicated to the ETTM System and not shared with other clients or part of Contractor's corporate IT infrastructure
23	All Roadside System Software shall meet Authority's most current technology standards; all such Software and Equipment shall meet the security standards set forth in ***Attachment 4: OCTA Information Security Policies.***

2.2.1.1 Maintainability

24	The ETTM System Hardware shall be Designed with the following specifications:
	• modular, replaceable and repairable components to allow for efficient Maintenance;
	• all replacements shall be plug compatible with no changes required;
	• all components that perform the same function shall be interchangeable;
	• all zone controllers shall be Designed such that they are identical and interchangeable and can be configured to operate the specific number of lanes at each Toll Zone through the addition of Hardware pluggable modules and setting of appropriate Software parameters;
	• where possible, all Equipment shall use TCP/IP network protocol to communicate with the zone controller;
	• all expansion bus (for example PCIe) shall have a minimum two (2) spare slots per lane to support the addition of components;
	• all network switches shall have a minimum two (2) spare jacks per lane to support the addition of components;

	• all field wiring shall be terminated on screw lugs or connectors and all connectors shall be keyed or polarized to prevent incorrect connections;
	• all wiring and connectors shall be labeled at each end with tape that is specified for the environmental conditions and strain relief shall be provided to protect the conductors;
	• Contractor's electronic Design and installation shall prevent electrical disturbances, damage and noise in the electronics;
	• Systems and field wiring that are exposed or susceptible to lightning and/or power surges and power loss shall be protected from damage;
	• all individual lane Equipment shall be internally protected against over current and over voltage and under voltage;
	• redundant power supplies shall be provided for all required internal DC voltages, and
	• all Equipment shall be properly grounded to ensure the safety of Maintenance personnel.
25	Equipment mounting and installation Design shall support the Maintenance of Equipment from below on toll gantries as applicable to each Toll Zone.

2.2.1.2 Diagnostics

26	Maintenance personnel shall have easy access to components, and removal, testing, and replacement shall not require extensive effort or tools. All test points necessary to diagnose the Equipment while in operation shall be easily accessible and Light Emitting Diode (LED) indicators shall be provided to assist technicians in identifying and diagnosing problems.
27	Technicians shall have the ability to connect a laptop in accordance with security policies of the Express Lanes Program to troubleshoot the components. Technicians shall have secured and remote access to the device to monitor its status and to perform diagnostics when the lane is in operation. Contractor shall document such security policies in the Maintenance Plan.
28	For easy diagnostic and troubleshooting, all error and event logs shall be consolidated such that all events and errors associated to a transaction are in a single log. The consolidated error and event logs shall be retained online for a Configurable period of time and shall be easily accessible to the technicians.
29	The consolidated error and event logs shall also be transmitted to the Maintenance Online Management System (MOMS) at Configurable intervals of no more than an hour, and be available to Authorized User in viewable form. Search and filter capability shall be provided to display and review data in the consolidated log for up to ninety (90) Days of backlog.
30	All diagnostics performed on the Roadside System shall be recorded and automatically reported to the MOMS, including the technician ID, the time the Maintenance was performed, and all status and recovery messages.
31	All diagnostic Software and specialty tools required for support of Maintenance activities shall be supplied by Contractor and Authority shall have full rights and access as further defined in the Agreement to such diagnostic Software and specialty tools.

2.2.1.3 Customized Hardware

32	If customized components or controllers are used, Contractor shall provide detailed Documentation on the Design, production and testing of these units and shall provide usage rights to Authority. Documentation shall include electronic diagrams, component layouts and the detailed Bill of Material listing manufacturers/vendors. Contractor shall identify all customized components and controllers and indicate their plan to make them available to the Authority, including the option for placing the Documentation in escrow.

2.2.1.4 Equipment Cabinets/Enclosures

33	Contractor shall design and provide NEMA 4 stainless steel cabinets and enclosures to house all Equipment.
34	Contractor shall ensure that all Equipment controllers, electronics, devices, servers and associated communications Equipment that require air conditioning are hardened or installed in an environmentally controlled environment. Contractor shall be responsible for the provision and maintenance of the air conditioner units.
35	All cabinets shall be equipped with monitoring sensors (including humidity and temperature) and if environmental conditions inside the cabinets exceed the Configurable threshold, alarms shall be generated and reported to the MOMS. There shall be no loss of data in such conditions and the integrity of the System shall be maintained.
36	Contractor-provided cabinets and enclosures shall support the Hardware through the Agreement Term.

2.2.1.4.1 Equipment Cabinets/Enclosures – 91 Express Lanes

37	Contractor shall not re-use existing ETTM cabinets and enclosures.
38	Contractor shall provide and install all ETTM System required cabinets, enclosures and computer rack.
39	Contractor shall provide and install NEMA 4 stainless steel cabinets along with all associated foundation, straps and conduit.
40	The primary cabinet at each ETTM Toll Collection and Enforcement Site and ETTM Transponder Read Site shall be provided and installed by Contractor.

2.2.1.4.2 Equipment Cabinets/Enclosures – I-405 Express Lanes

41	Contractor shall provide and install all ETTM System required cabinets, enclosures and computer rack, except the primary roadside cabinet is to be provided by Contractor and installed by the Design-Builder.
42	Contractor shall provide and install NEMA 4 stainless steel cabinets along with all associated straps and conduit.
43	The primary cabinet at each ETTM Toll Collection and Enforcement Site, ETTM Transponder Read Site, and ETTM Toll Rate CMS Site shall be provided by Contractor and installed by the Design-Builder.

2.2.1.5 Environmental

44	The Equipment to be supplied will be installed in areas exposed to the range of climatic conditions found in California. In addition to the climatic conditions, the Equipment will also be subjected to harsh environmental factors normally found in the operation of a toll lane, such as, but not limited to, combustion motor vehicle emissions; industrial exhausts; industrial cleaners; fuel and car lubricants; Electromagnetic Interference (EMI) and Radio Frequency Interference (RFI), and vibrations. These conditions shall be taken into account in the Design and selection of Equipment used on this Project and Contractor shall ensure that the System works accurately and reliably in such environment.
45	Lane electronics, zone controllers, image capture and processing system (ICPS) controllers/servers, automatic vehicle detection (AVD) system and other components shall be able to operate in the enclosed environment of the roadside cabinets and enclosures.
46	All Hardware provided under this Agreement shall be corrosion resistant and remain corrosion resistant for the Agreement Term.
47	All lane Equipment and devices shall be Designed to handle heavy rain, fog/smog and mist-like conditions and there shall be no degradation in the System performance under such environmental conditions.
48	The lane Equipment and devices not in environmentally controlled conditions shall operate with no degradation of performance in ambient air temperature of twenty (20) to one hundred and fifty (150) degrees Fahrenheit, with and without direct sunlight, and relative humidity of five to one hundred percent (5% to 100%) for Equipment installed in an outside environment and five to ninety-five percent (5% to 95%) non-condensing for Equipment installed inside cabinets.
49	During the Implementation Phase, Contractor shall provide specification sheets that prove the lane device meet the environmental specifications given above.
50	All exposed Equipment, when in its fully assembled configuration, shall not be damaged, nor shall operational performance or expected lifetime be degraded. During the Implementation Phase, Contractor shall provide specifications for the Equipment for Authority Approval.

2.2.1.6 Assembly

51	All customized Hardware shall be assembled and tested in Contractor's fabrication/assembly facilities before being installed in the lane in accordance with Authority Approved Test Plan for customized Hardware. All chassis, attachments, and Hardware shall be fabricated with stainless steel, hot dipped galvanized or other materials resistant to salt exposure and corrosion.
52	All customized Hardware shall be identified and shall undergo a seventy-two (72) hour burn-in before they are installed in the lanes.
53	Customized Hardware assembly shall facilitate easy replacement of failed components in accordance with this Scope of Work and Requirements.

2.2.2 Bill of Materials

54	Contractor shall include the Bill of Materials (BOM) for all Equipment and Hardware supplied for the ETTM System. The second manufacturer source for all Equipment and Hardware shall be included with any exceptions noted and explained. During the Implementation Phase the BOM shall be finalized and all changes shall be subject to the Approval of Authority. A separate BOM shall be provided for the 91 Express Lanes and I-405 Express Lanes.
55	Prior to purchase of any Equipment and as part of its Design Contractor shall submit the final BOM to Authority for Approval. No Equipment shall be purchased by Contractor prior to Approval of the BOM and the Design, unless otherwise authorized in writing by Authority.
56	All Hardware and Software procured under this Scope of Work and Requirements shall be confirmed to be the latest model/version at the time of purchase with the, security, Maintenance and support Services as specified in this Scope of Work and Requirements.
57	Updates to the BOM shall be provided by Contractor whenever Equipment and Hardware changes occur and at a minimum on a semi-annual basis over the Agreement Term. All Equipment and Hardware changes shall be subject to the Approval of Authority.

2.2.3 Spare Parts and Support

58	Contractor shall be responsible for providing and maintaining spare parts inventory per the Approved Maintenance Plan during the Agreement Term.
59	The Roadside Systems procured, furnished, and installed under this Agreement shall allow Contractor to maintain and replace the Roadside Equipment and components for the Agreement Term. Contractor shall provide a spare parts list to Authority which includes recommended quantities for all spare parts for all Hardware supplied for the Roadside Systems for each year through the Agreement Term. A separate spare parts list shall be provided for the 91 Express Lanes and I-405 Express Lanes.
60	This Agreement includes the initial quantities of spare parts required for the operation of the ETTM System during the Operations and Maintenance Phase as recommended by Contractor. Costs for the replacement of spare parts shall be the responsibility of Contractor.
61	At the end of the Agreement Term, all spare parts inventory shall be turned over to Authority at one hundred percent (100%) inventory level. Contractor shall identify (via the MOMS) the warranty status for each piece of Hardware and warranty period remaining, if applicable.

2.2.4 ETTM Software

62	The operating System, database, other third-party Software, and ETTM Software procured, furnished, and installed by Contractor shall support real time Operations of the lane.
63	The operating systems shall have a clear and documented future Upgrade path and shall be supported until the end of the Agreement Term.

64	All ETTM Software developed, furnished, and installed under this Agreement shall be warranted against Software defects, security vulnerabilities and deficiencies for the Agreement Term.

2.2.5 ETTM System Toll Facility and Lane Configurations

65	The ETTM System shall support the current and future Express Lanes Corridors as described in this Scope of Work and Requirements.
66	The ETTM System shall support the lane configurations in ***Attachment 2: 91 EL ETTM System Information*** and ***Attachment 3: I-405 EL ETTM System Locations*** and dimensions detailed for each Express Lanes Corridor. Drawing packages for existing and new Express Lanes Corridors are provided in the Reference Documents.
67	Shoulder lane and travel lane widths will vary by Express Lanes Corridor and Toll Zone and are detailed in ***Attachment 2: 91 EL ETTM System Information*** and ***Attachment 3: I-405 EL ETTM System Locations.*** Travel lanes shall be equipped with the required toll collection subsystems to accommodate the variation in widths and road curvature. During the detailed Design period, Contractor shall make the required adjustments to the System Design to accommodate for variations in the actual lane widths and curvature.
68	The ETTM Systems shall be capable of detecting Transponders and capturing images of all vehicles traveling on the shoulder, as required to meet Performance Requirements.
69	Sensor layout and Toll Zone Design shall ensure that narrow shoulders have full coverage to correctly detect and process vehicles straddling the shoulders.

2.2.6 ETTM System Access Requirements

2.2.6.1 Hub/Cabinet/Enclosure Access

70	Contractor is responsible for the security of all Hardware and shall control access to the hubs, cabinets and enclosures.
71	All hubs, cabinets and enclosures, both old and new shall be equipped with locks. Contractor may rekey the existing locks on the cabinets or replace all locks on the existing cabinets with new locks.
72	Contractor shall supply all locks, establish the keying index system for all Equipment hubs, cabinets and enclosures and install these locks before installation. A key set shall be provided to Authority upon the completion of the installation check-off.
73	Contractor personnel shall use only assigned, individual keys and shall not share keys with any other individuals or make copies of any assigned keys. Contractor personnel shall immediately return all assigned keys to Authority upon request.
74	Access to all Equipment cabinets, hubs and enclosures shall be recorded automatically and reported to the MOMS. The data reported shall include, but not be limited to cabinet status; date; time of door open; time of door close, and any applicable alarm conditions.

2.2.6.2 Roadside System Software Security

75	Accounts for user access to the System shall require a strong password in accordance with password management standards in applicable ***Payment Card Industry-Data Security Standards (PCI-DSS)*** requirements. The access shall be role based and limited to the authorized Contractor staff and designated Authority personnel.
76	User access security permission control and access privileges for different levels shall be provided for the files, directories and application Software and shall be fully Configurable by a system administrator.
77	Remote access to the ETTM System shall be performed via secured VPN access and controlled through a central system with each user having a unique log-in.
78	User sign-on, access and access failures, both local and remote, to any element of the ETTM System shall be recorded and tracked for security audit proposes and reported to the MOMS. Security Software shall continuously and automatically monitor the ETTM System for unauthorized access; access violations shall be reported to the MOMS as a Priority 1 Alert.
79	Contractor shall develop the access levels, user roles and privileges matrix for the ETTM System during System Design with Authority's input and Approval. The ETTM System shall allow for additional changes to the access levels, user roles and the addition of personnel in a secure manner. Company domain and other proprietary access methods shall not be used in establishing user access roles.
80	A system level account shall be provided for Authority or designated third-party personnel to perform manual and/or automated "credentialed" scans.
81	Contractor shall not circumvent the Approved System security. All access to the System and Approved changes made shall be recorded, monitored, reviewed and audited. Specific requirements for this shall be developed by Contractor during System Design.
82	Authorized Users shall have access to the zone controller user access logs to audit the System access.
83	All user identifications and passwords for all field devices shall be stored in an encrypted method acceptable to Authority.
84	Upon cut-over of each Toll Zone, Contractor shall provide Authority the encrypted file/data of all usernames and passwords used in field equipment.

2.2.7 Roadside System Subsystems

85	All Roadside System subsystem and components shall be hot-swappable and capable of replacement while the Roadside System remains in operation.

2.2.7.1 Automatic Vehicle Identification (AVI) System

86	Contractor shall provide an AVI System comprised of multi-protocol readers, antennas and ancillary Equipment that is compliant with the Title 21, CTOC ISO 18000-6C, and National Interoperability (NIOP) chosen to meet Map 21 requirements.
87	Multi-protocol readers shall be capable of reading Title 21 and 6C concurrently.
88	At Authority direction, Contractor shall replace the Title 21 protocol with the National Interoperability protocol.

89	At Authority direction, Contractor shall support the transition of the current CTOC protocol (Title 21) to the National Interoperability protocol and such support shall include but not be limited to installation adjustments, configuration, tuning, testing, verifying compliance to new ISO 18000-6C protocol and National Interoperability protocol requirements including accuracy requirements and operating the AVI System in ISO 18000-6C and National Interoperability multi-protocol.
90	The AVI System shall detect and report the vehicle occupancy setting irrespective of the CTOC protocols implemented in compliance with the specific interface control documents (ICDs).
91	The AVI System shall provide security features that support prevention of Transponder fraud, including but not limited to: prevent cloning; authentication of Transponder data; security key management and functionality to disable/lock Transponders.
92	Contractor shall procure the antennas and the readers that meets this Scope of Work and Requirements.
93	Contractor shall furnish and install all other Hardware, cabling (including RF, communication, and power cables), connectors and associated mounting fixtures to form a fully functioning AVI System that meets this Scope of Work and Requirements.
94	Contractor shall be responsible for the RF read zone tuning, certification of the AVI System which could include any combination of the AVI protocols required in this Scope of Work and Requirements, and for integrating the AVI System into Contractor Design. Contractor is responsible for obtaining the services of the AVI vendor to certify that the lanes are tuned for all initially and subsequently installed AVI protocols to the AVI specifications. The third-party AVI Certification Report (if Contractor is not the direct provider of the AVI System) shall be submitted to Authority for RF tuning and installation. All AVI installation, configuration and tuning shall be in compliance with the AVI vendor Requirements.
95	Contractor is responsible for synchronizing all AVI readers that are at close proximity as required by the AVI vendor.
96	The AVI System shall provide full coverage at all areas of the AVI enabled ETTM Sites to only read and report Transponders on vehicles in the Express Lanes.
97	Contractor shall provide the required antenna quantity based on the final lane configuration.
98	The ETTM System integrated with the AVI System shall have the ability to process Transponders mounted on vehicles traveling in stop and go and bumper-to-bumper traffic (three feet spacing) and vehicles traveling at speeds of up to 100 mph.
99	The AVI System shall be able to read and report Transponders even if the AVD System is not functioning properly.
100	The AVI System shall be able to read the Transponder and report all CTOC toll compliant Interoperable Transponders on vehicles traveling through any area of the Toll Zone, including but not limited to center of lane, traversing lanes, straddling lanes, and straddling shoulder with no degradation of performance or interference.
101	Contractor AVI configuration and tuning shall ensure that Transponders on vehicles traveling the general purpose lanes are not reported. The System shall only read Transponders on vehicles traveling in the Express Lanes and correctly correlate those reads to their respective vehicles in their respective lanes in accordance with the Performance Requirements.

102	The AVI System shall buffer Transponder reads when it is unable to communicate to the zone controller for a minimum period of 120 hours and longer based on the maximum number of buffered reads that the AVI System can hold. When communications are restored, the buffered reads shall be reported to and processed by the zone controller.
103	If more than one Transponder is present in a vehicle, the AVI System shall have the ability to accurately read and report multiple Transponders that are compliant with the protocols defined and Approved by Authority. The order of precedence for reporting Transponders shall be in accordance with the Approved BOS ICD and Business Rules.
104	Contractor shall use the full capability of the selected AVI System to obtain AVI System status in accordance with the manufacturer specifications and report such status to the MOMS. Loss of communication to any element of the AVI System shall be immediately detected by the zone controller and reported to the MOMS. Contractor-provided monitoring logic shall specifically detect any AVI failures and generate alarms when failures are detected.
105	To support remote access to the AVI System, a user interface shall be provided so that Software lane tuning, diagnostics, configuration changes, and other remote support shall be available to Authority authorized personnel. Setup and configuration of the AVI System shall be achieved remotely and shall not require lane closure except for major lane tuning; when initially installed; AVI protocol changes are initiated, or when a reader or antenna is replaced.
106	The AVI System shall report its health to the zone controller and shall provide status when polled. Loss of communication to any element of the AVI System shall be immediately detected and reported. All health and failure status messages shall be transmitted and reported to the MOMS.

2.2.7.2 Automatic Vehicle Detection (AVD) System

107	Contractor shall analyze the site conditions and design, procure, furnish and install the required sensors and Hardware on all lanes at the specified Toll Zones as part of the AVD System that performs in accordance with Performance Requirements set forth in this Scope of Work and Requirements under all weather conditions.
108	The AVD System shall accurately detect vehicles traveling in stop and go and bumper-to-bumper traffic, vehicles traveling at speeds up to 100 mph and shall separate vehicles spaced as close as three (3) feet apart. Trailers will be detected as part of the towing vehicle transaction.
109	The AVD System shall detect the speed of the vehicle and report the speed to the zone controller as part of the vehicle transaction data.
110	Contractor shall ensure that there is full sensor coverage at all areas of the Toll Zone/lane and shoulder to accurately trigger the ICPS and detect and report vehicles traveling the shoulder and vehicles straddling lanes.
111	The AVD System shall provide vehicle event messages and signals, and vehicle location and speed data to the zone controller. Exception conditions processed by the AVD System shall be included in the transaction data.

112	The AVD System shall report its health to the zone controller and shall provide status when polled. Loss of communication to any element of the AVD System shall be immediately detected and reported. All health and failure status messages shall be transmitted and reported to the MOMS.

2.2.7.2.1 Automatic Vehicle Detection (AVD) System – 91 Express Lanes

113	The AVD System shall provide a secondary sensor and Equipment. Should any element of the primary system fail or be degraded, the System shall determine the conditions that invoke the use of the secondary sensors and Equipment. The AVD System shall have adequate redundancy whereby a failure of a single sensor does not degrade lane operations or the ETTM System's capability to accurately associate Transponders, trigger the ICPS, capture images and process images.

2.2.7.3 Automatic Vehicle Classification (AVC) System (Separately Priced Option)

The ETTM System shall support the implementation of an AVC System. The AVC System will be a provided by Contractor as a separately priced option which Authority will have the option to execute. If Authority exercises the option, the Contractor shall provide the AVC System in accordance with the following requirements:

114	Contractor shall design, procure, furnish and install the required sensors and Hardware on all lanes at the specified Toll Zones as part of the AVC System that performs in accordance with Performance Requirements set forth in this Scope of Work and Requirements under all weather conditions.
115	The AVC System shall accurately classify vehicles traveling in stop and go and bumper-to-bumper traffic, vehicles traveling at speeds up to 100 mph and shall separate vehicles spaced as close as three (3) feet apart.
116	The AVC System shall accurately classify vehicles according to the number of vehicle axles and vehicle profile while traveling through the Toll Zones. The final classification scheme shall be subject to Authority review and Approval.
117	The AVC System shall detect trailer hitches to ensure that vehicles with a trailer/tow are reported as one unit (axles combined).
118	The AVC System shall classify two-axle, delivery-type trucks as two-axle vehicles equivalent to a passenger car.
119	The AVC System shall provide a confidence level algorithm that appropriately assigns the likelihood the classification produced by the AVC System is correct.
120	The AVC System shall provide vehicle classification data to the zone controller. Exception conditions processed by the AVC System shall be included in the transaction data.
121	The AVC System shall report its health to the zone controller and shall provide status when polled. Loss of communication to any element of the AVC System shall be immediately detected and reported. All health and failure status messages shall be transmitted and reported to the MOMS.

2.2.7.4 Image Capture & Processing Systems (ICPS)

122	Contractor shall provide an ICPS solution that meets the Performance Requirements continuously 24/7 and under all light and climate conditions.
123	Contractor shall design, procure, furnish, and install an ICPS containing cameras in sealed enclosures, lighting, necessary image triggers, back-up triggers and the necessary camera controls, and ancillary Hardware and Software required to support the transaction matching, trip creation, and violation processing Requirements as set forth in this Scope of Work and Requirements.
124	Lights installed by Contractor in support of the cameras shall not distract motorists traveling in either direction in the Corridor. Contractor shall make no assumption of ambient light and the system shall function without any degradation regardless of the ambient light. Contractor shall take the current site conditions into consideration which includes structure shadows and sun glare when designing the illumination.
125	Camera control Software shall be provided to automatically adjust the cameras to accommodate varying light and weather conditions to maintain adequate brightness and contrast settings, with or without traffic, to ensure optimum license plate information capture under all conditions and time of Day.
126	Contractor shall install high-resolution rear ALPR camera(s) per lane and shoulder lane (if necessary) to provide image coverage and capture of the Toll Zone including during system failures and excessive glare conditions and meet the accuracy Requirements.
127	Contractor shall install rear overview cameras to provide back-up image capture during normal operations and individual camera failures, as well as excessive glare conditions. The rear ICPS solution shall be a high availability design so that images can be captured in the case of a camera and server failure. The overview rear camera shall provide a general view for the purpose of identifying the vehicle and shall be installed at a different location than the high-resolution ALPR cameras.
128	ALPR cameras shall have lenses that will enable adjustment (tuning) both directly and remotely of the field of view, focus and zoom to fully and optimally capture the rear of all vehicle types within the Toll Zone.
129	Contractor shall install high-resolution rear overview color camera per lane and shoulder lane (if necessary) to provide a full image of the vehicle in the lane. The overview camera image shall be used as a back-up to obtain the license plate data if the ALPR camera images are not available.
130	The System shall associate all images captured for a single vehicle to the vehicle transaction including multiple images from the rear camera; images from the rear overview camera; and all captured images for a vehicle straddling the lanes.
131	The ICPS shall capture and process vehicles traveling in stop and go and “bumper-to-bumper” traffic, vehicles traveling at speeds up to one hundred (100) miles per hour, and vehicles with separation as close as three (3) feet apart.
132	Contractor shall ensure that there is shoulder coverage and vehicles traveling through any area of the Toll Zone/lane, including but not limited to shoulder, center of lane, traversing lanes and straddling lanes, shall be accurately detected and their images captured and processed in accordance with the Business Rules.

133	The ICPS shall be Configurable whereby images shall be saved for all vehicles. The default configuration shall be to save images of vehicles to support transaction matching and trip creation.
134	The ICPS shall buffer images (retaining an image until its disposition is known) such that no image is lost in order to support multiple vehicles in the lane and in accordance with the Business Rules.
135	Contractor shall procure, furnish, and install the necessary redundant controllers/servers and high availability architecture to support the ICPS Equipment. Contractor shall provide robust, industrialized platforms and operating systems (PC's or workstation-type operating systems are not permitted) and the processor speed and memory shall be sufficient to process vehicles in real time to meet the speed and traffic volumes as specified in this Scope of Work and Requirements.
136	The ICPS servers shall be separate from the zone controller servers.
137	The controllers/servers shall support standalone operations and the roadside storage media shall be sized to hold a minimum of thirty (30) Days of images and data per lane at each of the Toll Zones under normal operating conditions.
138	When the storage capacity reaches a Configurable utilization percentage (for example 80%), a message shall be transmitted to the MOMS. Images shall be deleted only after it is confirmed/acknowledged that the images have been successfully transmitted to the RSS. Any deletion of images shall be automatic, without user intervention, and shall generate a message to be transmitted to the MOMS (Configurable).
139	The ICPS controllers/servers architecture shall have sufficient reliability and/or redundancy such that failure of a processor, the communications, board, power supply, disk or other critical unit does not result in loss of images and data.
140	In the event communications to the ICPS are lost or any ICPS Hardware becomes non-operational, Contractor Design shall ensure that no images and/or data are lost and that all images and associated data are transmitted to the RSS.
141	Contractor's Design shall guarantee transmission of the images and data from the Roadside System to the RSS and shall provide the capability to reconcile images to the transaction data.
142	The ICPS shall be capable of transferring images and associated data to the RSS in real-time or in batch mode depending on the ICPS solution and the location of the OCR/ALPR Software. The System shall provide one hundred percent (100%) reconciliation of all images captured and transferred.
143	The ICPS shall be capable of continuously performing diagnostics and reporting its health to the zone controller or the MOMS. Loss of communication to any element of the ICPS shall be immediately detected. All health, failure and recovery status messages shall be transmitted and reported to the MOMS.
144	The ICPS shall provide the capability of detecting image quality degradation in near real-time and generate alarms that are reported to MOMS when image quality impacts OCR/ALPR or manual image processing performance.
145	Contractor shall provide for adjusting and tuning the cameras remotely.

2.2.7.5 Optical Character Recognition (OCR)/Automatic License Plate Recognition (ALPR)

Contractor's OCR/ALPR solution can be at the camera level, ETTM Site level or Corridor level as long as it meets the functional and Performance Requirements of this Scope of Work and Requirements.

146	Contractor shall provide OCR/ALPR Software for determining the license plate data (number, jurisdiction and plate type) in accordance with the requirements specified in this Scope of Work and Requirements.
147	The System shall correctly identify the jurisdiction (state/province), plate type, special characters and stacked characters (where applicable), and accurately determine the license plate number.
148	Temporary CA license plates are pursuable, and the System shall correctly determine the license plate number, plate type and jurisdiction.
149	The System shall meet the OCR/ALPR Performance Requirements specified in this Scope of Work and Requirements for all standard and special license plates from States of California, Nevada, Arizona, Texas, Washington, and Utah.
150	The System shall meet the OCR/ALPR Performance Requirements specified in this Scope of Work and Requirements for an image set containing only the California "California Legacy License Plate" that has gold letters and a black background.
151	If a vehicle has two license plates or multiple rear images are captured for a vehicle, the region of interest (ROI) for all license plates shall be obtained and the license plate number from all plates shall be extracted and associated to the vehicle transaction. Vehicles with two rear license plates shall be identified in order to apply separate Business Rules for such transactions.
152	The captured license plate results shall include the confidence level for each character; confidence level for the jurisdiction, confidence level of the plate type and an overall confidence level.
153	Contractor shall provide the necessary Hardware to ensure there is no backlog in the processing of images for obtaining the license plate data (number, jurisdiction and plate type)
154	Contractor shall provide server redundancy whereby standby servers are available immediately and fully operational in the event of a failure.
155	The OCR/ALPR Software procured, furnished, and installed under this Agreement shall include Software that enhances and improves the accuracy and efficiency of the OCR/ALPR process especially as it relates to transaction matching and trip creation.
156	Manual image review of vehicle license plates without a valid Transponder shall be required if the associated confidence level is less than a Configurable threshold;
157	For those images that are identified for manual review, the ETTM System shall associate all images captured for a vehicle for a trip as it travels through each of the Toll Zones on a Corridor, assign them a unique identifier and transmit the images to the RSS for manual image review.

158	The images identified for the BOS license plate and violation processing shall include, at a minimum, the rear full compressed image(s) and the associated ROI images, and the overview image. Other images shall be made available upon request.
159	The image data shall include, but not be limited to:
	• transaction data;
	• license plate data, including license plate number, jurisdiction and plate type;
	• confidence level of the OCR results for individual characters and overall license plate number, and
	• confidence level of the license plate type and jurisdiction.
160	The ETTM System shall utilize OCR/ALPR results to filter license plates/images that match specified states and license plate types that are not processed per the Business Rules.
161	For audit and Maintenance purposes, authorized personnel shall have the capability to view all the images in real time on any device connected to the ETTM Communications Network and verify the OCR/ALPR or manual image processing performance.
162	Contractor shall measure, continuously track and report on performance of image review accuracy, productivity, reversed write-offs, and manual entries for individual and group comparisons.

2.2.7.6 Vehicle Signature Recognition (VSR)

163	Contractor's OCR/ALPR solution shall include VSR to improve the license plate data extraction performance and minimize manual image review, and return the license plate number, jurisdiction and plate type that is associated to the transaction.
164	The ETTM System shall provide the VSR confidence levels for the license plate number and jurisdiction for each image processed for downstream processing, filtering and reporting.
165	The ETTM System shall have the tools to monitor the VSR performance and to update and configure the Software to maintain and enhance the VSR performance.
166	The ETTM System shall validate all license plates in the VSR database for the first time by requiring each image to be reviewed a Configurable number of times by an image reviewer prior to being added into the VSR database. Every license plate in the VSR database shall have been validated before it is recorded in the VSR database.
167	The ETTM System shall automatically validate the VSR database at Configurable periods (for example in 180 Days) which will result in the vehicle image requiring manual image review even if established confidence level is achieved. Those images requiring revalidation shall be removed from the VSR database until such time they are validated again.
168	The ETTM System shall provide the capability to automatically correct and validate the VSR database when any error in the VSR determined license plate result is identified at any point in the downstream processes including during audit and dispute data obtained from the BOS through the Plate Correction List.

169	The ETTM System shall provide the capability to perform VSR on a Configurable percentage (up to one-hundred percent (100%)) of images and obtain the license plate number, jurisdiction and plate type based on the jurisdiction of the license plate, the plate type, and the confidence level of the OCR results (individual characters and entire license plate number).
170	The ETTM System shall utilize VSR results to filter license plates/images that match specified states and license plate types that are not processed per the Business Rules.
171	The VSR solution shall provide license plate results that meet the accuracies specified in this Scope of Work and Requirements.
172	The VSR solution shall be used by Contractor to support transaction matching and trip creation to meet the Performance Requirements of this Scope of Work and Requirements.

2.2.7.7 Clean Air Vehicles (CAV)

173	Contractor's ETTM System shall support the automated identification of the Clean Air Vehicles (CAV) that are provided discounts by Authority based on a Configurable hierarchy-based pricing of transactions and inputs including but not limited to:
	• BOS clean air status;
	• Tag Status File (clean air status);
	• California DMV clean air status;
	• Transponder setting; and
	• Account setting.
174	The ETTM System shall interface with the BOS as required to assign a CAV status to each transaction.
175	The ETMM System shall flag a CAV for manual image verification based on Authority Business Rules.
176	The ETTM System shall pass CAV information to the BOS, per the Approved ICD.
177	The ETTM System shall be Configurable to comply with current and future Clean Air Vehicle state and federal law and comply with all current and future FHWA directive.

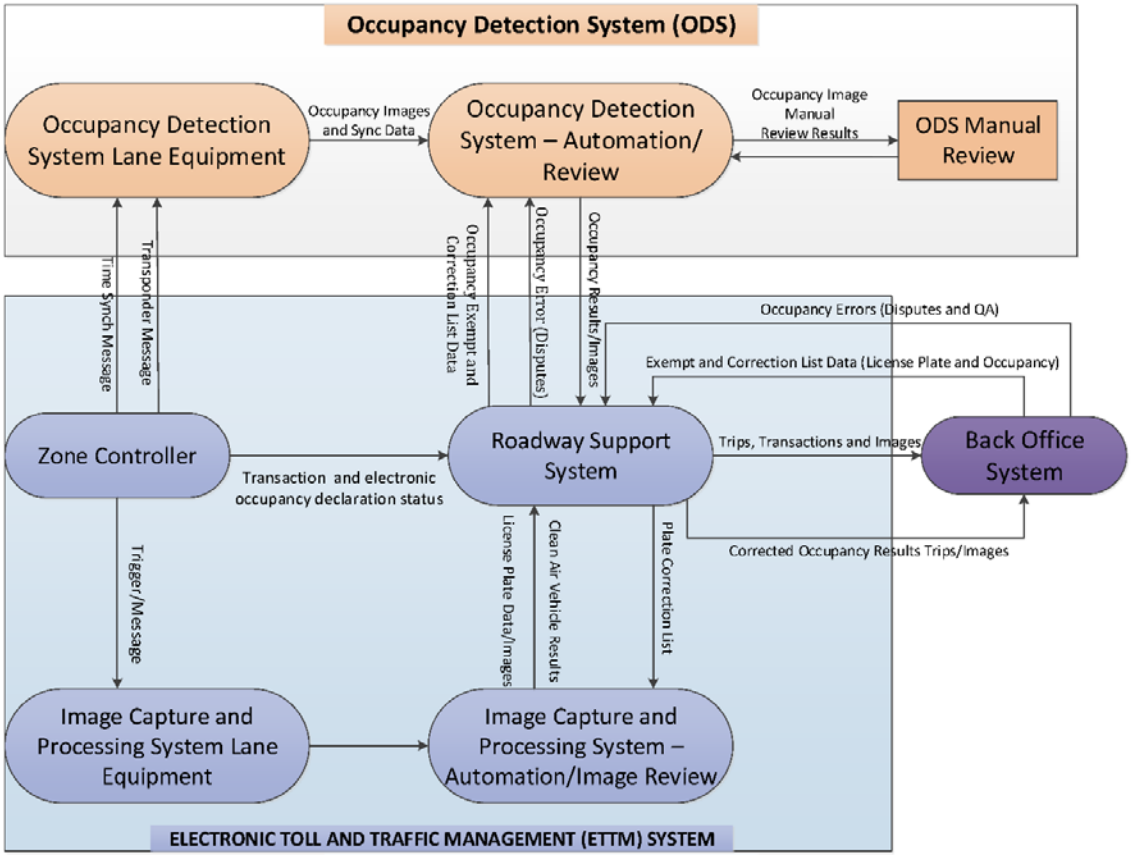
2.2.7.8 Occupancy Detection System (ODS) (Optionally Provided and Separately Priced)

Authority is interested in operating an ODS to deter misstated vehicle occupancy. The ETTM System shall support the implementation of an ODS. A proposer has the option to include or not include the ODS functionality as part of its proposal. If included, the ODS shall be a separately priced option which Authority will have the option to execute. If not included by the proposer or if the option is not executed by Authority, Contractor shall, if directed by Authority, integrate with an Authority selected third-party vendor during either the Implementation Phase or Operations and Maintenance Phase.

178	The ODS shall be a fully automated system to detect and report the number of occupants in each vehicle in the ETTM Toll Collection and Enforcement Sites.
179	Contractor's zone controller and the ETTM System shall interface to the ODS for the synchronization of the systems and transmission of occupancy detection results.

180	The ETTM System shall associate all images, data and ODS results to the transaction and record such information along with the transaction data. Such information shall be made available during the occupancy violation audit review process.
181	The ETTM System shall poll the status of the ODS and all communications, health and failure status messages shall be reported to the MOMS.
182	The MOMS shall be capable of continuously receiving diagnostics and health reports from the ODS.

Figure 5-1. Roadway Toll Collection System Interface to Occupancy Detection System



2.2.7.8.1 Occupancy Detection System (ODS) – Contractor-Provided Option

Prior to Authority's decision to execute the option and implement the ODS and prior to any ODS related payment, Contractor shall provide an ODS concept of operations, proof of concept plan and conduct a proof of concept test. The location of the testing will most likely be the 91 Express Lanes ETTM Toll Collections and Enforcement Site, but will be determined in discretion of Authority. Based on the result of the testing and other factors Authority deems appropriate in its discretion, Authority will decide whether to execute the option.

183	Upon Authority direction, Contractor shall design and provide an ODS for the Express Lanes. Contractor shall prepare an ODS concept of operations and proof of concept test plan for Authority Approval, at no additional cost to Authority.
184	Upon Authority direction, Contractor shall install the ODS at a single ETTM Toll Collection and Enforcement Site determined by Authority and conduct a proof of concept test. After the testing, Contractor shall provide a comprehensive report, at no additional cost to Authority.
185	The ODS shall be capable of accurately detecting and reporting the number of occupants of each vehicle passing through the ETTM Toll Collection and Enforcement Sites. The ODS shall be capable of differentiating between vehicles carrying 1, 2, and 3+ total vehicle occupants.
186	Contractor shall integrate the ODS with the ETTM System and interface to the BOS System to address all functionality and interfaces shown in ***Figure 5-1: Roadway Toll Collection System Interface to Occupancy Detection System***, which notes the required interfaces and files exchange between the different systems.
187	Contractor shall be responsible for providing MOT for the installation and testing of the ODS, at no additional cost to Authority.
188	The ODS shall provide a confidence level algorithm that appropriately assigns the likelihood the occupancy detected by the ODS is correct.
189	The ODS shall interface with the RSS and support the verification and toll rate adjustments of each transaction.
190	The ODS shall be capable of automatically adjusting the toll rate for transactions when the declared occupancy is different from occupancy detected by the ODS, per the Business Rules.
191	The ODS shall interface with the BOS and include both a primary viewer and a quality control viewer for image review.
192	The ODS shall redact facial images in conformance with the California Streets and Highway Code § 31490. Contractor shall provide Authorized Users the ability to view unredacted images.

2.2.7.8.2 Occupancy Detection System (ODS) and BOS (ODS-Related) - ETTM Integration Only Option

Contractor shall, if directed by Authority, integrate with an Authority selected third-party vendor during either the Implementation Phase or Operations and Maintenance Phase. In addition, Contractor shall interface with the BOS (existing and new) to support the exchange of ODS related information. The anticipated exchanges of data, triggers, transitions and images between the ETTM System, the ODS and the BOS are shown in ***Figure 5-1: Roadway Toll Collection System Interface to Occupancy Detection System***.

193	If directed by Authority, Contractor will be responsible for integrating the ODS into the ETTM System.
194	If directed by Authority, Contractor will be responsible for integrating with the BOS for the exchange of ODS-related information.

195	Contractor shall support the ODS vendor and the BOS with design of the ODS-related interfaces and processes to support the Approved ODS concept of operations.
196	Contractor shall support the ODS vendor during installation of the ODS during on-site integration testing, proof of concept testing and installation across the ETTM System.
197	Contractor shall support the ODS vendor in developing plans for and implementing MOT; however, the ODS vendor or Authority shall be responsible for all ODS related MOT.
198	Contractor shall integrate the ODS with the ETTM System in accordance with the ICD which will be developed by the ODS vendor in coordination with Contractor and the BOS Contractor.
199	The ODS provided by Authority will include all field Equipment, Software and applications and the results of the ODS will be transmitted to the ETTM System in accordance with this Scope of Work and Requirements.
200	The ODS Software will run on a separate server either at the ETTM Toll Collection and Enforcement Site or at the Corridor level provided by Authority and the results of the ODS will be transmitted to the ETTM System for integration and association to the transaction.
201	Upon acceptance of the ODS by Authority, the ODS vendor will provide the ODS equipment maintenance and support. All software support will also be performed by the ODS vendor.

2.2.7.9 Manual Image Review

202	Contractor shall provide manual image review as part of trip building process for all transactions that do not meet the required confidence levels.
203	Manual image review shall be required for:
	• All transactions that do not meet the required OCR/ALPR confidence level;
	• All Unpermitted Vehicles transactions;
	• All CAV transactions; and
	• All transactions where the declared vehicle occupancy does not match the vehicle occupancy detected by the ODS.
204	The ETTMS System shall be capable of queuing images by type (i.e. Unpermitted Vehicle, CAV, etc.) for manual image review and follow-on review by Authorized Users.
205	During the Implementation and Operations and Maintenance Phases, the Contractor shall work with the Existing and/or New BOS Contractor to update and test the ICD between the ETTM System and the BOS to support the differentiation, unique processing and transfer of different image types.

2.2.7.10 Toll Rate Changeable Message Sign

2.2.7.10.1 Toll Rate Changeable Message Sign – 91 Express Lanes

The 91 Express Lanes and RCTC 91 Express Lanes Toll Rate CMSs are jointly managed through an agreement between Authority and RCTC. It is not anticipated that Contractor will have an electronic interface directly with the signs or with any system that controls the signs. At some point during the Operations and Maintenance Phase, the Authority may direct Contractor to provide coordination of Toll Rate CMS maintenance with a third-party maintenance provider and the following requirements would apply.

206	In the event that an existing Toll Rate CMS is damaged or not functioning properly, Contactor shall provide initial maintenance response and coordinate the Toll Rate CMS maintenance with a third-party maintenance provider.
207	Contractor shall manage and oversee any Toll Rate CMS maintenance provided by a third-party maintenance provider.
208	Contractor's coordination, management, and oversight of Toll Rate CMS maintenance shall be provided at no additional cost.

2.2.7.10.2 Toll Rate Changeable Message Sign – I-405 Express Lanes

The Express Lanes will use full-matrix CMS modules/signs, integrated with and controlled by Contractor, to inform the motorists of the toll amount in effect on the Express Lanes so that motorists can choose their travel option.

209	Contractor shall design, procure, and install new Toll Rate CMSs and integrate them into the ETTM System. Toll Rate CMS are installed on the I-405 Express Lanes as shown in ***Attachment 3: I-405 EL ETTM System Locations***.
210	The Toll Rate CMS shall be Daktronics Vanguard VF-2420-54X255-34-X full-color CMS as specified in ***Attachment 5: Toll Rate Changeable Message Sign (CMS) Specifications***, or Approved equivalent.
211	The Toll Rate CMS shall support the display of toll amount for up to three (3) Configurable destinations and Express Lanes eligibility requirements on the -fourth row.
212	The Toll Rate CMS shall operate in temperatures from -30-deg F to +165-deg F and a humidity ramp of 0 to 99%, non-condensing.
213	The Toll Rate CMS shall include a high-intensity LED, full-color, full-matrix display capable of displaying four lines of text with a 13" minimum character height.
214	The Toll Rate CMS shall consist of 34 mm pixels.
215	The Toll Rate CMS sign intensity shall 12,400 candelas/m^2 minimum.
216	The Toll Rate CMS shall operate on NTCIP communications protocol.
217	The Toll Rate CMS shall meet or exceed NEMA TS 4 Section 2 environmental requirements.
218	The Toll Rate CMS shall be sufficiently wide to display the text "HOV 3+ WITH FASTRAK FLEX NO TOLL" on a single line.
219	The Toll Rate CMS display area shall be a minimum of 5'-11" by 27'-7"
220	The Toll Rate CMS shall be capable of displaying MUTCD, Authority, and Caltrans approved text, graphical images, and shapes, which shall comply with applicable MUTCD and Caltrans standards.
221	The Toll Rate CMS shall support the display of text messages in English for the display of incident mode data, for example CONSTRUCTION AHEAD, CLOSED TO TRAFFIC and HOV ONLY in accordance with the Business Rules.
222	The Toll Rate CMS will include a relatively small static sign panel identifying the Express Lane. Design-Builder will Design and furnish the static sign panel to be affixed to the Toll Rate CMS. Contractor shall assemble and install the Toll Rate CMS.

223	Contractor shall coordinate the Toll Rate CMS Design with the Design-Builder. The Design-Builder is responsible for the design and installation of Toll Rate CMS support structure, Toll Rate CCTV camera mounting structure, and Toll CCTV camera mounting structure.
224	Contractor shall furnish and install the Toll Rate CMS assembly (LED panel and static sign panel), Toll Rate CCTV camera, and Toll CCTV cameras.
225	If the Toll Rate CMS is upstream of the Toll Zone where vehicle is detected, the System shall consider the travel time between the Toll Rate CMS location and the Toll Zone to determine and assign the toll that was displayed to the customer in accordance with the Business Rules.
226	Contractor shall provide a sign control system which, in normal operations, communicates with the Time-of-Day pricing system and controls the Toll Rate CMS display.
227	The Toll Rate CMS shall store default toll rates by time of Day (Configurable time periods in as low as 15 minute increments) Day of week, and individual holiday schedules that will be displayed on the Toll Rate CMS when communications to the sign control system is lost.
228	Authorized personnel shall have access to the Toll Rate CMS through a secure and Authorized User network interface to directly control the Toll Rate CMS manually and override system messages. When operating in manual override mode an alarm message shall be generated and sent to MOMS at Configurable intervals.
229	The status of the Toll Rate CMS and the data on the Toll Rate CMS shall be displayed on the RSS Dashboard/Operations monitoring screen in real-time.
230	Specified CCTV cameras will be identified as Toll Rate CCTV cameras that will monitor the Toll Rate CMS at each Toll Rate CMS location. These cameras shall be integrated into the ETTM System by Contractor to record the data displayed on the Toll Rate CMS upon every change in message and at Configurable intervals. The recorded frames shall be displayed on the Operations monitoring screen/Dashboards and available for review.
231	The Toll Rate CCTV camera frames shall be available for display on the Express Lanes Management Dashboard.
232	Loss of communications or failure of any component of the Toll Rate CMS, including the Toll Rate CCTV camera, shall be detected and reported to MOMS and be displayed on the Operations monitoring screen as a Priority 1 event. Toll Rate CMS failures shall include loss of power to the Toll Rate CMS and blank display.
233	The Toll Rate CMS and the Toll Rate CCTV cameras shall be synchronized to the same time source as the RSS.

2.2.7.11 Enforcement Beacons

2.2.7.11.1 Enforcement Beacons – 91 Express Lanes

Contractor shall procure, install, and integrate Enforcement Beacons for each of the six (6) Express Lanes (three (3) in each direction) at the ETTM Toll Collection and Enforcement Site. Enforcement Beacons shall be installed for viewing from both upstream and downstream of the ETTM Toll Collection and Enforcement Site. Currently the Enforcement Beacons are only on the downstream side of the gantry. The purpose of the Enforcement Beacon is to indicate, primarily to CHP, if the vehicle has a valid Transponder that has been read. The criteria for a Transponder

to be considered “valid” will be determined by Authority during the Implementation Phase based on information passed from the BOS.

234	Contractor shall furnish and install Enforcement Beacons over each lane and at each ETTM Toll Collection and Enforcement Site.
235	An Enforcement Beacon for each Express Lane shall be clearly visible to CHP officers from downstream of the ETTM Toll Collection and Enforcement Site allowing them to associate the Enforcement Beacon display to the vehicle in the ETTM Toll Collection and Enforcement Site.
236	An Enforcement Beacon for each Express Lane shall be clearly visible to upstream vehicles traveling in the Express Lanes approaching the ETTM Toll Collection and Enforcement Site allowing CHP to associate the Enforcement Beacon display to the vehicle ahead in the ETTM Toll Collection and Enforcement Site.
237	The Enforcement Beacons shall not be blocked from view by the second gantry, signage, Equipment, mounting hardware or any other obstruction.
238	The Enforcement Beacons that display downstream shall provide a different distinct color for each lane.
239	The Enforcement Beacons that display upstream shall comply with applicable MUTCD and Caltrans standards, shall be configured to not resemble normal traffic control devices.
240	The Enforcement Beacons that display downstream shall be placed in the same location as the existing Enforcement Beacons.
241	The diameter of the Enforcement Beacons shall be equal to or greater than the existing Enforcement Beacons.
242	The Enforcement Beacon provided by Contractor shall include an ambient light sensor that allows the intensity of the LED display to be adjusted for changing light conditions.
243	Loss or failure of the Enforcement Beacon light arrays shall be detected immediately by the zone controller and transmitted in real-time to the RSS to be reported to the MOMS.
244	Beacons shall operate in AVD degraded mode where vehicles are not being detected but Transponders are still being read.
245	All Enforcement Beacon designs shall comply with applicable MUTCD and Caltrans standards and must be Approved by Authority and Caltrans with particular regard for driver distraction.

2.2.7.11.2 Enforcement Beacons – I-405 Express Lanes

Contractor shall procure, install, and integrate Enforcement Beacons for each Express Lane at the ETTM Toll Collection and Enforcement Site. Enforcement Beacons shall be installed for viewing from both upstream and downstream of the ETTM Toll Collection and Enforcement Site. The purpose of the Enforcement Beacon is to indicate, primarily to CHP but also to drivers, if the vehicle has a valid Transponder that has been read and what the occupancy setting is. The criteria for a Transponder to be considered “valid” will be determined by Authority during the Implementation Phase based on information passed from the BOS.

For the I-405 Express Lanes, Authority is looking for innovative designs that can be clearly interpreted by the CHP officers and help deter miss-stating of occupancy by making Express Lanes drivers aware that their occupancy setting is being read. The indicator will need to clearly

designate between 1) no Transponder or Transponder not valid; 2) switch set to SOV; 3) switch set to 2 occupants, and 4) switch set to 3+ occupants.

Authority understands that some designs may require additional civil infrastructure.

246	Contractor shall furnish and install Enforcement Beacons over each Express Lane and at each ETTM Toll Collection and Enforcement Site.
247	An Enforcement Beacon for each Express Lane shall be clearly visible to CHP officers from downstream of the ETTM Toll Collection and Enforcement Site allowing them to associate the Enforcement Beacon display to the vehicle in the ETTM Toll Collection and Enforcement Site.
248	An Enforcement Beacon for each Express Lane shall be clearly visible to upstream vehicles traveling in the Express Lanes approaching the ETTM Toll Collection and Enforcement Site allowing CHP to associate the Enforcement Beacon display to the vehicle ahead in the ETTM Toll Collection and Enforcement Site.
249	The Enforcement Beacon indicators shall not be blocked from view, signage, Equipment, mounting hardware or any other obstruction.
250	The Enforcement Beacon provided by Contractor shall include an ambient light sensor that allows the intensity of the LED display to be adjusted for changing light conditions.
251	The ETTM System shall directly control the illumination of the Enforcement Beacon to allow for instant feedback to observers on vehicle Transponder Occupancy Setting.
252	Loss or failure of the Enforcement Beacon light arrays shall be detected immediately by the zone controller and transmitted in real-time to the RSS to be reported to the MOMS.
253	Beacons shall operate in AVD degraded mode where vehicles are not being detected but Transponders are still being read.
254	Contractor shall be responsible for any civil infrastructure required to mount the Enforcement Beacon, other than the toll gantry provided.
255	All Enforcement Beacon designs shall comply with applicable MUTCD and Caltrans standards and must be Approved by Authority and Caltrans with particular regard for driver distraction.

2.2.7.12 Toll Transaction History Access for Enforcement Purposes

Contractor shall provide CHP (or other Authorized Users) secure, URL-based toll transaction history. It is anticipated that the CHP officer will access the information via their existing in-vehicle computer immediately after stopping drivers that are suspected of violating the law on the Express Lanes. Via access to the ETTM System, after stopping a driver, the CHP officer may opt to retrieve the toll transaction history by either entering the license plate and/or the Transponder ID. The ETTM System will provide the toll transaction history in near real time. It is not anticipated that Contractor will provide any in-vehicle or on-person Equipment to be used by CHP in accessing this information.

256	The ETTM System shall provide secure, URL-based access to CHP (or other Authorized Users) for accessing Transponder-Based and/or Image-Based Transaction history per OCTA Policy and the Streets and Highway Code 31490. The CHP officer, using a secure login, shall be provided the most recent Configurable number of transactions displayed on the CHP in-vehicle computer including Transponder-Based Transactions within the last two (2) minutes.
257	When using the license plate number, the ETTM System shall provide both Image-Based violation transactions and Transponder-Based Transactions for the Transponder associated with the license plate entered.
258	At a minimum, transaction data shall include Corridor, Toll Zone, transaction date and time, Transponder ID, and Transponder Occupancy Setting.
259	The CHP will have direct walkie-talking or phone access to the TOC. As a secondary method, the TOC shall be capable of using the same functionality to access the information and pass it verbally to the officer.

2.2.7.13 Digital Video Audit System (DVAS)

260	Contractor shall provide Digital Video Audit System (DVAS) units at each ETTM Toll Collection and Enforcement Site and ETTM Transponder Read Site which will provide an integrated solution with the capability to investigate lane performance issues and support testing.
261	The DVAS shall include one high resolution color camera per Toll Zone providing full coverage and continuous video footage of the Toll Zone.
262	The DVAS shall encompass all Equipment and Software necessary to provide the audit capability described herein, including but not be limited to:
	• digital cameras and any associated lenses, lighting and sensors;
	• interface to the zone controllers to capture event data;
	• storage media, and
	• application to view real-time video and events and playback the information.
263	Every Toll Zone shall be wired to integrate the DVAS, and the zone controllers at each location shall integrate the DVAS units to support the requirements in this Scope of Work.
264	The DVAS cameras shall have pan-tilt-zoom (PTZ) functionality that allows Authorized Users to remotely control the camera. The DVAS cameras shall revert to the default settings that can be overridden by Authorized Users when no PTZ commands are received within a Configurable time. Alarm messages shall be reported to MOMS when remote controls or setting other than default are detected.
265	Clear, high quality video of each toll lane shall be provided in accordance with the ambient lighting and/or weather conditions at each Toll Zone.
266	The DVAS and audit data shall be independent of the transaction data stream provided to the ETTM System; however, the DVAS shall be integrated into Contractor's System and linked to the transaction to meet the requirement specified in this section.
267	Contractor shall provide Authorized Users the ability to access the DVAS through the ETTM System application or through a secure application using any Authority authorized workstation connected to Authority System network.

268	The DVAS shall provide the capability to monitor an overall image of the Toll Zone with the ability to see each lane and the vehicle traveling in that lane, and shall display detailed events for each lane as they occur in real-time.
269	At a minimum, the DVAS shall display the Corridor ID, Toll Zone, lane number, transaction number, transaction date and time, Transponder ID, Transponder Occupancy Setting and status, operational mode and payment method. The DVAS video and data shall be accessible in read-only mode; no changes or alterations to the video or data shall be allowed.
270	All detailed data obtained from various subsystems shall be displayed to assist auditors and Maintenance staff with the investigation of discrepancies and problems. The DVAS shall perform and display video and data in real-time and shall have the ability to playback events and data.
271	The DVAS shall also have the capacity to record and store up to ninety (90) Days (Configurable) of video and data to an electronic media for each DVAS camera. DVAS video and the corresponding data (event information and the transaction information) shall be saved together as a unit such that when it is moved to a different environment, the video can be replayed with the events being displayed (Configurable) outside the production environment as long as the DVAS replay Software is available.
272	As part of the Implementation Phase, Contractor and Authority shall determine the optimum location for the installation of the DVAS Equipment to allow for the complete monitoring of each toll lane. If Contractor cannot install the DVAS cameras on existing infrastructure or on supports installed by the Design-Builder, it shall be the responsibility of Contractor to install the necessary infrastructure.
273	MOMS message shall be generated if there is failure of any component of the DVAS.
274	The DVAS shall be time synchronized to the same source as the zone controllers and interface to the zone controller to obtain event data.
275	Identification on the screens shall allow the reviewers to clearly differentiate the lane under review and its associated event data.
276	Controls shall be provided to step forward and backward by frame and display of events shall be synchronized. All digitized video and corresponding event data shall be tightly synchronized and stored.

2.2.7.14 Uninterruptible Power Supply (UPS)

Utility power will be made available to Contractor at the Equipment cabinets at each ETTM Site location on each of the Corridors. For the designated ETTM Sites, Contractor shall provide Uninterruptible Power Supply (UPS).

277	All ETTM System Hardware and Equipment shall be on UPS. The UPS shall be supplied by Contractor.
278	At all applicable ETTM Sites, Contractor shall furnish and install an automatic transfer switch (ATS) at cabinet. Contractor shall interface with the ATS and the smart Power Distribution Units (PDUs) to manage the Roadside power distribution. Maintenance technicians shall have remote access to manage power to critical devices.

279	Contractor shall furnish and install an electronic interface to the UPS to monitor its UPS performance. The MOMS shall detect the status of the UPS and Alert technicians when the System is on UPS and prior to any graceful shutdown.
280	Software drivers shall be developed, furnished, and installed to acquire, display, store and report all parameters provided as outputs from the UPS.
281	The UPS shall support the ETTM Sites for a minimum of four (4) hours.
282	Prior to the UPS being expended (i.e. 5 minutes after utility power outage), the power will switch to the Roadside Generator, where applicable.
283	If no Roadside Generator is provided, the System shall initiate a graceful shutdown of the servers/computers.
284	When utility power is restored and Hardware/Equipment is no longer on the UPS a notification shall be reported to the MOMS.

2.2.7.14.1 Uninterruptible Power Supply (UPS) – 91 Express Lanes

285	The existing ETTM Site UPSs shall not be re-used and Contractor shall remove and coordinate delivery to Authority for disposal the existing UPSs at each ETTM Site.
286	Contractor shall be responsible for taking over the existing meters at each ETTM Site and shall size the power, meter, and UPS to meet the power requirements at each site.

2.2.7.14.2 Uninterruptible Power Supply (UPS) – I-405 Express Lanes

287	Contractor shall be responsible for providing ETTM Site power requirements to the Design-Builder. The Design-Builder will design and provide power to each ETTM Sites.
288	Contractor shall be responsible for taking over the new meters at each ETTM Site and shall size the UPS to meet the power requirements at each site.

2.2.7.15 Roadside Generators

2.2.7.15.1 Roadside Generators – 91 Express Lanes

289	The existing Roadside Generator(s) shall be retained and re-used.
290	Contractor shall furnish and install a new electronic interface to the existing generators to monitor their performance. The MOMS shall detect the status of the generator and Alert technicians when the System is on/off the generator.

2.2.7.15.2 Roadside Generators – I-405 Express Lanes

291	Contractor shall provide Roadside Generators at each ETTM Toll Collection and Enforcement Site and ETTM Toll Rate CMS Site to supply continuous service in the event of a utility power loss.
292	The generators power supply shall be liquid propane (LP), liquefied natural gas (LNG), diesel, or other type as Approved by Authority.
293	The generator shall be capable of supplying Equipment with backup power within 5 minutes and maintain peak power draws until utility power is restored.
294	The generators shall be easily accessible to Maintenance technicians so that they can refuel the tanks in the event of extensive power outage.

295	Contractor shall secure the generators to prevent theft.
296	Contractor shall furnish and install an electronic interface to the generators to monitor their performance. The MOMS shall detect the status of the generator and Alert technicians when the System is on/off the generator.

2.2.7.16 Zone Controller

2.2.7.16.1 Zone Controller Hardware

297	A fully redundant zone controller that is capable of supporting the Requirements in this Scope of Work and Requirements shall be designed, procured, furnished, and installed at each Toll Zone as identified in ***Attachment 2: 91 EL ETTM System Information*** and ***Attachment 3: I-405 EL ETTM System Locations.*** The zone controller shall be designed in a redundant configuration where there is a single primary zone controller with a "hot standby" secondary zone controller operating in parallel and capable of assuming processing control in the event the primary unit should fail (automatic failover), without requiring human intervention.
298	When any Hardware and/or process on the primary zone controller fails preventing it from processing vehicles and creating transactions, the secondary zone controller shall assume the functions of the primary zone controller. The failover from the primary zone controller to the secondary zone controller shall be transparent to the System operations and shall not require the restart of any subsystems. Only one zone controller at a time shall generate revenue transactions.
299	Alarm messages shall be generated and reported to the MOMS when such a failover event occurs. Contractor's failover Design shall ensure that there is no loss of revenue or transactions when one of the zone controllers fails.
300	The System shall also provide Authorized Users the capability to manually and remotely switch the active zone controller to and from the primary zone controller to the secondary zone controller. All such events shall be recorded and transmitted to the MOMS.
301	The zone controllers shall be hardened, industrial grade servers and the processor speed and memory shall be sufficient to process vehicles in real time to meet the traffic speed and volumes as specified in this Scope of Work and Requirements. The current volumes are provided in ***Attachment 6: Current Traffic and Transaction Volumes by Facility.***
302	Storage shall be sized to hold a minimum of thirty (30) Days of one hundred percent (100%) of transactions and event data for each lane at the Toll Zone supported by the zone controller.

2.2.7.16.2 Zone Controller Software

303	The zone controller Software shall interface to the various devices and subsystems for each of the lane configurations specified and perform all the functions as described in this Scope of Work and Requirements.
304	The zone controller located at each of the Toll Zones shall process all of the data obtained from the other subsystems and devices as described in this Scope of Work and Requirements to generate a transaction record for each vehicle passage through the Toll Zone/lane. The zone controller shall:

	• manage the Transponder status list for Authority, all CTOC Interoperable agencies, and all National Interoperable Agencies used to validate the status of a Transponder received from the AVI System;
	• use the data obtained from the AVI and AVD systems to assign the Transponder read to the correct vehicle and frame the vehicle transaction accurately;
	• notify the ICPS to capture, if applicable, and process vehicle images in accordance with the Business Rules;
	• transmit the transaction record to the RSS, including but not limited to the following data: vehicle detection data, Transponder data, Transponder Occupancy Setting data, Equipment status data, and all other pertinent information regarding the transaction;
	• transmit to the MOMS all alarm messages relating to the health of each subsystem, including the health of the primary and secondary (redundant) zone controller. Recovery messages shall also be transmitted and reported;
	• transmit vehicle event data and transaction data to the DVAS; and
	• transmit to the RSS for further processing all other messages/events in accordance with Approved Interface Control Documents (ICDs).
305	The zone controller Software shall be Configurable and shall be able to support Authority Roadside operational needs without requiring changes to Software. The Configurable parameters shall be defined and documented during the Design process. All parameters shall have default values that shall be established during the Design process.
306	Contractor shall propose appropriate protocols and data structures to accomplish the communications required between various peripherals. These protocols and data structures shall be fully detailed and documented by Contractor during the Design process and Approved by Authority.
307	Guaranteed transmission protocols shall be used for all messages exchanged between systems, including but not limited to:
	• zone controller;
	• ICPS;
	• ODS;
	• AVI System;
	• AVD System;
	• RSS
	• MOMS;
	• DVAS, and
	• Toll Rate CMS (I-405 EL only).

2.2.7.16.3 Zone Controller Start-Up

308	Upon start-up or initialization, the zone controller shall perform a self-diagnostics test to ensure full System Operations. Alarm messages shall be reported for all failure conditions and a notification of the diagnostic check completion shall be displayed on the MOMS monitoring screen. The failure of a critical system shall result in the Toll Zone operating under degraded Operations in accordance with the Business Rules.
309	Upon start-up, the zone controller shall verify with the RSS that it has the latest configuration files; Transponder status file; and any other files required to support the lane Operations. If the latest files are not present on the zone controller, it shall request the latest data from the RSS. If a zone controller is unable to get the latest files, an Alert shall be generated and sent to MOMS.

2.2.7.16.4 Zone Operations

When the Express Lanes are open to traffic and operating in Normal Mode, Single Occupant Vehicles (SOV) are required to pay a toll using a Transponder. High Occupancy Vehicles (HOV) can use the Express Lanes for free or at discounted toll rates when equipped with a Transponder. Vehicles not equipped with Transponders are processed as Image-Based Transactions. The I-405 Express Lane Corridors support HOV 2+ and HOV 3+ toll-free or discount toll travel based on the TOD pricing schedule and the Business Rules. The 91 Express Lanes use lane declaration only to determine declared occupancy. The selection of a particular HOV requirement shall depend on Authority policy decisions as well as on the operational characteristics of the Roadside. For example, on the I-405 Express Lanes, if demand cannot be adequately managed in an HOV2+ mode, then it will be necessary to raise the requirement to HOV3+. The HOV requirement may vary by Day of week (e.g. weekdays vs. weekends) and by time of Day (e.g. peak periods vs. off-peak periods) and by Corridor. For example, a specific Corridor may operate as HOV2+ during off-peak periods and as HOV3+ during peak periods.

310	The Roadside Systems shall support each Corridor operation as specified in this Scope of Work and the Business Rules.
311	The ETTM System shall support the following modes of Operations:
	• **Normal Mode:** All transactions shall be processed normally in an open mode in accordance with the Business Rules to be determined during the Implementation Phase;
	• **Maintenance Mode:** Transactions created in Maintenance mode are processed as normal transaction but are identified as Maintenance mode transactions and transmitted to the RSS. Transactions that occur during Maintenance mode are not reported as traffic or revenue transactions.
	• **OPEN TO ALL:** Initiated by Authorized Users whereby the Express Lanes are open to all traffic (potentially due to incidents in the general purpose lanes or special events). During OPEN TO ALL mode of operation, tolls are suspended.
	• **CLOSED:** Initiated by Authorized Users whereby the Express Lanes are closed to all traffic (potentially due to incidents in the Express Lanes or system maintenance). Transactions detected during closed mode of operation are processed in accordance with the Business Rules to be determined during the Implementation Phase.

	• **HOV ONLY Mode:** Initiated by Authorized Users whereby the Express Lanes will operate in HOV ONLY Mode (2+ or 3+). The ETTM System should be able to support modes of both "HOV2+ ONLY" and "HOV3+ ONLY." SOVs that enter the Express Lanes when it is in HOV ONLY mode shall be flagged and assessed tolls and fees based on the Business Rules.
312	In the event of a power interruption, the zone controller shall open in the operational mode it was in before it was powered down.
313	Authorized Users shall have the ability (local and remote) to configure the next operating mode and to gracefully shutdown the zone controller. Each time a mode change is requested an Alert message shall be sent to the MOMS.
314	When a lane is operating in a mode other than Normal Mode (to be finalized during Design), an Alert shall be generated and sent to MOMS at regular (Configurable) intervals.
315	The ETTM System shall support various modes of operation that are managed and initiated by Authorized Users through the RSS and automatically by the Systems. The management and initiation of each mode shall be available at a single, multiple, and all Segment(s) and entire Corridor.
316	Transactions shall be processed according to different Business Rules either at the Roadside Systems level or the RSS level based on the mode of operation and the Corridor. Contractor shall be responsible for ensuring that the Transponder-Based and Image-Based Transactions are processed according to the Business Rules and transmitted correctly to the RSS.

2.2.7.16.5 Transaction Processing

317	The zone controller shall detect and frame vehicles, assign the Transponder accurately to the correct vehicle and capture and process the image of the correct vehicle in accordance with the Business Rules and in accordance with the Performance Requirements specified in this Scope of Work and Requirements.
318	The zone controller shall incorporate logic that will prevent the incorrect assignment of Transponder reads from vehicles driving in the adjacent general traffic lanes and in the opposite direction of travel.
319	The detailed transaction processing rules shall be defined and finalized during the Implementation Phase; however, the following basic rules shall apply:
	• The zone controller shall properly associate multiple Transponder reads reported by the AVI System to the vehicle and report the Transponders in the transaction transmitted to the RSS;
	• any compatible, but non-interoperable Transponder reads shall be reported to the RSS as a miscellaneous transaction for statistical purposes only;
	• a minimum of one revenue bearing transaction shall be created for each vehicle that travels through the Toll Zone and the zone controller shall ensure that the transaction is complete prior to transmitting it to the RSS;
	• the zone controller shall be able to accurately identify, process, and track multiple vehicles in the Toll Zone;

	• the zone controller shall ensure that duplicate Transponder transactions (same Transponder ID) are not reported from the same lane or Toll Zone within a Configurable period of time or consecutively;
	• buffered Transponder reads that are transmitted to the zone controller shall not be assigned to a vehicle by the zone controller but shall be Flagged and reported to the RSS for further processing and vehicle assignment;
	• the zone controller shall automatically synchronize with the various subsystems to ensure the events in the lane correspond to the transaction generated, and
	• the System shall incorporate self-correcting logic to adjust for lane anomalies and event synchronization issues.
320	The transaction message details shall be defined and finalized during the Implementation Phase; however, the following basic rules shall apply:
	• the Roadside System shall send transactions to the RSS for processing;
	• the transaction message shall contain the data required by the BOS to process the Transponder-Based and Image-Based Transaction;
	• the transaction message shall contain all data contained in the CTOC Interoperable, and the National Interoperable file specifications;
	• each transaction shall contain, and be reported with, various vehicle data and Transponder data including Transponder Occupancy Setting;
	• each transaction shall contain, and be reported with, various event times, including 'vehicle entry' time; 'ICPS trigger' time; 'Transponder read' time and 'vehicle exit' time that shall allow Transponder reads, images and transaction to be associated correctly with the vehicle; and
	• the System shall assign a lane number to each transaction and report the lane in which the vehicle was detected.

2.2.7.16.6 Configuration Files

321	All parameters and settings required to run the zone controller application shall be maintained in configuration files. Access to configuration files required to support the zone controller Operations shall be controlled and access to these files shall be limited to authorized personnel.
322	The configuration files shall be maintained at the RSS for configuration and version control. All zone controllers shall have default configuration files that shall allow the lane to start-up automatically.
323	Authorized personnel shall be able to make changes to parameters and settings that are defined as Configurable in this Scope of Work and Requirements and in the Approved Design documents. Authorized personnel shall be able to make changes to the configuration files in the field. Changes to configuration files shall be recorded in the MOMS. All changes made to the configuration files in the field shall be synchronized to the master configuration file that is maintained at the RSS.
324	Each zone controller shall automatically back up its critical configuration files to a back-up server to be used to rebuild the master drive in the event of hard disk failures.

2.2.7.16.7 Zone Controller Interfaces – General Requirements

325	The zone controller shall interface to various devices and subsystems to transmit and obtain data and synchronize the time.
326	The zone controller shall provide checks on all data it receives from each of the devices and subsystems it interfaces to and generate alarm messages that are reported to the MOMS.

2.2.7.16.8 Interface to AVI System

327	The zone controller shall interface with the designated AVI System in accordance with the Approved ICD and transmit all data received from the AVI System to the RSS.
328	The zone controller shall have the capability to interface to multiple AVI System vendors and vendor products. At a minimum, these AVI interfaces include Kapsch, 3M, Neology, and TransCore multi-protocol readers.

2.2.7.16.9 Interface to AVD System

329	The zone controller shall interface with the AVD System to obtain vehicle events that shall permit accurate detection, tracking and processing of vehicles. Vehicle speed information shall also be obtained from the AVD System and reported as part of the vehicle transaction data reported to the RSS for potential use.

2.2.7.16.10 Interface to AVC System (Optional)

330	The zone controller shall interface with the AVC System to obtain vehicle classification information and reported as part of the vehicle transaction data reported to the RSS for potential use.

2.2.7.16.11 Interface to ICPS

331	The zone controller shall interface with the ICPS to capture and process images of vehicles in accordance with the Business Rules to be developed during the Implementation Phase. The vehicle data, OCR/ALPR results (if applicable) and images obtained from the ICPS shall be transmitted to the RSS to support Authority license plate and violation processing Requirements and BOS operations Requirements.

2.2.7.16.12 Interface to Occupancy Detection System (ODS) (per Authority Selected Option)

332	The zone controller shall interface with the ODS to provide the vehicle message at a specified time when the vehicle is detected in the Toll Zone, and Transponder message when Transponder read is obtained. The ODS will capture and process images of vehicles and transmit the occupancy data in accordance with the Business Rules to be developed during the Implementation Phase.
333	If provided by a third-party the ODS ICD will be developed by the ODS vendor in coordination with Contractor.

2.2.7.16.13 Interface to Toll Rate Changeable Message Sign (CMS) – I-405 Express Lanes

334	The zone controller shall interface with the Toll Rate CMS for the transmission of toll rates as a back-up in the event communications from the Toll Rate CMS to RSS or the RSS is not functional.

2.2.7.16.14 Interface to DVAS

335	The zone controller shall interface with the DVAS to transmit event data for display on the DVAS. The event data shall be based on the Toll Zone and shall include Transponder read data, ICPS data, and AVD messages received as the vehicle travels through the lane.

2.2.7.16.15 Interface to UPS

336	The zone controller shall interface with the UPS to monitor the UPS performance. The MOMS shall detect the status of the UPS and Alert technicians when the System is on UPS.

2.2.7.16.16 Interface to Roadside Generators

337	The zone controller shall interface with the Roadside Generator to monitor fuel level and operational status. The MOMS shall detect the status of the generators and Alert technicians when problems are detected.

2.2.7.16.17 Interface to Enforcement Beacons

338	The zone controller shall interface with the Enforcement Beacon to display the status of the transaction (e.g., Transponder Occupancy Setting on the I-405). The interface specification shall be developed during System Design.

2.2.7.16.18 Interface to Roadway Support Systems (RSS)

339	The zone controller shall interface with the RSS to transmit lane data and receive files, commands, messages and data required for lane Operations. Error detections and data validation checks shall be instituted at both systems to ensure incorrect or corrupt data is detected and is not inserted into the System.
340	The ETTM System shall institute automated methods to determine loss of communications between the zone controller and the RSS and any failure detected shall be reported to MOMS.
341	Receipt of all files and data shall be acknowledged and any failures in the transmission or detection of data errors shall be reported to the MOMS.
342	Contractor shall provide an automated means of synchronizing the zone controller and RSS messages in the event the zone controllers are replaced, if communications are down, or if data on the zone controller is not retrievable due to a catastrophic failure.

2.2.7.16.19 Transmitting Data

343	All messages generated at the zone controllers shall be transmitted to the RSS (e.g., Corridor server (if provided) or RSS) in real-time using a transport mechanism that performs error detection and correction to guarantee data transmission. All messages shall be uniquely identified and validated at the RSS to ensure there are no missing or duplicate messages.
344	The System shall support exception handling in accordance with the Business Rules Approved during the Implementation Phase. Alarms shall be generated and reported to the MOMS for all exceptions/errors.
345	All failed transactions and exceptions shall be identified and reported.
346	In the event of communication failures, the messages shall be stored on the zone controller until successful transmission is complete and verified.
347	All messages shall be confirmed as received by the RSS before they are Flagged for write-over.
348	The zone controller shall transmit to the RSS all data, including but not limited to those identified below:
	• all transaction messages generated in the lanes;
	• all alarm and status messages generated in the lanes;
	• all lane operational, communication status and self-health messages;
	• all events generated in the lanes that are displayed on the Roadside Operations monitoring screen or are required at the RSS, and
	• all events required by the DVAS for real-time review or playback.

2.2.7.16.20 Receiving Data

349	The zone controller shall support the Transponder Status List (TSL) and any other Interoperable Agency lists and shall have the capability to support every Interoperable Agency and its assigned Transponder number range as described in the CTOC/National Interoperability specifications.
350	The zone controller shall accept comprehensive (complete list once a Day) and incremental (changes updated on a Configurable interval, but not more frequently than every ten minutes) TSL in accordance with the established Business Rules and shall activate the lists upon receipt after validation of the files.
351	Contractor shall use an effective method to transmit the files (compress, encode, etc.), store the files and use the files such that the new list is available at the zone controllers within ten (10) minutes of the RSS receiving the new list. The format of the file shall be finalized during the Implementation Phase.
352	The RSS shall download historic toll rates, TOD toll rates, or the minimum tolls in accordance with the Business Rules as default toll rates for each Toll Zone to the zone controller for transmission to the Toll Rate CMS as a back-up to the RSS.
353	All configuration files and tables needed to support the lane Operations shall be downloaded to the zone controllers from the RSS upon confirmed change or at scheduled intervals and activated as required. Versions of the Configurable files on each zone controller shall be maintained, tracked, and recorded.

354	All zone controller Software shall be downloaded to the zone controllers from the RSS and versions on each zone controller shall be maintained, tracked, and recorded.
355	The Roadside System shall institute checks whereby it detects issues with the data it receives from the RSS, including but not limited to:
	• incorrect versions of the data received;
	• corrupted data received, and
	• missing files when a file was expected.
356	The System shall support exception handling in accordance with the Business Rules Approved during the Implementation Phase. Alarms shall be generated and reported to the MOMS for all exceptions/errors.

2.2.7.16.21 Monitor All Lane Equipment for Device Status

357	Each zone controller shall self-monitor the System health of internal components and all associated Equipment devices for status. All ETTM System components, including AVI System, AVD System, ODS and ICPS shall be continuously polled for status. The health of some digital devices shall be inferred from events.
358	The System shall generate a recovery message and restore its operational status if a device recovers after reporting a failure. Recovery messages shall be recorded against the original failure work order, shall be reported through the MOMS, and shall be available to authorized staff. Recovery messages shall not close the associated failure/work order but shall serve as supporting evidence of an Equipment recovery.
359	All alarm, health, and recovery messages shall be transmitted and reported to the MOMS.
360	If communications from the zone controller to any RSS is unavailable, an alarm message shall be generated and reported to the MOMS.
361	If the lane is operating in any mode other than normal mode an Alert message shall be generated at Configurable intervals and reported to the MOMS.

2.2.7.16.22 Diagnostics and Equipment Malfunction

362	The zone controller Software shall execute periodic diagnostic checks on internal processes, the Equipment and interfaces. Intelligent peripheral devices shall be interrogated for device status on a regular basis. A device's failure to respond to a status inquiry after a Configurable number of retries shall be regarded by the zone controller Software as an Equipment failure. All failures shall be detected and alarms generated and shall be reported to the MOMS.
363	At periodic intervals (Configurable), the zone controller shall verify with the RSS that it has the latest configuration files; Transponder status file; and any other files required to support the lane Operations. If the latest files are not present on the zone controller, it shall request the latest data from the RSS. If a zone controller is unable to get the latest files, an Alert shall be generated and sent to MOMS.
364	Diagnostic and self-checks shall take place in all modes of lane operation and the results shall be placed in the associated zone controller's consolidated log and easily accessible to the technicians. Sanity checks for fault conditions and validations shall be incorporated into the System. Detection of such conditions shall be reported to the MOMS.

365	Degraded modes of operation shall be supported based on the Business Rules developed during the Design process, and Approved by Authority. Contractor shall ensure the ETTM System continues to operate without loss of revenue or visible impact to the patron in the event that some components of the ETTM System fail and degraded mode Operations occur.

2.2.7.16.23 Stand-alone Mode of Operation

366	When operating in stand-alone mode, the last files downloaded from the RSS shall be used for processing vehicles.
367	The zone controller shall have an available data port to permit onsite manual uploading of Software, TSL, or other pertinent data required for continued operation until communications with the RSS is re-established. Devices utilized to download the TSL to the lanes shall have the capability of synchronizing the current versions whereby a new TSL is updated on the device within an hour.
368	The System shall provide the capability for Authorized Users to download transactions from the zone controller and transfer such transactions to the RSS, and from the RSS to the BOS.
369	The System shall provide the capability for Authorized Users to download event/transaction data for manual and stand-alone playback of the DVAS.
370	Upon re-establishing communications with the RSS all back-logged messages, including manually transferred messages shall be transmitted and synchronized to the RSS without affecting the real time Operations or degrading the lane Operations.
371	Upon re-establishment of communications and successful transmission of all messages, a recovery message shall be transmitted to the MOMS.

2.2.8 ETTM Intelligent Transportation Systems (ITS)

Contractor shall install ETTM ITS Equipment along the Express Lanes to provide full coverage for monitoring and traffic detection. Power and communications will be provided by others.

2.2.8.1 ETTM Traffic Detection System (TDS) – I-405 Express Lanes

372	Contractor shall purchase, install and integrate TDS on the I-405 Express Lanes and general purpose lanes for measuring travel time, traffic volumes, traffic density and other data elements for reporting purposes as shown in ***Attachment 3: I-405 EL ETTM System Locations***.
373	The TDS shall include all elements to provide a fully functional system including but not limited to, traffic detection sensors, controllers, adapters, network devices, junction boxes, connectors and cables.
374	All parameters that define the traffic detection data reported shall be Configurable and Authorized Users shall have the capability to remotely manage and configure the devices.
375	The TDS shall monitor traffic and provide real-time traffic data to support the management of the Corridor including but not limited to:
	• The Shadow Dynamic Pricing System;
	• ATMS input and traffic monitoring at the I-405 Express Lanes TOC, and

	• Alerts and inputs Express Lanes Management Dashboard.
376	The TDS shall have the capability to monitor its status and report failure conditions and alarms to the MOMS.
377	The traffic detection provided by Contractor shall meet the Performance Requirements of this Scope of Work and Requirements.
378	Based on TDS requirements provided by Contractor, the Design-Builder shall design the TDS layout and install the traffic detection Equipment and cabinet/enclosure support structures. Contractor shall install all traffic detection devices and mounting adapters.

2.2.8.2 Toll Closed Circuit Television (CCTV) Cameras

379	Contractor shall purchase, install and integrate high resolution, IP-addressable color CCTV cameras to provide coverage of the Express Lanes and general purpose lanes in the Corridors.
380	CCTV cameras shall be capable of capturing high definition video of not less than 1080p resolution.
381	The CCTV camera mounting structures shall stabilize the CCTV camera and decrease the effects of vibration from sources prevalent in the Express Lanes environment.
382	The CCTV system shall include all elements to provide a fully functional system including but not limited to, cameras, servers, adapters, network devices, junction boxes, connectors and cables.
383	The CCTV cameras shall have pan-tilt-zoom (PTZ) functionality that allows Authorized Users to remotely control the camera via the Operations monitoring screen/Dashboards. The cameras shall revert to the default settings that can be overridden by Authorized Users when no PTZ commands are received within a Configurable time.
384	Alarm messages shall be reported to MOMS when remote controls or setting other than default are detected.
385	Authorized Users shall have the ability to individually setup and configure the cameras, and Configurable settings shall be available on a per-camera basis.
386	The CCTV camera video feed shall be transmitted and accessible to various applications, per OCTA Policy and the Street and Highways Code 31490, including but not limited to:
	• remotely via the website to Authorized Users;
	• Express Lanes Management Dashboard;
	• The existing ATMS operated at the existing 91 Express Lanes TOC;
	• I-405 Express Lanes TOC, and
	• other TMCs at Authority's direction.
387	Authorized Users shall have the capability to record video streams and save the recorded video to long term storage for later playback.

2.2.8.2.1 Toll Closed Circuit Television (CCTV) Cameras – 91 Express Lanes

388	Contractor shall replace the existing 91 Express Lanes CCTV cameras to provide coverage of the Express Lanes and general purpose lanes in the Corridor as shown in ***Attachment 2: 91 EL ETTM System Information***.

389	The Toll CCTV cameras shall be located at the same locations as the existing Toll CCTV cameras and shall be mounted to the existing poles or other structures.
390	The Toll CCTV cameras shall feed to the existing 91 Express Lanes TOC system and maintain the current CCTV functionality provided by the existing ATMS.
391	The Toll CCTV camera video feed shall be transmitted and accessible to various applications including but not limited to:
	• The existing ATMS operated at the existing 91 Express Lanes TOC and
392	• I-405 Express Lanes TOC.

2.2.8.2.2 Toll Closed Circuit Television (CCTV) Cameras – I-405 Express Lanes

393	Contractor shall provide Toll CCTV cameras to provide coverage of the Express Lanes and general purpose lanes in the Corridor as shown in ***Attachment 3: I-405 EL ETTM System Locations***.
394	Based on Toll CCTV camera requirements provided by Contractor, the Design-Builder shall design the Toll CCTV camera layout and install the Toll CCTV camera support structures. Contractor shall install all cameras and mounting adapters.
395	The Toll CCTV camera video feed shall be transmitted and accessible to various applications including but not limited to:
	• the ATMS provided by Contractor at the I-405 Express Lanes TOC;

2.2.9 Corridor Server

The provision of a Corridor server is optional but if Contractor's solution includes a Corridor server, then the Requirements in this section shall be met. Contractor has the option to use the Corridor server as an image server as long as the Design complies with this Scope of Work and Requirements.

396	Contractor shall provide one or more Corridor servers if it is deemed necessary to meet the Requirements specified in this Scope of Work and Requirements. A Corridor server or set of servers can support multiple Toll Zones.
397	Contractor shall furnish and install a complete Hardware configuration for each Corridor server to support the availability, redundancy and Performance Requirements of this Agreement, including but not limited to:
	• multiple processors;
	• dual, redundant, hot-swappable power supplies;
	• fault tolerant (RAID) storage devices; and
	• backup library.
398	The Corridor server shall interface to the zone controller and shall serve as a store and forward server for transactions and messages.
399	The Corridor server shall be used as a back-up server for the transmission of the pricing data to the Toll Rate CMS.
400	Each Corridor server shall communicate with the primary RSS and be configured or automatically communicate with the Disaster Recovery (DR) System.

401	Each Corridor server shall be capable of storing transactions and images (if used as a local image server) from the Roadside Systems for a period of minimum thirty (30) Days, in the event of a communications failure.
402	The Corridor server shall be capable of operating in a stand-alone mode for a minimum of thirty (30) Days if communications to the RSS are down. When operating in stand-alone mode, the last files downloaded from the RSS shall be used for processing vehicles.
403	The Corridor server shall have an available data port to permit onsite manual uploading of Software, TSL, or other pertinent data required for continued lane operation until communications with the RSS are re-established. Devices utilized to download the TSL and rate tables (if applicable) to the Corridor server shall have the capability of synchronizing the current versions whereby a new TSL is updated on the device within an hour of receipt.
404	The System shall provide the capability for Authorized Users to download transactions from the Corridor server and transfer such transactions to the RSS.
405	Upon re-establishing communications with the RSS all back-logged messages, including manually transferred messages, shall be flagged and transmitted to the RSS without affecting the real time Operations or degrading the lane Operations.
406	Upon re-establishment of communications and successful transmission of all messages, a recovery message shall be transmitted to the MOMS.
407	Failure of any component of the Corridor server shall be detected and reported to the MOMS.

2.2.10 Toll Equipment Building

The provision of a Corridor server is optional but if Contractor's solution includes a Corridor server, then the Requirements in this section shall be met.

2.2.10.1 Toll Plaza Building – 91 Express Lanes

Contractor will have access to the existing Toll Plaza Buildings (TPB) located at the existing 91 Express Lanes ETTM Toll Collection and Enforcement Sites. Space within the TPBs will be provided to accommodate the Corridor servers, network equipment, UPS and other RSS. Contractor will be responsible for outfitting the TPB with the necessary services in conformance with this Scope of Work and Requirements.

2.2.10.2 Toll Equipment Building – I-405 Express Lanes

The Design-Builder shall design, furnish, and install an environmentally conditioned Toll Equipment Building (TEB) with a Heating, Ventilation, and Air Conditioning (HVAC) system that provides space to accommodate the Corridor servers, network equipment, UPS and other RSS. Contractor will be responsible for outfitting the TEB with the necessary services in conformance with this Scope of Work and Requirements.

408	Contractor shall coordinate with Authority and Design-Builder to determine the TEB location. The TEB is to be located near the communications hub where Contractor will provide data/communications service for ETTM Communications Network.

409	Contractor will provide the Design-Builder Equipment space requirements and coordinate with the Design-Builder to determine the final size of the TEB. The TEB must contain sufficient space to accommodate the following:
	• Contractor provided and installed Equipment racks
	• Contractor designed, furnished, and installed a floor mounted fire suppression system per Appendix C of the National Fire Protection Association Standard on Clean Agent Fire Extinguishing Systems (NFPA-2001).
410	Contractor shall provide and install a TEB secure access system. The TEB secure access system must utilize an electronic key to authorize access and provide remote monitoring of all alarms for unauthorized entries into the TEB. The Design-Builder shall provide steel doors and frames for the TEB per Steel Door Institute Recommended Specifications for Standard Steel Doors and Frames (SDI-100).
411	Contractor shall coordinate the TEB communications service design and installation with the Design-Builder. The Design-Builder shall terminate the ETTM Communications Network fiber optic cable on a Contractor provided fiber panel within the TEB. Contractor shall provide conduits and cable runs from the fiber panel to the equipment racks.
412	Contractor shall coordinate the TEB power distribution system design and installation with the Design-Builder. The Design-Builder shall design furnish and install a TEB power distribution system that provides a dedicated service panel and individual circuit protection for the Equipment installed in the TEB. The TEB power distribution system shall include a Contractor furnished and installed automatic transfer switch and Contractor furnished and installed emergency generator located outside the building. Contractor shall provide conduits and power runs from the power panel to the equipment racks. The Design-Builder shall design, furnish, and install lightning protection and grounding systems in the TEB.
413	Contractor will design, furnish, and install an emergency generator that will provide power for all of the systems inside the TEB building, including exterior lighting and security camera systems. Coordinate with the location of the generator with the Design-Builder and Authority. Conduits from the generator to the TEB shall be provided by Design-Builder.
414	Contractor will design, furnish, and install a fire alarm system to monitor the TEB for heat and smoke emissions, and provide remote monitoring alarms upon activation of system.
415	Security cameras must provide for a 360-degree, unobstructed view of all sides of the TEB, including one displaying the TEB entrance door and surrounding maintenance parking area. Contractor will design the layout of the security camera system and will furnish and install the security cameras. The Design-Builder will design, furnish, and install foundations and poles for security cameras at the TEB. Contractor will furnish and install camera mounting adapters for the security cameras. Coordinate the security camera mounting details with Design-Builder to match the security camera mounting requirements.
416	The Design-Builder shall design, furnish, and install conduit, service cabinets, and pull boxes to provide electrical service and communications to the TEB for each security camera.

2.2.11 Roadside Infrastructure

Contractor will install Equipment on existing 91 Express Lanes ETTM System Infrastructure, I-405 Express Lanes ETTM System Infrastructure provided by the Design-Builder, and ETTM System Infrastructure provided by Contractor (91 Express Lanes and I-405 Express Lanes), in accordance with this Scope of Work and Requirements.

2.2.11.1 Toll Gantry

417	The horizontal alignment of the toll gantry shall be perpendicular to the travel lane(s).
418	Provision of all mounting brackets, arms, structures, and junction boxes to install and connect the equipment on the toll gantry is the responsibility of Contractor.

2.2.11.1.1 Toll Gantry – 91 Express Lanes

419	Contractor shall use the existing toll gantry infrastructure to mount all Equipment necessary to meet this Scope of Work and Requirements.
420	The existing toll gantry infrastructure shall have the following Equipment weight restrictions:
	• The total weight of Equipment (both existing equipment and Contractor's Equipment) installed on the Toll Collection and Enforcement Site upstream gantry shall not exceed 750 lbs.
	• The total weight of Equipment (both existing equipment and Contractor's Equipment) installed on the Toll Collection and Enforcement Site downstream gantry shall not exceed 900 lbs.
421	• The total weight of Equipment installed on the Transponder Read Site eastbound gantry (single lane configuration) shall be submitted to Caltrans for review and approval.
422	• The total weight of Equipment installed on the Transponder Read Site westbound gantry (single lane configuration) shall be submitted to Caltrans for review and approval.
423	Modifications to the existing toll gantry structures are prohibited, and it shall be the responsibility of Contractor to design the ETTM System to comply with the Equipment weight restrictions specified in this Scope of Work and Requirements.

2.2.11.1.2 Toll Gantry – I-405 Express Lanes

Toll gantry structures designed and installed by the Design-Builder shall be as specified in Caltrans *Standard Specifications* Section 56 (Overhead Sign Structures, Standards, and Poles).

424	Contractor's ETTM System shall work within the Design-Builder's toll gantry requirements and specifications.
425	Toll gantry structures shall support Equipment loads as determined by Contractor.
426	Contractor shall provide the Design-Builder information in regards to the toll gantry including weights, clearances, brackets, vibrations specifications, routing, etc. for the Design-Builder to design the toll gantry structure.
427	Contractor shall use the toll gantry infrastructure provided by the Design-Builder to mount all Equipment necessary to meet this Scope of Work and Requirements.

2.2.11.2 Conduits and Cable Trays

428	The Contactor shall be responsible for establishing conduit requirements from the Equipment cabinets to the Equipment.

2.2.11.2.1 Conduits and Cable Trays - 91 Express Lanes

429	The Contactor shall be responsible for establishing conduit requirements from the Equipment cabinets to the Equipment.
430	Contractor may use the existing conduits and cable trays, however, the existing ETTM System operations and performance shall not be impacted during installation.
431	Provision of any additional conduits and cable trays to connect the ETTM System is the responsibility of Contractor.

2.2.11.2.2 Conduits and Cable Trays - I-405 Express Lanes

432	The Design-Builder shall design and install all below ground conduits as specified by Contractor. Contractor shall use the conduits and cable trays provided by the Design-Builder as specified by Contractor.
433	Contractor shall design and install all above ground conduits and cable trays.
434	Provision of any additional conduits and cable trays to connect the ETTM System not included in the Design-Builder's Design is the responsibility of Contractor.

2.2.11.3 Toll Zone Pavement

435	Contractor is responsible for the Design and installation of all elements of the ETTM System that is applied on or embedded into the pavement to achieve the required System Performance.
436	Contractor is responsible for repair, rehabilitation or replacement of the pavement due to any work performed in the lane by Contractor.

2.2.11.3.1 Toll Zone Pavement - 91 Express Lanes

437	Contractor shall design and install Toll Zone pavement as required to support the ETTM System.
438	All Toll Zone pavement shall be coordinated with Caltrans and shall comply with Caltrans standards.

2.2.11.3.2 Toll Zone Pavement - I-405 Express Lanes

439	Contractor shall provide the Design-Builder special Toll Zone pavement requirements for the Design-Builder to design the pavement.

2.2.11.4 ETTM Communications Network

440	Contractor shall procure, furnish, install and test the communication network equipment required to connect all elements of the Roadside System to the RSS, TOC and the BOS.

441	Network monitoring Software shall be procured, furnished, and installed on the RSS servers to monitor the System network status and communications, including the connection to the TOC and BOS. The Software shall specifically monitor network topology changes, network routing changes and network utilization on the fiber as well as leased lines.
442	All network alarms shall be reported to the MOMS. The network monitoring Software tool shall utilize the Simple Network Management Protocol (SNMP) to poll devices real time for status where possible.
443	Contractor shall provide network security at the RSS locations and shall comply with ***Attachment 4: OCTA Information Security Policies***.
444	The LAN within a Toll Zone shall be connected by CAT6 (or higher) cabling. The LAN connections from the vault to the roadside Equipment may either be CAT6 or fiber-optic cable according to Contractor's design. Contractor shall be responsible for providing and obtaining the WAN connectivity from any primary RSS or DR System locations to BOS.
445	The Roadside System at the Toll Zones/Segment shall be connected and communicate to the primary RSS and DR System.
446	Contractor shall coordinate with Authority and the Caltrans regarding demarcation points between the onsite fiber network and Internet Service Providers (ISPs).
447	Contractor shall provide appropriate firewalls to completely separate Caltrans communications from ETTM communications if existing Caltrans D12 Fiber Network is utilized to support the ETTM System operations.
448	Contractor provided ETTM System and network architecture shall support the image, transaction and video throughput Requirements specified in this Scope of Work and Requirements.
449	Contractor is responsible for securing the connectivity from the DR System location to the TOC and BOS.

2.2.11.4.1 ETTM Communications Network– 91 Express Lanes

Authority owns and maintains fiber communications throughout the SR-91 Corridor connecting all Roadside Systems to the 91 Express Lanes TOC. The Roadside System is connected to the 91 Express Lanes TOC via fiber optic cable and a secondary laser point-to-point communications path as shown in ***Attachment 7: Express Lanes Wide Area Network***. The existing 91 Express Lanes ETTM communications network (fiber backbone) shall remain; however, all communications equipment, including but not limited to switches, routers, and servers, shall be replaced.

450	All ETTM Systems at the roadside are connected to systems at the 91 Express Lanes Anaheim Administration building, including the TOC.
451	The existing ETTM Communications Network fiber optic cable shall be retained and re-used to the maximum extent possible.
452	Contractor’s Design shall conform the existing ETTM Communications Network capacity. Contractor shall be responsible for any ETTM Communications Network improvements needed to operate the ETTM System, including but not limited to replacement of fiber optic cable, fiber optic cable splices, and networking equipment.

453	Contractor shall replace all ETTM Communications Network networking equipment, including but not limited to switches, routers, and servers.
454	Contractor shall replace the existing secondary laser point-to-point communications path and configure it with any new ETTM Communications Network Equipment. The replacement laser point-to-point communications devices shall be similar to the existing equipment and shall be submitted to Authority for review and approval.
455	Contractor shall test the existing ETTM Communications Network and make all repairs and replacements of connectivity devices required to meet the functional and Performance Requirements of this Scope of Work and Requirements.
456	Contractor shall provide communications connectivity between the Equipment and the ETTM Communications Network.
457	Contractor shall work with Authority in Designing the network communication interfaces between the ETTM System and the 91 Express Lanes TOC and the Existing BOS.

2.2.11.4.2 ETTM Communications Network– I-405 Express Lanes

The Design-Builder will design, furnish, and install a dedicated I-405 Express Lanes ETTM Communications Network infrastructure including conduit, fiber optic cable, splice vaults, pull boxes, vaults, foundations, service cabinets, electrical service, and appurtenances required to provide connectivity to all ETTM Sites. The Design-Builder will install conduit from a weather proof demarcation box to a connection with the nearest AT&T cable demarcation point near the I-405 / Euclid Avenue interchange. Contractor's ETTM Communications Network requirements are as follows.

458	Contractor shall provide all ETTM Communications Network Equipment, including switches and routers.
459	Contractor shall provide ETTM Communications Network connectivity. Contractor is responsible for establishing all required secure communications service connections between Roadside Systems and Caltrans communications network and a third-party communications service provider. Contractor shall establish communications service on behalf of Authority for billing directly to Authority.
460	Contractor shall provide communications connectivity between the Equipment and the ETTM Communications Network.

2.3 Roadway Support Systems (RSS) – Functional Requirements

Contractor's Roadway Support Systems (RSS) architecture shall have a fully, Configurable, high availability primary RSS and a DR System that meets the functional and Performance Requirements of this Scope of Work and Requirements. The RSS shall initially interface with the Existing BOS Contractor's 91 Express Lanes system and then transition to the New BOS Contractor's solution prior to the opening of the I-405 Express Lanes.

2.3.1 Roadway Support Systems (RSS) – General Requirements

461	Contractor's RSS architecture shall include a high-availability architecture for both the primary RSS and DR Systems that meets the functional and Performance Requirements of this Scope of Work and Requirements and is accessible to Authorized Users of Express Lanes System network. The DR System shall be a fully redundant and fully functional backup to the primary RSS.
462	The RSS shall support Contractor's ETTM System for the 91 Express Lanes and the I-405 Express Lanes. The System architecture shall be scalable and Configurable to support any additional Express Lanes Corridors that will be added in the region.
463	Contractor shall procure, furnish, and install all servers, third-party services, storage and communications Hardware needed to support Authority System and architecture provided by Contractor to meet this Scope of Work and Requirements.
464	Contractor shall provide innovative solutions related to infrastructure and platform that provides Authority technology and maintenance support services for the Agreement Term. The solution shall support future Upgrades to functionality and meet this Scope of Work and Requirements, including:
	• dedicated primary RSS and infrastructure installed locally at Authority facilities or at a location Approved by Authority
	• dedicated infrastructure for disaster recovery purposes installed at a geographically diverse location within the continental United States in a separate time zone or Approved by Authority;
	• RSS primary Hardware and Software shall be dedicated to Authority; and
	• the RSS shall be Designed and configured to be straightforwardly transitioned to Authority at the end of the Agreement Term.
465	The primary RSS and DR System configuration shall meet the Disaster Recovery and Performance Requirements guaranteeing availability as identified in this Scope of Work and Requirements.
466	The DR System shall be configured as a stand-by to allow Operations to continue in the event of a failure of the primary RSS, and be capable of being out into full production within four (4) hours.
467	The DR System shall perform all functions of the primary RSS as described in this Scope of Work and Requirements.
468	The DR System environment shall mirror the primary RSS in all Hardware and Software configurations, be kept up to date and be capable of performing all functions of the primary RSS as described in this Scope of Work.

469	Unless otherwise noted, all Hardware and Software procured under this Scope of Work and Requirements shall be confirmed to be the latest model and version at the time of purchase.
470	All computers, servers and Hardware procured, furnished, and installed under this Agreement shall have the most current and up-to-date virus, firewall, spam protection and other security Software that protects from virus attacks, intrusions and unauthorized access. Virus protection and other Software shall automatically obtain definition and security Updates according to a recommended (Configurable) Maintenance schedule.
471	All computers, servers and Hardware shall automatically generate an Alert that is reported to MOMS upon a failure to obtain the definition or security update. Virus protection and security Software Updates to workstations shall be automatic but Software Updates to servers shall be scheduled and deployed only upon Authority Approval. Such updates shall not impact the performance of the System.
472	The System shall detect intrusion attempts and prevent all unauthorized access and intrusions at all levels and report such events to the MOMS. Any attempted intrusions, intrusions, compromise or breach must be reported to Authority immediately once detected.
473	Contractor shall provide the RSS Software in accordance with the Software License Agreement in the Agreement and the Software shall support the following general functions:
	• communicate with all zone controllers in receiving transactions, alarms and other messages and transmitting TSLs, toll rate schedules (for backup), user identification lists (UIL), and configuration files as defined during Implementation Phase;
	• provide real-time roadside operations monitoring screens and Dashboards to assist operations, maintenance and supervisory staff in observing transaction and event data in real-time, including reviewing DVAS image/video and data;
	• provide the ability to remotely operate and control the lanes through real time screens;
	• interface to the ETTM ITS devices directly to obtain traffic data for Shadow Dynamic Pricing System;
	• provide the sign control system that interfaces to the Toll Rate CMS to manage the display of the toll amounts, operational message and override messages;
	• obtain the video feed from the Toll Rate CCTV cameras and provide access to the video from the Express Lanes Dashboards;
	• perform transaction processing, trip building, and fare determination based on the Corridor and trip classification;
	• interface with BOS to transmit images, transactions, trips transactions and correction for further processing and Toll Rate CCTV images, and receive TSL, exempt list, plate correction list, occupancy setting correction list, occupancy setting errors and other messages identified during Implementation Phase;
	• perform Maintenance management functions of the System, including alarm notification and tracking, Equipment inventory, Maintenance history and other Maintenance related functions, incorporated into the MOMS;

	• provide an independent audit of successful receipt of all transactions and images from the zone controllers to the RSS;
	• provide various management reports that assess the operational performance of the System and transaction/trip reconciliation reports as determined by Authority during Design;
	• communicate with Corridor servers (if provided) in receiving transaction, alarm and other messages and transmitting TSLs, and UIL;
	• communicate with the applicable image server(s) for tracking and reconciliation image transmission and transfer status, and
	• provide the capability to enter or obtain employee information defined in the Implementation Phase such as employee ID, role and access privileges from Active Directory and, if required, to transmit the UIL to the zone controllers.
474	All RSS Software shall meet Authority's most current technology standards; all such Software and Equipment shall meet the security standards set forth in ***Attachment 4: OCTA Information Security Policies.***

2.3.2 Roadway Support Systems (RSS) Hardware and Third-party Products

The Work under this section shall include all labor, materials, and support Services to complete the Design; fabrication; integration; delivery; testing, and Acceptance of the primary RSS and DR System Hardware and third-party Software in accordance with this Scope of Work and Requirements.

2.3.2.1 Roadway Support Systems (RSS) Hardware

475	Authority shall have ownership of all Hardware procured, furnished, and installed as part of the RSS and specified in the Agreement, including spares.
476	The RSS solution shall be dedicated for Authority and shall not be shared with other programs.
477	The RSS shall be located locally at an Authority or Authority Approved facility.
478	Contractor is responsible for obtaining all required licenses in the name of Authority. All licenses and media shall be provided to Authority for all Hardware.
479	Contractor shall furnish and install a complete, high availability, fault tolerant RSS Hardware configuration needed to support the Performance Requirements of this Agreement, including but not limited to:
	• multi-processors;
	• load-balanced;
	• multiple network interface controllers (NICs) on the same subnet;
	• dual, redundant, hot-swappable power supplies;
	• storage devices, and
	• backup library.
480	The RSS Hardware solution shall provide high-speed connectivity between all storage, databases, servers, and backup systems. The Hardware solution shall be scalable and provide for storage expansion and Upgrades.

481	The System Design and implementation shall ensure the ETTM System continues to operate without data loss even if any unit of the server configuration fails.
482	Contractor shall provide a test environment that is independent and separate of the production environment to support testing, including validation of new releases.
483	All components, supplies, Hardware and materials furnished under this Agreement shall be new, COTS and field proven.
484	The RSS server configuration, including all major Hardware elements, shall be of the latest Design and incorporate standard commercial products currently in production.
485	All components procured, furnished, and installed by Contractor shall be multi-sourced and readily available to Authority.
486	Proof of purchase in the form of dated invoice and shipping bills shall be retained and furnished to Authority in accordance with this Scope of Work and Requirements for all Hardware purchased by Contractor. The invoice and shipping bill shall list all the items included in the purchase. To the extent possible, Documentation shall be provided separately for the 91 Express Lanes and I-405 Express Lanes.
487	The RSS Hardware shall be supported for the duration of the Contact after the date of Operational Test Acceptance. During the life of the Agreement Contractor is responsible for ensuring the System is operational in accordance with the Performance Requirements.
488	Contractor shall use proven server configurations that support future Upgrades to processors, memory, storage, operating System, database, and other System components.

2.3.2.2 Roadway Support Systems (RSS) Third Party Software

489	Authority shall have ownership of all third-party Software and firmware procured, furnished, and installed as part of the RSS and specified in the Agreement.
490	Contractor is responsible for obtaining all required licenses in the name of Authority. All licenses and media shall be provided to Authority for all third-party Software and firmware. Contractor shall retain authorized copies (backups) for all Software media to use for periodic System Maintenance, Upgrades, or restore, as required.
491	Proof of purchase in the form of dated invoice and shipping bills shall be retained and furnished to Authority in accordance with this Scope of Work and Requirements for all third-party Software and firmware purchased by Contractor. The invoice and shipping bill shall list all the items included in the purchase. To the extent possible, Documentation shall be provided separately for the 91 Express Lanes and I-405 Express Lanes.
492	All third-party Software and Contractor Software shall be Hardware neutral and shall perform without intervention on any Hardware platform.
493	The operating System for the RSS servers shall be a proven, multi-tasking, multi-user system used widely throughout the United States for intensive database Operations and shall be compatible with the Relational Database Management System (RDBMS) and other tools employed.
494	The operating System shall fully utilize the high-availability RSS server architecture and shall support all peripherals defined in these specifications.
495	The operating System shall also support the proposed communications topology, DR System configuration, and Contractor's application Software.

496	Contractor shall provide and maintain supported versions of the operating System for the Agreement Term and all Upgrades of the RSS shall be Contractor responsibility. These Upgrades shall not impact System performance.
497	The operating System shall have a future Upgrade path and be supported for the Agreement Term and shall not be nearing end-of-support for at least three (3) years after end of the Agreement Term.
498	Contractor shall provide a highly reliable and secure RDBMS for the storage of images, video, transaction data, Image-Based Transaction data, audit data, and all other data, as applicable, for the retention period specified in this Scope of Work and Requirements.
499	Contractor shall provide the latest version of the RDBMS that is field-proven to operate in a transaction intensive environment.
500	The RDBMS architecture shall support the RSS functions for each of the Roadsides and allow Authorized Users seamless access to all data.
501	The RDBMS shall be compatible with the operating System and application Software, and shall support the DR System server architecture.
502	The RDBMS shall have an Upgrade path and shall support Upgrades to individual components including but not limited to operating System, application, memory, and processors.
503	The RDBMS shall have Maintenance and Upgrade Services from the third-party Software provider for the Agreement Term. For example, Microsoft Software Assurance or Oracle Software Update and License Support shall be required.
504	Contractor shall provide and maintain supported versions of the RDBMS for the Agreement Term and all Upgrades of the RSS RDBMS to the latest supported version shall be Contractor responsibility.
505	The RDBMS shall be supported by Contractor for the Agreement Term.
506	Contractor shall keep all Software instances throughout all environments at the same Software version, configuration and patch level.

2.3.3 Roadway Support Systems (RSS) Printing

Contractor will not be required to procure, furnish, and install any printers for Authority use as part of the RSS.

507	Contractor shall provide the capability so that Authority personnel have the ability to print from the RSS interface to any printer connected to Authority System network.

2.3.4 Roadway Support Systems (RSS) Uninterruptible Power Supply (UPS)

508	All RSS Hardware and Equipment shall be on UPS supplied by Contractor and Contractor shall furnish and install an electronic interface between the RSS and the UPS to monitor the UPS performance. The MOMS shall detect the status of the UPS and Alert technicians when the System is on UPS.
509	Software drivers or interfaces shall be developed, furnished, and installed where required to acquire, display, store and report all parameters provided as outputs from the UPS. The interface shall be designed to provide support for TCP/IP, SNMP, and/or a web

	interface that can be used to configure and administer the UPS, as well as support email-based Alerting.

2.3.5 Image Server

Contractor's image processing solution shall meet the functional and Performance Requirements of this Scope of Work and Requirements. The Design shall support the transfer of images to the BOS in real-time and batch mode and prevent loss of images if there are communications or server issues. The receipt of images from the Roadside systems and their transmission to BOS shall be one-hundred percent reconcilable with zero loss of images. If Contractor's solution includes the provision for a central image server as part of the RSS, then the central image server shall be dedicated to Authority and located within the continental United States.

510	The image processing solution shall meet the Performance Requirements of this Scope of Work and Requirements and shall support, but not be limited to the following general functions:
	• communicate with all of the roadside ICPS for the transmission, tracking, reconciliation and processing of all vehicle images;
	• interface with Existing BOS for the processing and reconciliation of all vehicles images;
	• support the transmission of images to the BOS without loss of any image in accordance with Approved ICD, and
	• provide reconciliation reports as determined by Authority during Design and prove one-hundred percent reconciliation.

2.3.6 Data Backup

511	The RSS shall include data backup Software and Hardware that allows remote incremental and full back-up of data without manual intervention. Notification on the status of the backup process shall be transmitted to MOMS.
512	Contractor shall provide a solution for data backup storage. In the event of a catastrophic failure that results in the loss of data, Contractor shall provide the means to restore the data and reconfigure the servers without disruption to the Express Lanes Operations.
513	The backup Software shall be capable of displaying the backup data in a user-friendly and readable form as defined during the Implementation Phase.

2.3.6.1 Archive and Purge Control Mechanisms

514	Provide the capability for fully automated and Configurable archival and purging of data, images, video and files in accordance with Authority's data retention Requirements and Streets and Highways Code 31490.
515	Archival and purge routines shall be Configurable for each impacted data element, including but not limited to:
	• data;
	• images;
	• video;

	• MOMS data;
	• third-party Software Updates;
	• error/System logs, and
	• interface files.
516	Servers shall retain transaction and summarized data, images, MOMS data and error/System logs, in accordance with the retention procedures, including but not limited to:
	• Transaction data shall be retained online for ninety (90) Days and then archived and purged if they are confirmed to have formed into trips;
	• compressed images associated with Transponder-Based Transactions shall be retained online thirty (30) Days and then archived and purged;
	• Image-Based Transactions and images (compressed image and region of interest) online for ninety (90) Days and then archived and purged;
	• trip data shall be retained online for six (6) months and then archived and purged;
	• traffic data shall be summarized and raw traffic retained online for ninety (90) Days and then archived and purged;
	• TOD pricing data shall be retained online for the Agreement Term;
	• Toll Rate CMS static video/frames shall be retained online for one (1) year and then archived and purged;
	• CCTV video, DVAS video, and other video shall be retained online for three (3) months, then archived for and additional nine (9) months, and then purged;
	• summarized data (transactions and traffic) shall be retained online for at least ten (10) years and then archived and purged;
	• ten (10) Days of transponder status lists shall be retained online and then archived and purged;
	• last two versions of the third-party Software Updates shall be retained online and then archived and purged;
	• Error/System logs shall be retained online on the System for ninety (90) Days and then archived and purged;
	• MOMS data shall be retained online for the Agreement Term, and
	• all other data as defined during the Implementation Phase shall be retained on the System for ninety (90) Days and then archived and purged.
517	The status of the archival process shall generate a message to be transmitted to MOMS. No record shall be deleted unless confirmed to be successfully archived.
518	The servers shall be sized to accommodate for the restoration of selected archived data (two months minimum).
519	Authorized Users shall be able to generate queries from the restored data.

2.3.7 Maintenance Access and Application Access

520	Technicians and authorized Authority staff shall have ability to access the System and application as applicable.

2.3.7.1 Maintenance Access

521	Contractor shall procure, furnish, and install the required keyboards, video monitors, mouse(s), remote desktop applications, diagnostic tools, and KVM switches over IP to allow technicians to access all servers, controllers, computers, and devices in order to perform diagnostics.
522	Authorized technicians shall be able to access the System through a secure virtual private network (VPN) connection provided by Contractor and through any Authority authorized workstation connected to Authority System network.
523	All Maintenance Hardware and diagnostic Software and tools installed on the Roadside System and RSS shall comply with Express Lanes security Requirements.

2.3.7.2 Authority/Third-party Access

524	Authorized Authority staff, CSC operations staff and designated personnel shall be able to access the ETTM System through a secure virtual private network (VPN) connection provided by Contractor and through any Authority authorized workstation connected to Authority System network.
525	The RSS shall provide a browser-based Graphical User Interface (GUI) application accessible by any Authority authorized workstation connected to Authority System network.
526	Access to the application Software shall not require the installation of any Contractor supplied application Software on Authority authorized workstations and shall be accessible via External networks with via Secure VPN access. Based on the user's access privileges the appropriate menus shall be made available.
527	Provide the capability for Authorized Users (regardless of location and assuming connectivity) to access and monitor Express Lanes operations and data via an online portal, including but not limited to:
	• Express Lanes Dashboard;
	• MOMS Monitoring Dashboard;
	• video feed from the CCTV and Toll Rate CCTV cameras;
	• saved video feeds/frames from the Toll Rate CCTV cameras to support customer disputes;
	• time-of-day pricing schedules and toll amounts displayed on the Toll Rate CMS at each location to support customer disputes;
	• search transactions/trips to obtain transaction/trip details;
	• review images and trips;
	• perform audit checks on the license plate extraction/image review results;
	• create/update the Plate Correction List that identified license plates that had an error;
	• generate operations reports;
	• perform Toll Rate CMS override, and
	• perform transaction/trip adjustments.
528	Provide the capability for an Authorized User's ETTM System access to be based on user role and associated permission settings.

2.3.8 Roadway Support Systems (RSS) Software

The RSS Software shall support the functionality detailed in this section and shall meet Authority operational Requirements set forth in this Scope of Work and Requirements and Agreement for the Agreement Term.

2.3.8.1 Data Communications and Interface Requirements

529	Electronic interfaces are required to provide connectivity between the RSS and other interfacing systems for the exchange of data. Contractor shall work with Authority, the BOS Contractor and other external partners and third-party vendors/entities in the Designing; developing; documenting; testing and implementing of all required interfaces and portals.
530	Contractor shall coordinate with the BOS Contractor in developing the Interface Control Documents (ICDs) for the interface between the BOS and ETTM System. Contractor shall work with BOS Contractor to develop a data transfer process that meets this Scope of Work and Requirements.
531	Where an existing ICD does not exist, Contractor shall develop the documents, and where changes to existing ICDs are required, these documents shall be modified by Contractor during the Implementation Period as part of this Scope of Work based on Contractor solution. The ICDs shall include requirements for data format and transmission, criteria for acknowledgement and validation of transmitted data and procedures for recording and reconciliation, as appropriate for each interface. The Contractor shall implement the latest version of the ICDs at Go-Live and Contractor shall continue to update the ICDs for the Agreement Term.
532	Provide electronic automated interfaces to Roadside systems, BOSs and third-party vendors/entities and external partners required to meet the functional requirements.
533	Provide portals to Authorized Users required to meet the functional requirements.
534	Provide for guaranteed transmission of data for all interfaces and portals.
535	Provide real-time monitoring and Alerts of interface data transmissions and failures.
536	Provide for one hundred percent (100%) reconciliation of the transmitted data records and files.
537	Provide an integrated integration engine for all interfaces and portals with functionality, including but not limited to:
	• real-time Dashboard for managing and monitoring of interfaces;
	• workflow user interface for managing and monitoring steps within each interface;
	• status and history of executions;
	• comprehensive scheduling of file transmissions;
	• tools for viewing data and/or contents of files received via interfaces and portals (compressed or encrypted);
	• comprehensive reporting for inbound and outbound transmissions;
	• tight integration with the MOMS and notification of failed transmissions, and
	• manually execute a failed transmission.

538	Utilize secure file transmission protocols for the transfer of data and/or files via interfaces and portals.
539	Provide the capability to transmit and receive multiple files during each scheduled batch.
540	Provide the capability to transmit and receive multiple files in a Day.
541	Utilize file naming conventions that prevents the overwrite of data and/or files (for example include the date and time of transmission).
542	Utilize file handling and processing methods that provide complete audit trail of the data and/or file transfer process (for example files that are successfully processed are moved to a processed folder).
543	Validate records and identify errors in the received data and/or files, including but not limited to:
	• mandatory fields;
	• data formats;
	• data validity (for example Account number not found in the System);
	• duplicate files or records;
	• unexpected response;
	• checksum/record count verification;
	• incorrect status, and
	• incorrect change in state.
544	Provide Authorized Users a user interface to correct and re-initiate/re-transmit data and/or files.
545	Provide the capability to process re-transmitted data and/or files.
546	Provide the capability to transmit the error details to the transmitting entity.
547	Provide the capability to identify missing or partial records/transactions/images and request the transmission of such missing records/transactions/images.
548	Provide the means to identify interface issues by validating the file transmission process, including but not limited to:
	• creation and transmission of data and/or a file at the scheduled time even if there are no records to transmit;
	• determining if the data and/or file was transmitted or received at the scheduled time;
	• creation of Alerts to the MOMS if data and/or file was not created or received at the scheduled time;
	• creation of Alerts to the MOMS if received data and/or file was not acknowledged;
	• creation of Alerts to the MOMS if records in the received data and/or file had errors when processed;
	• provide details to the MOMS of each failed record;
	• creation of automated emails to the third-party when file has been successfully transmitted;

	• creation of automated emails to the third-party when third-party data and/or file had errors, and
	• creation of Alerts to the MOMS when response has not been received for individual records within the predefined duration.
549	Provide data and/or file transmission and reconciliation reports as described in these requirements.
550	Provide a Dashboard that tracks the progress of the file transmissions through each stage and their acknowledgements by the receiving entity, including but not limited to:
	• transactions eligible for transmission;
	• file and /or data created with file name;
	• file and/or data transmitted;
	• file and/or data received;
	• file and/or data accepted;
	• file and /or data rejected;
	• file and/or data re-transmitted;
	• number of records in the file and/or data set;
	• number of unique accounts, and
	• number of failed records.
551	Provide Authorized Users the configuration screen(s) to establish, update and modify the parameters related to file and/or data transmission for each interface.
552	Monitor the storage and backup capacity where files and/or data are deposited and send an Alert to the MOMS and third-party entities if allocated storage for those folders are near capacity (Configurable) or full.
553	Provide the tools to automatically manage the folders by archiving successfully processed data and/or files after a Configurable number of days.
554	Provide the tools to import data to reconcile file transmissions.
555	Conform to all existing ICDs if applicable and develop all new/missing ICDs.
556	The RSS shall communicate with various other systems for the transmission and receipt of toll collection data in accordance with Approved ICD.
557	All data; transactions; images; files, toll rate data, traffic data and messages transferred between all subsystems shall be guaranteed and have the required data validation protocols to confirm the accuracy and validity of data transfer.
558	The System shall support error detection and recovery process in accordance with the Business Rules Approved during the Implementation Phase. Alarms shall be generated and reported to the MOMS for all exceptions/errors.
559	Authorized Users shall have the capability to correct the errors and re-process the data without compromising System security.
560	The RSS shall support the interfaces specified in this Scope of Work including, but not limited to:
	• Interface to the zone controllers/Roadside Systems;
	• Interface to the existing Corridor servers until the completion of the transition;

	• ODS;
	• Interface to the Corridor servers (if provided);
	• Interface to the BOS;
	• Interface to the image server(s) (if provided);
	• Interface to the MOMS;
	• Interface to the traffic detection system;
	• Interface to the Toll Rate CMS (I-405 EL only), and
	• Interface to future System to support transition to new systems at the end of the Agreement Term.
561	The ETTM System shall provide the capability to interface to a third-party ATMS for managing and monitoring the CCTV cameras and display of traffic detector data. Contractor shall provide an interface that is compliant to NTCIP standards.

2.3.8.1.1 Interface to the Zone Controllers/Roadside Systems

562	The RSS shall support the interface to the zone controllers/Roadside Systems to transmit and receive toll collection data in real-time including, but not limited to:
	• transaction data;
	• ICPS images and data;
	• alarm messages;
	• remote Authorized User Operations;
	• TSL;
	• User Identification Lists (UIL);
	• Manual data entry into an electronic file for upload for the 91 Express Lanes;
	• Automated toll schedules and toll rates (back-up) for the I-405 Express Lanes, and
	• configuration files.

2.3.8.1.2 Interface to the Occupancy Detection System (ODS) and BOS for ODS Information

563	The RSS shall support the ODS provider in development of an ICD between the ETTM System and the ODS to exchange triggering, synchronization and occupancy detection results and images.
564	The ICD will be developed by the ODS vendor in coordination with Contractor. ***Figure 5-1: Roadway Toll Collection System Interface to Occupancy Detection System*** provides an overview of the anticipated ODS integration to the ETTM System.
565	The RSS shall support the BOS Contractor (existing and/or new) in development and or modifying of an ICD between the ETTM System and the BOS to exchange occupancy detection related information.
566	The ICD will be developed by the ODS vendor in coordination with Contractor. ***Figure 5-1: Roadway Toll Collection System Interface to Occupancy Detection System*** provides an overview of the anticipated ODS integration to the ETTM System.

2.3.8.1.3 Interface to the Corridor Servers (if Provided)

567	If Contractor's solution includes Corridor servers, the RSS shall interface to the Corridor servers to transmit and receive data and files described in the interface to the Zone Controllers/Roadside Systems section.

2.3.8.1.4 Interface to the BOS

The RSS shall interface with the Existing BOS and a New BOS anticipated to be implemented during the Agreement Term, prior to the full implementation of the I-405 Express Lanes. The 91 Express Lanes RSS shall initially communicate with the Existing BOS. Once the Existing BOS is replaced with the New BOS, Contractor shall interface the 91 Express Lanes RSS and the I-405 Express Lanes RSS with the New BOS.

568	The RSS shall communicate with the BOS per the Approved Interface Control Document in real time and in batch mode for the transmission and receipt of toll collection data including, but not limited to:
	• Transaction and trip data upon creation of the pursuable trip, including disposition of the transactions/trip;
	• images and image review results for license-plate trips that include license plate number; jurisdiction and plate type (if applicable);
	• images and image review results for Transponder-Based trips that were not posted to a customer Account, for example due to insufficient funds on the Account;
	• Plate Correction List resulting from customer disputes and audit checks no less than every hour (Configurable);
	• Exempt List maintained at the BOS no less than every hour (Configurable);
	• Transponder Occupancy Setting Correction List resulting from customer disputes and audit checks no less than every hour (Configurable);
	• comprehensive TSL once a Day and incremental TSL Updates not less often than every ten (10) minutes (Configurable);
	• toll rate schedules and TOD pricing data to support customer disputes;
	• summary toll collection traffic and revenue data, and
	• all other data files needed for BOS transaction/trip processing.

2.3.8.1.5 Interface to the Image Server (if Provided)

569	If Contractor's solution includes an image server, the RSS shall interface with the image server to obtain reconciliation data related to receipt of images from the Roadside Systems and transmission of the images to the BOS.

2.3.8.1.6 Interface to the Maintenance Online Management System (MOMS)

570	The RSS shall include or interface with the integrated MOMS to transmit alarms and RSS operational status including recovery messages and operational Alerts.

2.3.8.1.7 Interface to the Traffic Detection System

571	The RSS shall interface to the traffic detection System to obtain traffic data required to support the Shadow Dynamic Pricing System and support Express Lanes operations.

2.3.8.1.8 Interface to the Toll Rate CMS – I-405 Express Lanes

572	The RSS sign control System shall communicate with the Toll Rate CMS for accurate display and recording of the Toll Rate CMS display data including, but not limited to:
	• TOD pricing data that indicate the toll amounts to the specified destination;
	• manual override data;
	• Toll Rate CMS messages in incident mode based on the Business Rules;
	• confirmation of successful receipt of the data at the Toll Rate CMS;
	• receipt and creation of alarm when there are Toll Rate CMS or communication failures and
	• frequent polling of the Toll Rate CMS at Configurable intervals for the data displayed on the Toll Rate CMS.
573	The RSS sign control System shall display the changed toll amount and incident mode messages on the Toll Rate CMS within five (5) seconds of change in toll amount or initiation of incident mode.

2.3.8.2 Version Tracking Requirements

574	The RSS shall maintain records of all versions of the TSL; UIL; toll rate schedules; incident mode message; remote overrides; Configurable parameter changes; Business Rule modifications; third-party Software Updates; lane configuration files, and lane executable programs that it received and/or created as specified in the Archive and Purge Control Mechanisms section of these Requirements.
575	Receipt and transmission of files from and to the source/destination Systems, their version, time of receipt/transmission and processing status shall also be tracked to provide an audit trail of all changes.
576	The RSS shall maintain records of all the files it created and processed in accordance with the data retention requirements.
577	Reports and screens shall be made available to verify the versions and the file download status.
578	The System shall provide the capability to track the versions of lane executable programs installed at each Toll Zone location.

2.3.8.3 Diagnostics

579	The RSS shall provide self-diagnosis functions to detect and report on the status and functioning of the RSS Hardware devices, third-party Software, communications, processes, tasks, and Software applications, as defined in Authority Approved Design Document.
580	The RSS shall report all Hardware and Software failures detected to the MOMS.

2.3.8.4 Data Security

581	Contractor shall ensure that any transaction and user entered data records, once recorded into the System, cannot be deleted or changed.
582	Contractor shall protect all data from being corrupted by unauthorized changes, whether by system error, human error, or intentional alteration. Data shall only be modified by Authorized Users according to defined privileges and procedures. However, no data shall be deleted from the ETTM System in this process.
583	Data records and files shall only be appended to and not edited or deleted. If manual intervention is required to complete the audit and verification process, only Authorized Users shall be permitted to Flag a data record or file to ensure the integrity and provide a complete audit trail.
584	All System access/entry, logins, and modifications (for example, flagging actions) shall be recorded and unauthorized access shall be prevented and logged and reported to MOMS.
585	Data shall be protected from unauthorized disclosure. Access to systems shall be restricted to Authorized Users with privileges appropriate to the confidentiality of the data.
586	Data shall be prevented from being lost or becoming inaccessible. Authorized Users shall be able to gain access to information to which they are privileged whenever they are authorized to do so. Encrypted business computers shall be used. Unprotected personal computers shall not be used.
587	All Personally Identifiable Information (PII) data shall be protected in accordance with California state law and shall be encrypted within the ETTM System both while at rest (electronically stored in a database or electronically offline) and in transit (during transmission between ETTM System subsystems and external entities). Unless explicitly approved by Authority, Contractor shall otherwise keep all PII confidential and shall not disclose such information, except as required by California state law or where the express written consent of the customer is obtained by Authority.

2.3.8.5 Time Synchronization

588	The RSS server and subsystems shall be synchronized to a certified source Approved by Authority using standard network time protocol at Configurable intervals but at a minimum every five (5) minutes.
589	The zone controllers; AVI Systems; AVD Systems; ICPS; ODS servers; image server; OCR server; DVAS, and other servers needed to support this Scope of Work and Requirements shall be synchronized to a Contractor-provided primary network time protocol appliance within the RSS. Such appliance shall synchronize with the Authority's Network Time Protocol source or a Stratum 0 or 1 time source. Contractor shall also supply a secondary time source. Both the primary and secondary time synchronization sources shall be Approved by Authority.
590	If needed, synchronization messages shall be sent to devices that do not support off-the-shelf time synchronization Software.
591	The time synchronization technique shall prevent the possibility for duplicate or incorrect transaction time. The time synchronization precision format shall support fractional seconds (hh:mm:ss:000).

592	Alarm messages shall be generated when there are time synchronization failures and when time drifts are more than a Configurable threshold.
593	The ETTM System shall have the capability to handle daylight saving time changes.

2.3.8.6 Transaction Audit and Verification

It is critical that all messages and transactions from the zone controllers are transmitted to the RSS and a verification of this data transmission shall be performed by the System.

594	Contractor shall perform automatic audit and verification process that confirms all data transmissions between the zone controller and RSS are successful.
595	The ETTM System shall perform an independent automatic audit and verification process that confirms the following including but not limited to:
	• all vehicles traveling through the toll lane are detected and reported as transactions;
	• all transaction transmissions between the zone controller and RSS are successful;
	• all image transmission between the Roadside System, the RSS and BOS are successful;
	• all transactions are formed into trips;
	• all transactions and trips are successfully transmitted to the BOS, and
	• the System has the screens and reports to validate the audit trail.
596	If the validation process fails for any reason, failure messages shall be created and reported to the MOMS. If the audit process determines that vehicles, transactions or trips are missing, the missing information shall be identified and reported to the MOMS.
597	If the audit process is successful then the audit for the location for the Day shall be deemed “complete” and System shall track this status of the audit on reports.
598	Once the audit is “complete” the data reported for that Day from the lanes shall not change. Any condition that results in changes to the data shall be identified and Authorized Users Alerted.

2.3.8.7 Data Summarization

599	Traffic and transaction data shall be summarized for reporting purposes. Summarization date and status shall be recorded to provide an audit trail.
600	In the event additional data is received that changes the summary counts previously generated, then an alarm message shall be generated and the System shall automatically re-summarize the data until a Configurable period has lapsed after which the re-summarization shall be performed manually.

2.3.8.8 Data Warehouse

601	Contractor shall provide a replicated database environment independent and separate of the RSS production environment for reporting and analytics to which Authority shall have full access.

602	Contractor shall provide validation that any and all data replicated between the production database(s) and the replicated database is complete and accurate.
603	The replicated database environment shall be updated with all non-sensitive data (production data excluding any PII related data) at a minimum once per Day.
604	Provide a schema architecture that is simple to understand so that Authorized Users familiar with query commands can effectively query data for export/input into common business intelligence tools for data reporting and analysis.

2.3.8.9 Interoperability

605	The Roadside System shall be Designed to accommodate future Interoperability such that it supports the inclusion of multiprotocol readers and Transponders. Contractor's solution shall allow for modifying and adapting the System Design to incorporate new readers and support the transition to the new Interoperable solution with limited interruptions to the revenue collection.
606	Contractor shall support the conversion to the CTOC ISO 18000-6C protocol as it is scheduled to become the CTOC compliant standard during the Agreement Term. The System shall continue to support Title-21 as well until the sunset period determined by CTOC and Authority.
607	Contractor shall support the conversion to National Interoperability if it becomes available during the Agreement Term.

2.3.8.10 Express Lanes Operations Management

2.3.8.10.1 Express Lanes Operational Goals

608	Contractor shall provide an ETTM System that supports each of the following operational goals for a specified Corridor:
	• **Speed**. The Express Lanes shall, at a minimum, achieve the following speed requirements: o The Express Lanes must maintain a minimum average operating speed of 55 mph o Vehicles must maintain this minimum average operating speed at least 90% of the time over a consecutive 180-Day period during morning or evening weekday peak hour periods (or both).
	• **Density.** The Express Lanes should maintain a level of service (LOS) of "D" or better during peak periods. LOS A-D, as defined by the Highway Capacity Manual, requires a density of **less than** 35 vehicles per lane per mile. This operational standard shall be achieved 85% of the time during peak periods.
	• **Peak period travel time savings.** The end-to-end travel time in the Express Lanes shall be less than the travel time in the general purpose (GP) lanes at least 90% of the time during peak periods.
	• **Configurability.** The standards identified above shall be Configurable by *Corridor* and *direction*. o The ETTM System shall be capable of supporting a minimum average operating speed that exceeds 55 mph.

	o The operational goals for traffic density shall be Configurable (either up or down) o The operational goals for performance (e.g. the percentage of time meeting the density and travel time savings goals) shall be Configurable

2.3.8.10.2 Toll Policy - 91 Express Lanes

609	Contractor shall provide a ETTM System that supports the following Toll Policy:
	• **Time of Day.** This is a form of variable tolling in which tolls vary by the time of Day according to a pre-established schedule. Hourly traffic volumes are continually monitored. Periodically, adjustments to the published toll schedule are triggered through increases and decreases in traffic demand and may move up or down.

2.3.8.10.3 Toll Policy - I-405 Express Lanes

610	Contractor shall provide a ETTM System that supports each of the following Toll Policies:
	• **Time of Day.** This is a form of variable tolling in which tolls vary by the time of Day according to a pre-established schedule. The tolls are set as the result of simulation testing, experience, and/or trial and error, and are designed to rise and fall according to observed peak travel patterns. The scheduled fares may be updated at frequent intervals after opening and then at more consistent pre-determined intervals as traffic stabilizes.
	• **Shadow Dynamic Pricing.** This is a form of dynamic tolling, which runs in the background, in which tolls fluctuate in real time in response to prevailing traffic conditions. Tolls vary in response to traffic operational conditions in both the Express Lanes and the general purpose lanes. The algorithm output will be used to inform the TOD pricing process.

2.3.8.10.4 Basis of Toll Adjustment - 91 Express Lanes

Contractor shall provide capability to adjust the TOD toll pricing based on Authority-provided TOD pricing information, similar to the existing 91 Express Lanes pricing concept.

611	The Implementation Phase will establish specific guidance for adjusting the TOD toll rate schedule in conjunction with Authority policy.
612	Contractor shall provide capability to adjust TOD toll pricing via an updated electronic file (Excel or simple file format) for uploading to the 91 Express Lane Toll Rate CMSs. The file type and format shall be determined during the Implementation Phase and shall be synchronized with the ETTM System toll rates.
613	Contractor shall coordinate the 91 Express Lanes ETTM System TOD toll rate schedule with the Authority's Approved toll rate schedule, including all changes to the schedule.

2.3.8.10.5 Basis of Toll Adjustment - I-405 Express Lanes

The I-405 Express Lanes pricing shall provide the capability to support multiple variable and dynamic pricing systems to run simultaneously. Contractor will develop a TOD pricing system that adjusts I-405 Express Lanes toll rates based on a TOD pricing schedule, similar to the existing 91 Express Lanes pricing concept. Contractor will also develop a Shadow Dynamic Pricing

System (DPS) to inform the Authority on routine updates to the TOD pricing schedules, through review of historical shadow tolling trends.

614	During the Implementation Phase the Contractor shall develop the logic for for adjusting toll rates via TOD pricing.
615	Contractor shall provide a ETTM System that supports the following potential bases for adjusting toll rates:
	• **Speed in the Express Lanes**. The average speed in the Express Lanes shall be a potential trigger for adjusting the tolls. The tolls shall be designed in part to achieve the average speed goals.
	• **Speed differential.** The value provided by the Express Lanes is related in part to the average speeds experienced in the parallel general purpose lanes. The greater the speed differential between the Express Lanes and the general purpose lanes (assuming that the Express Lanes are faster), the greater the relative value of the Express Lanes. The speed differential may therefore be used as a trigger for a toll adjustment in the Express Lanes.
	• **Volume in the Express Lanes.** Experience has shown that Express Lanes can readily accommodate 1400-1600 vehicles per hour per lane while maintaining near-free flow speeds. This value (or range of values) represents the effective capacity of the Express Lanes; its actual value will need to be confirmed via simulation and experience. The tolls in the Express Lanes may need to increase as the actual usage approaches this capacity.
	• **Density in the Express Lanes.** The Highway Capacity Manual defines level of service (LOS) in terms of density. One operational goal of the Express Lanes is to consistently maintain LOS D or better during peak periods. Therefore, traffic density (expressed in terms of vehicles per mile per lane, or vpmpl) may be used as a basis for adjusting the tolls in the Express Lanes. Tolls may need to increase as the density approaches the Configurable upper limit of 35 vpmpl.
	• **Peak period travel time savings.** One purpose of the Express Lanes is to provide a faster travel time (especially during peak periods) compared to the general purpose lanes. It will be important to monitor the difference in travel time and to adjust the toll in order to (a) take advantage of relative value of the Express Lanes (by charging drivers what they are worth), and (b) preserve the travel time benefit of the Express Lanes (by increasing the price in order to avert a breakdown in the Express Lanes).
	• **Performance ratios.** In order to ensure that the Express Lanes provide consistently superior performance compared to the general purpose lanes, the ETTM System should be configured to enable the attainment of selected performance ratios. This could include, for example, maintaining an Express Lanes density that is no greater than 80% of the density in the general purpose lanes, or maintaining an Express Lanes flow rate that is no greater than 75% of the flow rate in the general purpose lanes.
	• **Density in the general purpose lanes.** The Contractor shall monitor the density (and therefore the level of service) in the general purpose lanes in order to provide another means of evaluating whether the Express Lanes are providing superior service. Tolls may need to be adjusted in order to ensure that the density in the Express Lanes is lower than density in the general purpose lanes.

	• **Speed in the general purpose lanes.** The Contractor shallmonitor the speeds in the general purpose lanes as an additional means of comparing the relative performance of the Express Lanes. Tolls should be adjusted to support conditions in which speeds in the Express Lanes are faster than speeds in the general purpose lanes for any given peak period time increment.

2.3.8.11 Shadow Dynamic Pricing System (DPS) - I-405 Express Lanes

Contractor shall also develop and use a Shadow Dynamic Pricing System (DPS) to inform Authority on routine updates to the TOD pricing schedules, through review of historical shadow tolling trends.

616	Contractor shall perform comprehensive toll rate setting analysis and reporting based on the data collected and produced by the Shadow DPS to inform Authority's routine updates to the TOD pricing schedules. Contractor shall conduct such analysis and reporting no less frequently than every 6 months during the Operations and Maintenance Phase. Contractor shall provide toll rate analysis and reporting at more frequent intervals (daily, weekly, monthly) as directed by Authority during the first 12 months following Go-Live.

2.3.8.11.1 Shadow Dynamic Pricing System - General Requirements

617	Contractor shall provide a Shadow DPS that determines the per mile Shadow Toll Rate for each Segment in each direction of travel. Shadow Toll Rates shall indicate what the toll rate would be in any given interval, given the prevailing speeds and traffic volumes on the facility.
618	The Shadow DPS shall provide sufficient user-Configurable parameters of sufficient detail to support multiple optimization strategies. For example, the parameters shall be able to support strategies relating to meet the following strategies:
	• An "Adaptive Value Pricing" strategy that indicates the toll that should be assessed during any given interval based on the travel time savings provided by the Express Lanes.
	• A "Demand Management" strategy that indicates the toll that should be assessed during any given interval in order to manage usage of the Express Lanes, subject to the operational requirements established by Authority.
619	Contractor shall provide a Shadow DPS that has the ability to implement the following methods of calculating dynamic pricing. The values selected for these rules shall be Configurable. Final identification of Business Rules shall be completed during the Implementation Phase.
	• **Minimum toll.** The minimum toll shall apply in any mode in which some or all vehicles are assessed a toll. The price for tolled vehicles shall not go below this mark. The Shadow DPS shall provide the ability to implement this as a "minimum rate per mile" toll, a "minimum Segment" toll, and a "minimum trip" toll and these Configurable minimums may be different during peak and off-peak periods.
	• **Maximum toll.** The maximum toll shall apply in any mode in which some or all vehicles are assessed a toll. The price for tolled vehicles shall not go above this mark. The Shadow DPS shall provide the ability to implement this as a "maximum rate per mile" toll, a "maximum Segment" toll, and a "maximum trip" toll and these Configurable

	maximums may be different during peak and off-peak periods. If traffic conditions in the Express Lanes continue to degrade when the "maximum toll" is in effect, then the Segment/Corridor may need to shift to "HOV ONLY" mode based on real-time conditions.
	• **Minimum toll increment and decrement**. This represents the minimum amount by which a toll may change from one interval to the next. For example, a minimum toll increment of 10¢ would indicate that if the toll were to change at all from one interval to the next, it would need to change by at least 10¢. A minimum toll increment and decrement could be applied on either a per-mile basis, a per-Segment basis, or a per-trip basis. The Shadow DPS shall have both Configurable minimum increments and Configurable minimum decrements and these Configurable minimums maybe different during peak and off-peak periods.
	• **Maximum toll increment.** This represents the maximum amount by which a toll may change from one interval to the next. It is meant to limit the volatility in toll rate changes. For example, a maximum toll increment of $1.00 would indicate that the toll would not change by more than $1.00 from one interval to the next. A minimum toll increment could be applied on either a per-mile basis, a per-Segment basis, or a per-trip basis. The DPS shall be able to accommodate distinct values for toll increases and toll decreases and these Configurable parameters may be different during peak and off-peak periods. In other words, the Shadow DPS shall be able to accommodate a condition in which the rate at which tolls *increase* is different from the rate at which tolls *decrease*.
	• **Rounding increment**. This represents the increment to which fares shall be rounded (e.g. to the nearest penny, nickel, dime, quarter, etc.). The Shadow DPS shall be able to accommodate distinct rounding increments for the rate per mile, rate per Segment, and rate per trip. Additionally, the Shadow DPS shall support distinct rounding increments for ETC toll rates and for image-based toll rates. The specific rounding method shall be determined during the Design process and specified in the Design Documentation.
	• **Rate lock.** The Shadow DPS shall enable the locking (or guaranteeing) of toll rates. This Business Rule assures drivers that the rate to be charged will be no greater than the rate that was posted on advanced signage prior to the driver's decision to use the Express Lanes. The Shadow DPS shall support locking toll rates at the point of entry for the entire trip, ensuring that customers will pay no more than the trip rate that was in effect when the vehicle first entered the Express Lanes. The point of entry shall be defined during the Implementation Phase based on Contractor's solution.
	• **Exempt vehicles.** In any of the modes of operation, certain vehicles may be designated for free travel. Exempt vehicles may include (but are not limited to) emergency vehicles, military vehicles, law enforcement, transit buses, and electric cars. A detailed list of exemptions shall be established in the Design process. Exempt vehicles that regularly use the facility (e.g. transit buses, electric cars, law enforcement) must request and acquire a non-revenue Transponder. Exempt vehicles that do not regularly use the facility (e.g. emergency vehicles, military vehicles) shall be identified through their license plates and flagged for addition to the Exempt List and not assessed a toll.

	• **HOV Requirements**. The Shadow DPS shall have the ability to accommodate different HOV Requirements (namely, HOV2+ and HOV3+) when the Segment/Corridor is operating in HOT mode, in HOV ONLY mode, or in a third mode in which the Business Rules allow for different toll rates depending on the vehicle's HOV status. These HOV Requirements shall have the flexibility to vary by time of Day (e.g. peak periods vs. off-peak periods) and by Corridor/direction.
	• **Criteria for transitioning to HOV ONLY mode.** Contractor shall enable Configurable criteria for transitioning from either Normal Mode of operation to HOV Only mode. Although the criteria will be defined in the Implementation Phase, they will likely have two elements: (1) the toll has reached the maximum rate and has remained there for a Configurable number of intervals, and (2) Express Lanes Operations (as defined by speed or density) remain at an unacceptable level with no trend of improvement.
	• **Criteria for transitioning to "OPEN TO ALL" mode.** Contractor shall enable Configurable criteria for transitioning to "Open to All" mode, in which one or more Express Lanes Segments are made available for all vehicles in a toll-free condition. Although the criteria will be defined in the Implementation Phase, they will likely have one or more of the following elements: (1) An incident in the general purpose lanes has degraded conditions so badly that immediate relief is needed; or (2) Law enforcement or public officials have identified an emergency condition that temporarily warrants the elimination of tolls in the Corridor.
	• **Interval frequency**. The intervals or special events define the frequency at which rates can change. The frequency shall be Configurable, generally as short as 1 minute and as long as 30 minutes, but may need to be more frequent or less frequent to efficiently manage demand.
	• **Configurability.** For all variables requiring configurability, the Shadow DPS shall support the ability to make them Configurable *by Corridor/direction* as well. For example, the Shadow DPS shall support a pricing system in which the maximum toll increment on the I-405 Express Lanes can be different based on direction of travel, subject to any policy-related restrictions.

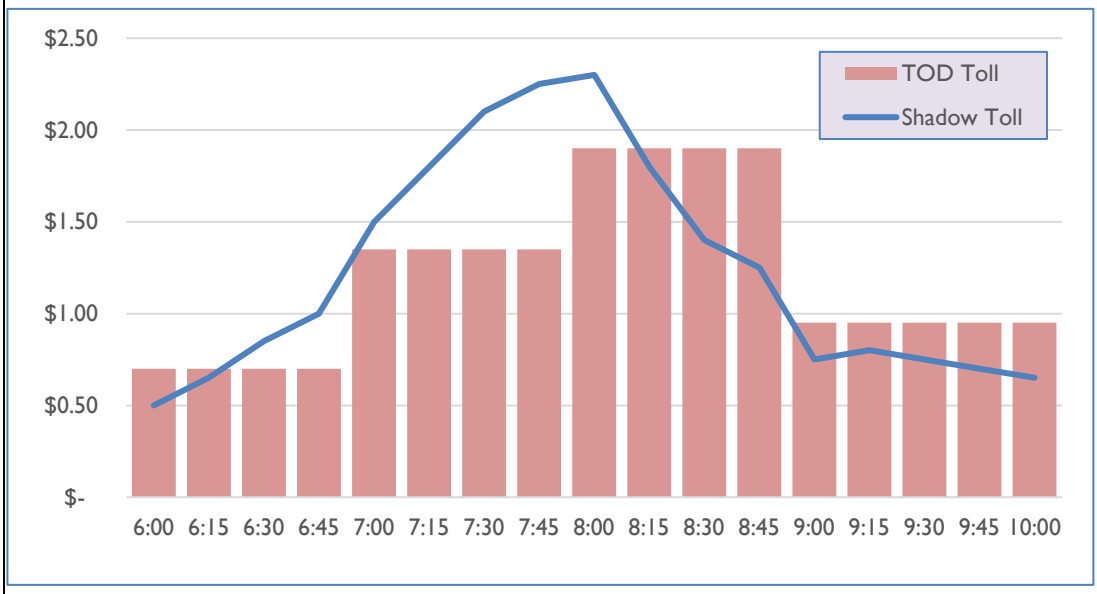
2.3.8.11.2 Shadow Dynamic Pricing System - Detailed Requirements

620	All of the Shadow DPS parameters and Business Rules used for performing the pricing algorithm shall be Configurable and flexible. Initial settings shall be determined during System Design. Tables shall be provided that (a) identify default values for all Configurable parameters, (b) provide reasonable ranges of values for all Configurable parameters, and (c) provide high-level information regarding the pricing implications of changing each parameter.
621	The Shadow DPS shall establish and maintain various Configurable pricing drivers for each Corridor. Such conditions shall include but not be limited to:
	• types of algorithms and when to activate the required algorithm;
	• the type of data to use for each algorithm (speed, volume, density, capacity, travel time);
	• the source of data for each algorithm parameter (Express Lanes data and general purpose lane data);

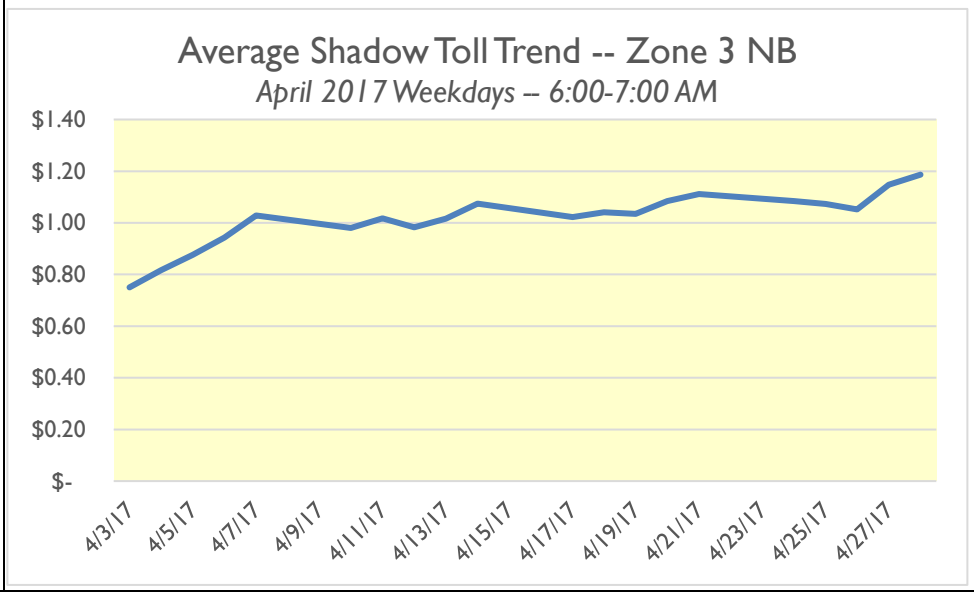
	• the percentage and/or weight of data to use for each source and type;
	• the parameters for going into and coming out of “HOV ONLY” Mode;
	• the parameters for transitioning into and out of “OPEN TO ALL” Mode:
	• the frequency of calculation (computed as often as determined most effective for determining price and managing traffic in the Corridor);
	• the interval for data collection;
	• any additional data required outside of the Segment, for example: o downstream congestion of the subsequent Segment or Corridor; o upstream congestion in a preceding Segment or Corridor;
	• trigger for price increase (level of service thresholds, changes in density, changes in travel time, and changes in travel time savings in both Express and general purpose lanes);
	• trigger for HOV ONLY Mode operation; and
	• the percentage of data points needed to be sufficient to support the dynamic pricing calculation.
622	The Shadow DPS shall calculate Shadow Toll Rates in Configurable intervals. The minimum interval shall be one (1) minute and the maximum interval shall be sixty (60) minutes, with a default interval of five (5) minutes (Configurable).
623	The Shadow DPS shall provide a Configurable price protection whereby customers are charged the toll that is lower of the price in effect within a Configurable time period when the customer entered the Express Lanes. Such Configurable capability shall include a setting from the time a price/mode is displayed on the pricing sign to when it is enabled for the customer.
624	The System shall provide the capability to establish various safeguards for Configurable minimum and maximum thresholds. This shall include but not limited to:
	• the minimum and maximum pricing increments per interval;
	• minimum and maximum toll rate per mile;
	• minimum and maximum trip fare by Corridor;
	• minimum and maximum toll per payment type and payment method;
	• minimum and maximum toll per Segment; and
	• minimum and maximum toll by occupancy (i.e. HOV2+ is 50% of the SOV per-mile rate during peak periods)
625	The Shadow DPS shall also provide the capability of considering conditions in downstream Corridors (if applicable) when calculating the price at each entry point including the capability to determine how many downstream Segments should be included when calculating the price for each entry and their weightage.
626	The Shadow DPS shall provide the capability to support multiple dynamic pricing algorithms to run simultaneously per Corridor/direction with a default algorithm that will be used unless changed based on conditions or the Business Rules.

627	The Shadow DPS shall provide the capability to run one or more pricing algorithm configurations in the background to provide insight regarding how various pricing approaches would respond to various traffic conditions.
628	The Shadow DPS shall calculate the per mile toll rate, minimum and maximum charges, the travel time to specific locations on the Corridor, and the toll amount to specified locations for each entry Toll Zone. This information, along with the time of pricing calculation, the effective time of the pricing and unique pricing identifier is considered a pricing schedule and shall be saved.
629	Using the data from the traffic detectors installed on the Express Lanes, as well as data from traffic detectors installed in the general purpose lanes as part of this project, the System shall determine the travel time between various Segments of the Corridor. As a back-up, the travel times for the Corridor shall be determined from the Transponder read data, vehicle detection data and other available sources.
630	A user interface shall be provided that displays the results of the dynamic pricing including the values for all of the parameters that drive the algorithm. Tools shall be provided to analyze and compare the pricing results to the traffic conditions.
631	A user interface shall provide the following information in real time, for each Toll Zone:
	• The current density (and corresponding level of service) in the Express Lanes
	• The current average density (and corresponding level of service) in the parallel general purpose lanes
	• The current rate in effect via TOD pricing
	• The Shadow Toll Rate under a “Adaptive Value Pricing” pricing approach
	• The Shadow Toll Rate under a “Demand Management” pricing approach
632	The Shadow DPS shall have the capacity to generate reports and graphs that support the use of Shadow DPS in informing the TOD toll rate adjustment process. These reports shall include the following:

- A graph that compares the TOD price with the Shadow Toll Rates over time. These graphs shall be developed per Toll Zone per Day. The variable tolling system shall give the user the ability to select a specific Day, to select a range of dates, or to select a type of Day (e.g. weekdays vs. weekends). An example of what this graph could look like is provided below.



- A graph that illustrates how, for a given zone during a specific interval, the Shadow Toll Rate has changed over time. The graph shall have the capacity to draw from up to six (6) months of historical data. If the Shadow Toll Rate is trending upward, it suggests that it may be appropriate to implement an upward adjustment to the prevailing TOD price. An example of what this chart could look like is provided below:



633	The parameters underlying the Shadow DPS shall be calibrated once TOD pricing is implemented. The purpose of calibration is to understand the parameters that correspond with the observed relationships between pricing and Express Lanes usage.
634	Once the parameters are calibrated to existing conditions, Contractor, in conjunction with Authority, shall modify them as necessary to develop an "Adaptive Value Pricing" approach and a "Demand Management" pricing approach. The modification of these parameters may be achieved through usage of a microsimulation model.
635	Provide the capability to export the traffic data from the Express Lanes and general purpose lanes, toll rates, and other parameters for use as inputs to external traffic simulators (e.g. TransModeler, VISSIM).
636	Traffic and dynamic pricing data shall be transmitted to third parties and to BOS in a format to be defined and Approved during Implementation Phase.

2.3.8.12 Travel Time Determination

637	The RSS shall determine the Express Lanes and general purpose lanes travel times between various Segments of the Corridor no less often than sixty (60) seconds (Configurable).
638	The RSS shall calculate the travel time using the TDS installed by Contractor.

2.3.8.13 Transaction Pre-processing

639	The RSS shall ensure all transactions eligible for trip creation are pursuable and comply with the ICD specifications.
640	The RSS shall pre-process all transactions in accordance with the Approved Business Rules in order to filter incorrect/exception transactions that may result from Equipment failures and lane logic issues.
641	Transactions that should not be processed further at the BOS shall be identified, Flagged and filtered at the RSS and not transmitted to the BOS.
642	The RSS shall identify exceptions, anomalies and other conditions determined during the Implementation Phase in the event they have not been filtered at the zone controller, for example, same Transponder read within Configurable conditions.
643	In scenarios where multiple Transponders with valid status are reported, the System shall select one Transponder with valid status to be included the trip (per the Approved Business Rules) and transmitted to the BOS.
644	In cases where a Transponder read and an Image-Based Transaction are created for a vehicle (in case of buffered reads or lane logic issues) then the RSS shall perform the filtering based upon Configurable parameters Approved during the Implementation Phase. In case of buffered read transactions, the Transponder read time shall be used as the transaction time.
645	Alarm messages shall be created and reported to the MOMS in the event such exceptions identified in this section exceed a Configurable threshold.

2.3.8.14 Transaction Matching and Trip Creation

Contractor will send fully formed 91 Express Lanes trips to the Existing BOS and New BOS once in operation. Contractor will send fully formed I-405 Express Lanes trips to the New BOS only.

646	The RSS shall provide transaction matching and trip creation functionality for the Corridor to determine the fare amount to be charged. Transaction matching and trip creation shall be in accordance by Authority Business Rules and they shall vary by Corridor.
647	The System shall support the switchable ISO 18000-6C Transponder identification scheme. The RSS shall support the accurate creation of a customer's trip where the customer may switch the ISO 18000-6C setting mid trip.
648	The System shall ensure that all data required to complete a customer trip are at the RSS, including but not limited to:
	• all transactions from the Toll Zones in the customer direction of travel are transmitted to the RSS and Toll Zones are online and current;
	• license plate results are available and meet the required confidence level or manual image review is complete; and
	• a Configurable time has lapsed since the transaction was reported.
649	The RSS shall use the Transponder reads and the license plate data from each Toll Zone to determine the trip for each customer.
650	Trips shall be created for Authority specified payment types, for example currently trips are created for Transponder-Based and Image-Based Transactions and paying and toll free transactions.
651	Trips shall be Transponder-Based; Image-Based or a combination of image and Transponder.
652	The System shall use the license plate data and other characteristics of the vehicle (i.e. VSR) to match the vehicle's transaction at each Toll Zone and create a trip for the vehicle.
653	The System shall have the capability of utilizing customer Account information obtained from the CTOC files and the RSS to match the Transponder from a transaction to the license plates associated with that Account to create a trip in the event images/license plate data is missing from the transaction.
654	The RSS shall support the trip creation possibilities for Express Lanes Corridors where a trip can be made up of a single transaction or it can be made up of multiple transactions based on the number of Toll Zones a vehicle drove through during its trip. A transaction shall be used only once to create a trip.
655	Trip creation functionality shall be Configurable to allow transactions on the 91 Express Lanes or I-405 Express Lanes to be matched with transactions on a future intersecting Toll Facility (i.e. future SR-241 direct connectors).
656	The System shall constantly process the license plate results in real time against transactions that are Flagged for image review. If transactions are matched and a trip is created using images Flagged for review, then the System shall consider the image matched and remove the image from image review queue.
657	The System shall support default Business Rules for matching transactions where some components of the trip are missing and for handling exception conditions.

658	The System shall use Configurable logic to avoid splitting a customer trip into two or joining two separate trips into a single trip. Such logic includes but is not limited to:
	• time taken to travel between individual and multiple Toll Zones;
	• time taken to travel the Corridor, and travel time for each Segment.
659	The System shall create a trip for each Corridor in the event a customer traveled multiple Corridors.
660	The System shall provide an audit trail for tracking transactions to trips and provide one hundred percent reconciliation of the transactions to trips.
661	Transactions that are not matched per the Business Rules shall not be transmitted to the BOS.

2.3.8.15 Trip Classification

662	The System shall classify the trip based on the Business Rules using the data obtained from the following subsystems including but not limited to:
	• roadside systems;
	• ODS;
	• CAV data, and
	• BOS
663	The trip classification shall include but not limited to:
	• transponder-based paying trip;
	• transponder-based toll violation trip;
	• transponder-based occupancy violation trip;
	• transponder-based toll exempt/toll discount trip;
	• transponder-based HOV ONLY violation trip;
	• image-based paying trip (matched to customer account);
	• image-based toll violation trip; and
	• image-based toll exempt/toll discount trip

2.3.8.16 Fare Calculation

664	The RSS shall support fare calculation Business Rules by Corridor. Fares shall be determined in U.S. currency for the specified Corridor.
665	The System shall maintain a Configurable hierarchy that defines which Flag or status on the transaction takes precedence when creating and classifying the trip, and calculating the toll amount.
666	The RSS shall calculate the fare to be charged to the customer Account for the trip in accordance with the Business Rules, and including but not limited to:
	• the Toll Zones traversed by the customer during travel on the Express Lanes;
	• the Corridor;
	• the Segment prices that were in effect at the time that the driver passed the Toll Rate CMS just upstream of the entry point to the Express Lanes;

	• Transponder Occupancy Setting;
	• occupancy status of each transaction as determined by ODS;
	• CAV data;
	• trip classification;
	• flags on the transaction;
	• the payment method (based on TSL) on each transaction, and
	• any minimum/maximum criteria established by Authority for each Corridor.
667	The rate calculation shall use travel time data (gathered from AVI sensors and/or roadside traffic detectors) to ensure that customers are charged a fare that is no greater than the fare that was posted on the Toll Rate CMS prior to entering the Express Lanes.
668	The fare due from a vehicle without a Transponder that is determined to be an Image-Based Transaction shall be in accordance with the Business Rules established by Authority during the Implementation Phase.
669	The HOV2+, HOV3+, and CAV fare shall be discounted a Configurable percentage of the SOV fare. This configuration shall be by Corridor.
670	The System shall confirm that the toll amount/toll rate determined by the pricing system matches the toll amount/toll rate displayed on the Toll Rate CMS for each destination. In the event of a discrepancy, the toll amount/toll rate displayed on the Toll Rate CMS shall be used and such transactions Flagged.
671	The System shall assess a default toll amount in accordance with the Business Rules if the toll amount/toll rate cannot be determined or if error conditions are detected.

2.3.8.16.1 Fare Calculation - 91 Express Lanes

672	The 91 Express Lanes use lane declaration only to determine declared occupancy. The RSS shall calculate the fare to be charged to the customer Account for the trip based on the lane declaration and the toll schedule in place at the time of the transaction.

2.3.8.17 Trip Correction

673	The RSS shall use the occupancy results obtained from the ODS to re-classify a vehicle if the initial classification was incorrect based on the Configurable classification hierarchy, and correct the toll charged for the trip if applicable. The integrity of the original trip shall be maintained for audit purposes.
674	The corrected Transponder Occupancy Setting trip transaction and the back-up images shall be transmitted to the BOS.
675	The RSS shall also have the capability to handle trip re-classification and fare calculation if the occupancy results are obtained from the ODS prior to transmission of the trip transaction to the BOS.

2.3.9 Roadway Support Systems (RSS) Application Software

676	Contractor shall develop, furnish, and install a single GUI application Software for the ETTM System that supports all user functions for the RSS, including the MOMS, all Dashboard, image review, DVAS and reporting.

677	The System shall provide role-based single sign on (login) capability for all RSS functionality.
678	Using a role-based login, the System shall provide Authorized Users with specific authority to perform functions within the System. An Authorized User could be Contractor or other designated Authority user.
679	Provide a browser-based application compatible with Authority Approved current version, or immediate prior Authority Approved version, releases of the following browsers, including but not limited to:
	• Microsoft Internet Explorer;
	• Microsoft Edge Browser;
	• Mozilla Firefox;
	• Google Chrome;
	• Apple Safari;
	• any other browser reaching five percent market penetration, as Approved by Authority and
	• smartphone/tablet/mobile browsers.
680	Based on the user's access privileges obtained from Active Directory the appropriate menus, screens, tabs, reports and other System functionality shall be made available.
681	Changes to the System data and System parameters shall be through screens and only Authorized Users shall have access to these screens.
682	All access to the application and changes to the data shall be recorded and tracked, and the System shall provide an audit trail for all data modifications and parameter changes.

2.3.9.1 Graphical User Interface (GUI) Requirements

The GUI Design must include accepted industry design standards for ease of readability, understanding and appropriate use of menu-driven operations, user customization and intuitive operation.

683	The GUI Design and development shall incorporate human factors and usability engineering and be optimized for speed, as well as provide the following controls, including but not limited to:
	• menus (such as pull down, popup, cascading, leveling, etc.);
	• windows (allowing for multiple windows within the application, such as to navigate back without having to re-enter information)
	• informational messages;
	• positive feedback;
	• provide warning and/or confirmation messages when appropriate as defined during the Implementation Phase
	• exception handling and error dialogs, including logging the error;
	• control icons, links and action buttons;
	• data entry fields, combo boxes, check boxes;

	• provide the capability for the user to print screens
	• display (read-only) fields, and
	• general and context-specific help menus.
684	Data entry screens shall have Configurable mandatory fields that require data entry prior to continuing through the process.
685	Provide field-level validation (server-side enforced) and format verification upon exiting data fields applicable to pre-defined formats or standards, including but not limited to:
	• alpha-numeric;
	• date;
	• time;
	• special characters;
	• length;
	• lane and Toll Zone ID, and
	• Transponder numbers.
686	Provide other formatting masks (server-side enforced) as configured by the System administrator (visible to certain users but masked for other users), which can be applied to any other field in the GUI.
687	Provide field-level “tooltips” or other interactive help, Configurable by the System administrator, that provide specific guidance on any field presented, including but not limited to:
	• alpha-numeric fields;
	• date fields;
	• time fields;
	• special characters;
	• username and password;
	• length restrictions;
	• lane and location ID, and
	• Transponder fields.
688	Online help shall be provided for each screen, each editable field and each selectable option within each screen.

2.3.9.2 Screens and Report Access

689	Provide the capability to control all access rights through the assignment of user-roles.
690	Based on the access levels/role a user is assigned to the appropriate menus, screens, tabs, reports and all other required user information shall be displayed.
691	For some screens, certain access levels/roles may only be allowed to view the contents and not allowed to enter any data.
692	Provide Authority Authorized Users the capability to make changes to user roles. The System shall prevent the direct assignment of rights to a user, and all rights must flow from a user role.

2.3.9.3 User Management

User setup and management is a critical task since the user access levels/roles created through the System determines what privileges and access rights each user is granted.

693	Access to the zone controllers; RSS; the MOMS, and the image review shall be controlled through the user access privileges set up through the user management module.
694	Allow for full integration with Microsoft Active Directory (AD) or similar access system Approved by Authority so users are not required to enter separate passwords for system access (the System shall prompt users for their credentials and not allow pass-through authentication), and that all rules for password security (for example, characters or rotations) are enforced and passed between the network and the application.
695	Authorized Users shall have the capability to add new users into the System, to update/modify existing users, and to disable users.
696	The user identification data shall include the user name, job designation and identification number.
697	All users shall be assigned individual user IDs and an individual default password which they are required to change when first accessing the application.
698	Accounts for user access to the System shall require a strong password in accordance with password management standards in ***applicable PCI requirements***. The access shall be role based and limited to the authorized Contractor staff and designated Authority personnel.
699	Access to all information on the ETTM System, including EDMS, shall be limited to designated Authority and Contractor personnel and shall be password controlled. User access security including sign-on facilities, access privileges, user role and different levels of access shall be provided for the application, database, files and directories and shall be fully user Configurable. Specific Requirements shall be developed during the System Design.
700	All user lane and application privileges shall be maintained at the RSS and transmitted to other systems for user validation.
701	Contractor shall develop the matrix of access levels/user roles and allowed privileges during System Design with Authority input and Approval. The System shall allow for addition and changes to the access levels/user roles and addition of personnel in a secure manner. Authorized Users shall have the ability to activate, deactivate, and terminate user's access to the System in accordance to Approved Business Rules.
702	The System shall generate a user identification list (UIL) that is transmitted to the zone controllers each time there is a change that impact toll collection Operations. It shall at a minimum contain the user ID, PIN and access level. All access to the lane System shall be validated against this list. The UIL shall become active upon receipt by the lane/zone controller.

2.3.9.4 Toll Rates and Schedule

703	The System shall provide Authorized Users the capability to create and manage TOD toll rates and schedules.

704	At a minimum, capability shall be provided to establish toll rates based on Corridor, Segment, declared occupancy, and shall support TOD and holiday toll rates as defined during the Implementation Phase.
705	Authorized Users shall have the capability to pre-establish the effective date/time the toll rates will be enabled. The System shall permit Authority to schedule toll rates and changes in toll schedules in advance of the new rates becoming effective.
706	The toll rates shall be transmitted to the zone controllers and the Toll Rate CMS to support degraded modes of operation.
707	The System shall record and track the toll rate ID and toll schedule ID and their transmission status for audit purposes.

2.3.9.5 Toll Rate Changeable Message Sign Control System

708	The System shall provide the capability to define the destinations and operational modes to be displayed on the Toll Rate CMS by Corridor.
709	Authorized users shall have the capability to define the Corridor Operations schedule and based on the schedule or conditions that trigger a change in the Operational Mode, the Toll Rate CMS control system shall transmit the appropriate message to display on the Toll Rate CMS.
710	The sign control System shall interface with the Toll Rate CMS to obtain and display the toll amount on the Toll Rate CMS and to update toll amounts at Configurable intervals. The System shall confirm that the data is acknowledged by the Toll Rate CMS.
711	For audit and dispute purposes, the System shall capture multiple video frames of the Toll Rate CMS at the time the pricing data was acknowledged by the Toll Rate CMS.
712	Multiple Toll Rate CMSs shall be supported at an access location and the System shall institute logic that ensures the toll information is displayed at the correct time at each of the Toll Rate CMSs.
713	The System shall poll the Toll Rate CMS at frequent, Configurable and user-defined intervals to be determined during Design and shall obtain the data that is displayed on the Toll Rate CMS. Any variation in the displayed data to the expected data shall result in a potential increase the polling rate (to be determined during Design) and the creation of an alarm message to Operations and capture of the video frame when the variance is initially detected.
714	Any exceptions in the Toll Rate CMS displayed data shall be conveyed to the fare calculation module so that toll is charged based on Authority Business Rule for such conditions.
715	The System shall provide the capability to override the Toll Rate CMS and allow Authorized Users the ability to select default rates to be used, suspend toll rates or freeze toll rates for a selected period of time. The System shall ensure that when fares for specific Segments are overridden or frozen at one Toll Rate CMS, then these rates should simultaneously be distributed to all other Toll Rate CMSs that are displaying fares for the same trip(s).
716	The System shall support activating incident mode Operations for selected Segments of the Express Lanes. The Toll Rate CMS shall be synchronized such that the affected Toll Rate CMS display the correct incident mode.

717	Incident modes and operational conditions shall be triggered manually by Authorized Users. Manual incidents shall include CLOSED and OPEN TO ALL and Automatic mode of operation includes HOV ONLY and TOLLS IN EFFECT. The message displayed on the Toll Rate CMS under such conditions and their triggers shall be Configurable by Authorized Users and shall be displayed in English.
718	If the Toll Rate CMS losses connectivity to the ETTM Communications Network, the System shall enable a backup wireless communications link between the Toll Rate CMS and TOC.
719	The System shall support the automatic triggering of historic toll rates, TOD toll rates, or the minimum tolls as configured in accordance with the Business Rules for each destination when communication to the Toll Rate CMS is lost.

2.3.9.6 Transaction/trip Filters

2.3.9.6.1 Filters – General Requirements

Transactions/trips that Authority does not want to post to a customer Account or pursue as a violation shall be filtered at the RSS based on Authority Approved Business Rules and shall not be submitted to the BOS for processing.

Filters applied to transactions/trips can have the following effects on the transaction/trip:

- Closes a transaction/trip, preventing it from moving through the normal process flow;
- Delays processing of the transaction/trip until:
  - a Configurable time threshold is met;
  - the transaction/trip and associated images are reviewed.
- Queues the transactions/trips and images for special processing based on specific characteristics and criteria.

720	The RSS shall provide the capability to support filtering transactions/trips by a combination of filter criteria, including but not limited to:
	• Corridor;
	• direction of travel;
	• Toll Zone;
	• transaction/trip type (Transponder-Based Transaction or Image-Based Transaction);
	• transaction/trip classification (payment or toll free or occupancy violation)
	• Transponder status;
	• Transponder ID;
	• mode of lane operation (example Incident Mode);
	• flags on the transaction, for example Clean Air Vehicle flag and non-revenue flag;
	• license plate number;
	• license plate type;
	• Jurisdiction including Mexico;
	• date;

	• time of Day, and
	• workflow status.
721	Provide the capability to apply filters to each Corridor's transactions/trips based on Authority filter rules.
722	Provide the capability to add new filters and maintain existing filters for each Roadside System by specifying, including but not limited to:
	• the filter criteria, such as license plate number and Jurisdiction;
	• the disposition of filtered transactions/trips. The disposition determines what happens to the transactions/trips that meet the filter criteria. For example, such transactions/trips are identified as terminated or placed in a queue for review;
	• where in the transaction/trip flow process the filter should be applied for a specific transaction such as prior to image review, prior to trip review, at any stage in the process, or prior to transmitting the transaction/trip to the BOS;
	• the status of the transaction/trip when the filters are applied. For example, if the transaction/trip is in a terminal status then automatic filtering is not applied;
	• the Alert conditions, for example, send an Operational Alert Notification to the MOMS when a high number of transactions/trips are filtered;
	• the date range that the filter should apply, for example, infinitely until license plate/Transponder is removed from the filter list and
	• the effective date the filtering should start for the selected license plate/transaction.
723	Provide the capability to configure the frequency of occurrence (number per period) for a specified filter category and condition that will trigger manual review; for example, if filtered license plates for a specified Jurisdiction exceeds the Configurable frequency then manual review and user action will be required.
724	Support various actions for filtered transactions/trips, including but not limited to:
	• close the transaction/trip and prevent it from moving through the process flow, such as Image-Based Transactions/trips that match the Exempt List;
	• place the transaction/trip in queue for a Configurable number of days, or until re-occurrence threshold is reached, such as occupancy violation and
	• place the transaction/trip and associated images for review, such as Image-Based Transactions/trips that match the Plate Correction List.
725	Require all transactions/trips that are filtered have a disposition code and a reason code that identifies the filter applied in the user interface and reports.

2.3.9.6.2 Filters – Exempt List

The BOS maintains an Exempt List of license plates and Transponders for each Corridor and for the Express Lanes as a whole. The Express Lanes Exempt List contains those license plates and Transponders which shall be filtered on all Corridors. The Corridor-specific Exempt Lists contain those license plates which shall be filtered for that specific Corridor only. The Exempt List is transmitted to the RSS from the BOS. In addition, during the image review process an exempt plate/vehicle may be identified or flagged for addition to the Exempt List. The transaction/trip shall not be processed further if the license plate or Transponder on a transaction/trip is on the Exempt List and matches the exempt criteria.

726	Match, filter and process the license plates and Transponders in the transaction/trips against the Exempt List at any stage in the transaction flow process.
727	Check the license plate against the Exempt List each time a license plate number is modified and it is re-introduced into the process.

2.3.9.6.3 Filters – Plate Correction List

The BOS maintains and updates a Plate Correction List, which contains license plate numbers that have been problematic and require review and verification. Since a license plate can be problematic for one Corridor and not for another, a Plate Correction List is maintained for each Corridor. Images and Image-Based Transactions/trips that contain license plate numbers on the Plate Correction List for the Roadside the transaction/trip shall be filtered. and queued for separate processing. Review could result in the correction of the license plate number or rejection of the license plate number. The problematic license plates could be entered at the BOS by the Roadside operations staff or the CSC operations staff and it will be transmitted from the BOS.

728	Provide the capability to accept from the BOS a Plate Correction List that applies to images and Image-Based Transactions/trips for the Express Lanes.
729	Transmit the Plate Correction List to the ICPS to initiate re-validation of the VSR database.
730	Match and filter the license plates in the image and Image-Based Transactions/trips against the Plate Correction List.
731	Provide the capability to queue the filtered images and Image-Based Transactions/trips for review and corrective action.
732	Provide the capability to retrieve other transactions/trips that could potentially have errors and take corrective action (if needed) on the Image-Based Transactions/trips.
733	Support taking the following actions on the filtered transactions/trips, including but not limited to:
	• reject the image or transaction/trip;
	• correct the license plate data, and re-introduce the Image-Based Transaction/trip into the process flow; and
	• Flag the transaction/trip as approved for re-processing if no error was identified during review and no correction was necessary. Approved transactions/trips that require no correction will not be queued for Plate Correction List filtering again.

2.3.9.6.4 Filters –Transponder Occupancy Setting Correction List

734	Provide the capability to accept from the BOS the Transponder Occupancy Setting Correction List by Corridor by Toll Zone and for the Express Lanes.
735	Transmit the Transponder Occupancy Setting Correction List to the ODS.
736	Match and filter the Transponder ID numbers associated with transactions/trips against the Transponder Occupancy Setting Correction List.
737	Provide the capability to review these filtered transactions/trips including available video, images and occupancy detection results.

738	Provide the capability to change the occupancy status in the transaction/trip based on the results of the review and the data in the Transponder Occupancy Setting Correction List.

2.3.9.6.5 Transponder Occupancy Setting Errors

739	Provide the capability to accept from the BOS the Transponder occupancy setting errors that are generated at the BOS from customer disputes
740	Transmit the Transponder Occupancy Setting Errors to the ODS.
741	Provide the capability to review Transponder Occupancy Setting Errors including available video, images and occupancy detection results.

2.3.9.7 Image/trip Review and Processing Queue

The image/trip review process shall be designed to meet the Performance Requirements specified in this Scope of Work and Requirements. Image enhancement tools shall provide image reviewers the capability to identify every human readable plate and comply with the Performance Requirements. The screens, enhancement tools and navigation methods shall be optimized for speed, reliability, and accuracy. The enhanced image that results from the manual review process, upon which the license plate determination is based, shall be saved for use in the downstream processes, in addition to the saving of the original unaltered image. Image disposition reasons shall be Configurable and shall cover all possible conditions upon which a disposition could be based.

742	Contractor shall deliver a fully integrated image review system and perform image review Services in order to provide fully formed trips which are ready for processing by the BOS.
743	The RSS shall provide the capability to configure the conditions that results in images being queued for manual review, including but not limited to:
	• the license plate is from a Configurable list of Jurisdictions requiring manual review.
	• images that do not meet the Configurable OCR confidence thresholds (by character and overall);
	• images that do not meet the Configurable VSR confidence thresholds;
	• the license plate is seen on the Roadside for the first time irrespective of the OCR confidence level;
	• when the license plate has not been manually reviewed within a Configurable number of days of the last review;
	• license plates can be configured to be reviewed ‘always’, and
	• the license plate is on a Plate Correction List whereby it was Flagged to have an error.
744	The RSS shall provide the capability to configure the conditions that results in trips being configured for review, including but not limited to:
	• trips where the OCR confidence is within a Configurable threshold;
	• trips where the VSR confidence is within a Configurable threshold;
	• trips where the image review went through a Configurable review cycle;

	• unmatched transactions;
	• Trips/transaction where system has identified anomalies, for example Transponder Occupancy Setting not the same on transactions in a trip; Transponder Occupancy Setting not matching the customer's electronic declaration and Clean Air Vehicle detection discrepancies.
	• trips that have not been transmitted to the BOS;
	• trips where the trip duration is above a Configurable threshold, and
	• other conditions as defined during the Implementation Phase, for example customers who have multiple disputes related to incorrect trip creation.
745	The RSS shall provide the capability to configure the image review process based on Roadside whereby images from a specific Roadside can be configured for separate review process.
746	The RSS shall provide the capability to configure the image review process based on the status of the transaction/trip; for example, completed trips not transmitted to the BOS go through a trip review process whereas transactions go through the image review process.
747	The RSS shall provide the Configurable capability to queue images for separate manual image review based on OCR confidence range. This will provide the capability to queue low quality images for specialized image review.
748	The RSS shall provide the Configurable capability to queue images for separate manual image review based on anomalies identified, for example this will provide the capability to queue CAV transactions through different image review process.
749	The RSS shall provide the capability to categorize the image review process based on Jurisdiction and plate type whereby images that meet the specific Jurisdiction and plate type are queued for a specialized image review. The System shall support adding and modifying the Jurisdiction and plate type.
750	The RSS shall provide the capability to perform a manual review process that allows images to be automatically directed to specified review queue based on license plate characteristics or manual data entry, for example, if the OCR identifies a Mexico plate, it should automatically flow to special coding review.
751	The RSS shall provide the capability to configure the OCR and VSR thresholds such that license plates that meet the established criteria may by-pass image review and be eligible for transaction matching and trip creation.
752	The RSS shall automatically queue and present images for manual image review based on Configurable Approved Business Rules established whereby images that are identified as requiring manual review and queued for review First in First Out (FIFO) based on the transaction/trip time.
753	The RSS shall provide the capability to make available/group all images for the vehicle image being reviewed if the images are identified by the Roadside System to be part of the same trip. This will permit image reviewers to review all images associated to a vehicle and enter the license plate information more efficiently and accurately.
754	The RSS shall provide Authorized Users the capability to search for the specific images/trips for each type of review (license plate, CAV vehicles, trip) and review them.
755	The RSS shall provide Authorized Users the capability to review the Clean Air Vehicle database based on specified search criteria.

756	The RSS shall provide consistency in the image review user interface and presentation of images and data at all stages of the image review process, for example, all images associated to Image-Based Transaction/trip shall be made available at all image review stages.
757	The RSS image review functionality shall be optimized for operational efficiency whereby the image review process can be completed without the use of mouse clicks but by utilizing hot keys if the image review is performed on a workstation.
758	The RSS image review functionality shall be optimized for operational efficiency whereby the image review process can be completed using a tablet/touch screen.
759	The RSS shall provide the capability to configure the image review display screens whereby the System displays only those buttons, data and functions that are applicable to the specific review level, including but not limited to first review, secondary review, special reviews, supervisory review, and corrective reviews.
760	The RSS shall provide the capability, based on user role, to present the image reviewer the specific data set related to the transaction/trip to help identify trends and make an informed decision, including but not limited to, OCR jurisdiction and license plate confidence for character and jurisdiction; lane transaction/trip details; vehicle details; vehicle registration details (if available); image reject details, and number of times in review queue.
761	The RSS shall provide an image review workflow that results in Contractor meeting the Performance Requirements of this Scope of Work and Requirements.
762	Contractor shall be responsible for modifying the workflow and image review process if Contractor is unable to meet the Performance Requirements using the proposed solution.
763	The RSS shall provide image review enhancement tools, including but not limited to zoom image; crop ROI from the full image and save it for further processing and display as Approved by Authority; brighten image; invert image; darken image; switch primary and secondary images, and choose another image as the image of record. Image enhancement tools shall permit Contractor to meet the image review accuracy and Performance Requirements.
764	Image review functions provided by the RSS shall include the capability for users to:
	• accept OCR license plate data if it is displayed and determined to be correct (for image above a Configurable threshold);
	• enter license plate data and accept the image (for example in case of blind review);
	• identify a vehicle as Clean Air Vehicle;
	• identify a vehicle as Clean Air Vehicle that does not meet the criteria;
	• reject the image and enter the reject reason;
	• skip the image, and
	• Flag the image for supervisory review/action.
765	The RSS shall require that rejected images have a reject reason and the reject reason can be selected either during the first review or supervisory review.
766	The RSS shall provide the capability to define the Configurable number of reject reasons and maintain and modify the reject reasons.

767	The RSS shall provide the Configurable capability that may require all rejected images being queued for supervisory review.
768	The RSS shall require that at all times the license plate information is standardized within all subsystems as it relates to the Jurisdiction, plate number and plate type so that the license plate number includes the required pre-fix and suffix in compliance with each Jurisdiction's requirements. The standardization shall result in the license plate number format being the same regardless of where it is input including but not limited to CSRs via the application, OCR/VSR during the license plate extraction process, and image reviewers during the image review process.
769	The RSS shall provide the capability to track the rejected images, their reject reason codes and generate maintenance Alerts and reports to MOMS if rejected images are above a Configurable threshold for each lane for a Configurable period of time based on reason codes.
770	The RSS shall provide the capability to track the rejected images and generate Operational Alerts if rejected images are above a Configurable threshold for an image reviewer for a Configurable period based on reason codes.
771	The RSS shall provide the capability to track the temporary and fraudulent plates and identify frequent usage of temporary/ fraudulent plates.
772	To support trip review, the System shall present images and transaction data for all transactions associated to the trip. Only trips that are meet the Configurable parameters are presented for review. Users shall have the ability to accept the trip or select transactions that need to be removed from the trip.
773	The System shall re-process the results of the trip review process if the trip was not accepted by the User in accordance with Authority Approved Business Rules.
774	The RSS shall provide the capability to track and Alert operations if the image reviewer is entering the same value repeatedly over a Configurable period of time, or if the image reviewer is inputting data too quick for quality or too slow for performance.
775	Upon the completion of the license plate extraction process the RSS shall process the license plate through the applicable filters as described in this Scope of Work and Requirements.

2.3.9.8 Review of Image/trip Review Results

776	The RSS shall provide, via screens, the capability to search and view all stored information regarding images and transactions/trips based on the type of review, including but not limited to:
	• user ID;
	• license plate number;
	• partial license plate number (without the suffix/prefix);
	• Jurisdiction;
	• image disposition;
	• disposition reason;
	• transaction/trip type;
	• transaction/trip ID;

	• transaction/trip date and time;
	• image review queue;
	• transmission date and time;
	• OCR results;
	• OCR confidence level;
	• VSR results;
	• VSR confidence level;
	• CAV data review results;
	• Business Rule exceptions;
	• toll amount;
	• adjusted transaction/trips;
	• lane anomaly;
	• trip review results;
	• Corridor;
	• Toll Zone and
	• lane ID.

2.3.9.9 Image/trip Review Quality Assurance Process

777	The RSS shall provide the capability for an automated random selection of images/trips for audit and a manual selection of images using a GUI for audit based on specified selection criteria including by date time and transaction type. The images/trips selected for audit and all available license plate results and images shall be presented to the Authorized User for review (for example, all OCR results, occupancy detection results and manual image review results) through a GUI.
778	For images where the transaction is flagged for occupancy violation, the System shall present additional images, transaction data and additional layout and button as needed to streamline the occupancy validation process.
779	The Authorized User shall be provided the capability to enter the results of the assessment and corrections as needed for each image/transaction. Based on the audit performed the System shall automatically compute the error rates for images and trips, and reject rates by image reviewer (human and OCR) and location (Corridor, Toll Zone and lane).
780	For occupancy violations, the System shall calculate the ODS error rate for each class of occupant including false positives.
781	The plate errors identified through this quality assurance process shall be included in the Plate Correction List.
782	The occupancy errors identified through this quality assurance process shall be included in the Transponder Occupancy Setting Correction List.

2.3.9.10 Lane Operations Manual Override

When conditions in the Express Lanes require the lane operations to be changed, Authorized Users shall have the capability to change the operational mode of the Express Lanes.

783	The System shall provide Authorized Users the capability to remotely change the operational mode of the lane to handle incidents and other conditions as determined by Authority, including but not limited to:
	• open the Express Lanes to all traffic;
	• close the Express Lanes to traffic;
	• place the Express Lanes in HOV ONLY mode, and
	• place the Express Lanes in Maintenance mode.
784	Authorized Users shall have capability to select one or multiple criteria to which the mode change applies, including but not limited to:
	• Corridor;
	• direction of travel;
	• Segment, and
	• Toll Zone(s).
785	The System shall have the capability to configure the following Business Rules, including but not limited to:
	• impacted Toll Zones;
	• Impacted Toll Rate CMS;
	• Toll Rate CMS display, and
	• handling of transactions and trips that occur in these modes.
786	Authorized Users shall have the capability to revert the Express Lanes to normal mode at which time the Express Lanes pricing and travel times shall be managed by the TDS.
787	Upon initiation of a mode change, Alerts shall be generated every Configurable interval.
788	When the Operations of the Express Lanes change, the appropriate transaction processing rules shall be applied.

2.3.9.11 Adjustments and Waivers

Adjustments are processed in the RSS when conditions in the Express Lanes require tolls to be adjusted or waived. Identification of incidents in the Express Lanes shall be automatic or manual including for example:

- The System shall detect conditions that are Configurable, for example low speeds, high travel time or bad level of service (LOS) that requires adjustments and waivers of tolls.
- User shall search for transaction/trips that meets selected criteria.

The adjustment to the trips only happens if the trips have not been transmitted to the BOS for processing. Adjustments can be processed for single transactions or in bulk. An example of a bulk adjustment is waiving tolls on all trips for a specific Corridor or Segment during a specific time period, as would be the case when there is an incident mode. An audit trail will be maintained for all adjustments and the RSS shall have the capability to report on both the unadjusted transaction/trip amount and the adjusted transaction/trip amount.

2.3.9.12 Automatic Detection of Incidents

789	Provide Authorized Users the capability to Configure the conditions that could potentially require transaction/trip adjustments or waiver of toll. Such conditions shall include but not be limited to:
	• speeds below a Configurable threshold;
	• congestion level above a Configurable category or LOS below a Configurable level;
	• travel time above a Configurable threshold, and
	• travel time differential above a Configurable threshold.
790	The System shall suspend transmission of the trips/transactions to the BOS, and suspend transaction matching and trip creation based on the Business Rules when the Configured conditions occur. Suspension of the process shall generate alarm messages that are reported to MOMS.
791	Operational Alerts shall be generated when Configured conditions occur.
792	The System shall Flag transactions/trips that occur under the Configured conditions and queue them up for review and potential adjustment/waiver.

2.3.9.13 Manual Adjustments and Waivers

793	Provide Authorized Users the capability to make adjustments to transactions/trips while preserving the original transaction/trip, including the original transaction date and amount. Any adjustments shall be tied to, but not change, the original transaction.
794	Adjustment of all trips shall be performed before the trip is transmitted to the BOS.
795	Provide a transaction search and adjustment screen(s) where Authorized Users can enter the selection criteria, retrieve the transactions/trips and make bulk adjustments or waivers. This capability shall allow the selection of groups of transactions/trips to which the correction will apply and adjustment comments entered for the affected transactions/trips. The Authorized User shall be allowed to select/deselect specific transactions/trips within the group. For example, Authority may want all trips within two Segments between 5 AM and 6 AM to be waived due to an incident in the Express Lanes.
796	Provide the capability to adjust the entry and/or exit Toll Zones on a trip and automatically assign the correct toll amount for the adjusted trip.
797	Provide the capability to manually adjust the toll amount of a trip or a selection of trips without changing other attributes of the trip such as entry and/or exit location. User shall be able to select the default rate per mile, the minimum amount or the maximum amount in addition to manually entering an amount.
798	Provide the capability to waive the toll amount of a trip or a selection of trips without changing other attributes of the trip such as entry and/or exit location.
799	Provide the capability for approval of adjustments and waivers, for example prompt for a supervisor's password when any adjustment or waiver is initiated.
800	Process the adjusted transactions/trips through the safeguards instituted and in accordance with Authority Approved Business Rules.

2.3.9.14 Configurable Parameters

801	The System shall provide the ability for Authorized Users to modify the Configurable System parameters.
802	Any configuration change shall result in the creation of an audit trail and each change shall be identified by a unique identifier.
803	Changes to Configurable parameters can be scheduled to take effect immediately or at a scheduled time as determined by the user.
804	The System shall record and track all changes to Configurable parameters through version control for audit purposes.
805	When a new parameter takes effect, a notification shall be generated and reported to the MOMS.

2.3.9.15 Express Lanes User Queries and Reports – General Requirements

806	All data entered or generated in the System shall be retrievable through reports and screens.
807	Reports menu shall be organized by category of reports (i.e. transaction, performance, operational, financial, audit & reconciliation, etc.) and shall be intuitive to users and easily accessible based on user access.
808	All reports shall have the capability to be limited to 91 Express Lanes only, I-405 Express Lanes only or combined. The System Design shall provide for similar separation and selective combining for future Authority Express Lanes Corridors.
809	Data shall be summarized to improve report generation performance and to track changes in data for as-of-date reporting.
810	Report generation shall not impact the production system and a separate Data Warehouse shall be provided for ad-hoc reporting.
811	Reports shall be made available through the System on demand and on an ad-hoc basis; shall have various selection and sort criteria, and shall be intuitively Configurable with user selected criteria from drop down data elements as defined during Implementation Phase.
812	The location selection criteria shall include, but not be limited to Corridor; Toll Zone; Segment; lane, and direction of travel.
813	The date selection criteria shall include but not be limited to the ability to generate the same report by hour; Day; date range; weekly; monthly; yearly, year-to-date and user-defined range.
814	Data shall be presented as an accumulation or individually for the selected criteria. This capability shall be Configurable and applicable to individual Toll Zone and different transaction types whereby the user can choose the data to be presented as an accumulation of Toll Zones and/or payment types or as individual Toll Zones and/or payment types.
815	Reports developed shall allow Authority to audit and reconcile the transaction data and trips from Roadside to the transaction and trip data at the RSS and the BOS in accordance with this Scope of Work and Requirements.

816	Capability shall be provided to modify the report format to perform comparative analysis and statistical calculations.
817	Contractor shall provide ad-hoc reporting tool capabilities to Authorized Users to allow the creation and execution of custom reports, including but not limited to:
	• drag-and-drop field functionality;
	• drill down functionality;
	• filtering;
	• parameter prompting;
	• formula support;
	• grouping;
	• sorting, and
	• stored procedure and function support.
818	The ad-hoc reporting tool shall be COTS Software and be the latest version at the time of Acceptance testing and field-proven to operate in a transaction intensive environment.
819	The ad-hoc Software shall be compatible with operating System standards and shall be patched and Upgradeable to new versions of the Software and operating System.
820	Ad-hoc report templates created by Authorized Users shall be made available to all Authorized Users.
821	All reports shall show the status of the validation/audit process, as defined by Authority and other relevant statuses that indicate items, including but not limited to whether:
	• all data has been obtained from the lanes;
	• the data has been re-summarized;
	• correlation of transaction to trip;
	• the transactions/trips have been transmitted to the BOS, and
	• the report data is audited and complete.
822	The date and time of the last transaction processed shall be included in all applicable reports.
823	Once the audit process is completed for the Day, the data on reports for the Day shall not change unless data is re-summarized after Authority Approval.
824	All reports shall include individual totals, sub-totals, and grand-totals as appropriate and such totals shall be maintained when data is exported to other formats.
825	Reports shall have the capability to select the date type, including but not limited to:
	• revenue date;
	• transmission date;
	• as-of date;
	• process date;
	• transaction date, or
	• a combination thereof, as designated by Authority.

826	Reports shall use conditional formatting to identify exceptions and data that are outside the normal trend.
827	All reports and screens shall have the capability to be printed or saved in various formats (both compressed and uncompressed), formats to be Approved during the Implementation Phase including but not limited to:
	• Portable Document Format (PDF);
	• plain text format (TXT);
	• rich text format (RTF);
	• Microsoft Excel (2010 version and later);
	• delimiter-separated values;
	• hypertext markup language (HTML), and
	• extensible markup language (XML).
828	A report generation feature shall be available for configuration and shall permit an individual with permission to request selected reports for auto delivery by email or to a designated location according to a routine or custom-specific interval.
829	Selected reports shall be automatically generated and made available to authorized personnel at the start of the Day or at other appropriate time as designated or requested by Authority.
830	The System shall provide the capability to drill down all high-level reports/screens to the next level of detail all the way to the most basic level of detail available as required.
831	Authorized Users shall have the ability to display and review the ICPS images, Toll Rate CMS frames and DVAS video (if available) and event details associated with the selected transaction from the drilled down details.
832	Authorized Users shall have the ability to view the contents of files that are received by the RSS and transmitted by the RSS in a readable format. If files are compressed or encrypted, the necessary Software tools shall be provided to view their contents. If the user selects a specific file, the contents of the file shall be displayed and the user shall have the ability to save the contents as a .csv file and in a useable Excel format.
833	Where applicable, data shall also be presented in graph forms and chart types and the user shall be able to select presentation form from a variety of graphic styles. Report Designs shall be presented and finalized during the Implementation Phase.
834	Data shall be organized and summarized in a manner to allow for report generation within no more than ten (10) seconds for canned daily reports, and no more than thirty (30) seconds for canned weekly, monthly and annual reports, of a report generation request.
835	Additionally, after the deployment and implementation of the System but prior to Project Acceptance, the need may arise to create additional reports and modify implemented reports and Contractor shall support such additions and/or modifications. It is anticipated that no more than five (5) additional reports will be required.

2.3.9.15.1 Express Lanes Reports

The ETTM System shall provide reports to audit and reconcile the System and validate System performance. The report Design, templates, selection criteria and other report and graphing

requirements shall be defined and Approved by Authority during reports Implementation Phase and after iterative process described in this Scope of Work and Requirements.

836	At a minimum, Contractor shall provide a version of the existing reports developed during the Implementation Phase.
837	Traffic Reports: Provide traffic report by peak hour (user-selectable); 15 minute increments, hourly; daily; weekly; monthly and comparative traffic reports shall be provided that help Authority gauge congestion, mobility, travel times and throughput. Average travel time, average toll rate, and minimum and maximum toll rate shall be included in the traffic reports.
838	Average Lane Throughput Report - Traffic: This report shall display hourly Express Lanes and general purpose lanes traffic volumes for each lane grouped for each Segment and Toll Zone within the selected Corridor. Hourly traffic volumes shall be totaled by lane for the Day to calculate the average lane throughput.
839	Average Lane Throughput Report - Person: This report shall display hourly Express Lanes person throughput based on Transponder occupancy setting or ODS results for each lane grouped for each Segment and Toll Zone within the selected Corridor. Hourly person throughput shall be totaled by lane for the Day to calculate the average lane throughput.
840	Comparative performance reports. The following data should be summarized by 15-minute intervals, differentiating between the general purpose lanes and the Express Lanes: Average speeds; Average density; Full-length travel time. Reports shall have the ability to be broken down by Segment and by Corridor.
841	Toll Rate Graphs. The ETTM System shall be able to generate toll rate graphs for any given Day, showing the rates by interval for each Segment, in each direction.
842	Assessment of Operational Standards. In order to validate the Operational Performance of the Corridor the following reports shall be provided broken down by Corridor, by Segment, and direction that shows:
	• the percentage of time during peak periods in which the average speed in the Express Lanes was greater than or equal to the operational goal (initially set at 55 mph).
	• the percentage of time during peak periods in which density in the Express Lanes was less than or equal to the operational goal (initially set at 35 vehicles per mile per lane).
	• the percentage of time during peak periods in which the full-length travel time in the Express Lanes was less than the full-length travel time in the general purpose lanes.
843	Counts and Percentages Report: This report shall display vehicle counts and percentages of each count grouped by payment type and payment method for example Transponder-based (SOV, HOV 2 and HOV 3+) and Image-based (occupancy violation, toll violation and other Image-Based Transaction types) for each Toll Zone. This is a daily report and is grouped by Toll Zone for the selected Corridor. This report shall drill down to the Counts and Percentages by Direction Report.

844	Counts and Percentages by Direction Report: This report shall display vehicle counts and percentages of each count grouped by payment type and payment method for example Transponder-based (SOV, HOV 2 and HOV 3+) and Image-based (occupancy violation and toll violation) counts and percentages for each Toll Zone. This is a daily report and is grouped by Toll Zone and direction for the selected Corridor.
845	Lane Traffic Counts and Statistics Reports: This report shall provide AM and PM traffic counts and statistics by hour for each Corridor and Toll Zone by payment type and payment method. The report shall also include AM and PM peak hour statistics and provide a grand total by payment type and payment method for all peak hour.
846	Market Penetration Report: This report shows traffic counts by payment type and trip classification, for AM/PM peak hours and includes the Transponder penetration percentage.
847	Speed Bin Reports: This report shows the traffic count information per lane by user-definable speed bins. This report is used by Operations staff to monitor traffic flows at various speeds.
848	Traffic Counts Report: This report shows traffic count information grouped by payment type for example Transponder-based and Image-based with breakdown by payment method and sub-totaled by Toll Zone.
849	Vehicle Count by Lane Mode Report: This report shall display Toll Zone, lane and detailed transaction information for vehicles that travel through a lane based on the date range, Corridor and lane mode.
850	Vehicles and Mileage Report: This report shows traffic counts for all payment methods for each payment type between Toll Zones, average travel time between Toll Zones and total distance traveled for the selected criteria. The report includes a summary page with traffic between Toll Zones and total miles traveled. Each summary shall be grouped by payment type for example Transponder-based and Image-based with breakdown by payment method.
851	Transaction Audit Report: This report shows the status of the transaction transmission from the zone controllers to the RSS, the audit status, the failed transactions, all exceptions, and missing transaction sequence numbers at each of the Toll Zones. The communication status between the zone controllers to all of the subsystems shall be displayed. The report shall also include the date the transactions were received at the RSS and the Days lagging. It also shows the transmission status of the transactions to the Existing BOS.
852	System Audit Trail Reports: Weekly and monthly reports shall be made available that show the modifications made by the users to system parameters and ability shall be provided to obtain the details of the modifications.
853	System Exceptions Report: The System Exceptions report shall display transactions that are considered exceptions, including but not limited to duplicate transactions; dual Transponders; RSS filtered transactions and non-interoperable Transponder reads. Exception handling errors and the disposition of these exceptions shall also be displayed along with the transaction.

854	Image Reconciliation Report: The Image Reconciliation report shall provide the ability to match transactions by type to images and to help identify missing images. These reports shall not only reconcile the actual images saved to what was expected but also verify that the images were successfully transmitted to the RSS for image review images were transmitted to the BOS for transactions/trips as required by the Business Rules.
855	Transactions Reconciliation Reports: Yearly, quarterly, monthly, weekly, and daily reports that show Transponder-Based and Image-Based Transaction transmission reconciliation for all of the Toll Zones. These reports shall validate that all of the Transponder-Based and Image-Based Transactions received from the lanes were posted to the RSS and transmitted to the BOS. Reports shall be available by transaction Day and transmit Day, and transmit Day reports shall show the files transmitted and acknowledged by the receiving system.
856	Fare Schedule Report: This report shall provide user-selectable criteria to include at a minimum, fare schedule, the rate per mile at each Segment and the toll amounts to the defined locations for each Toll Rate CMS. Information shall include when the schedule was generated, transmitted to each Toll Rate CMS, acknowledged by the Toll Rate CMS and made effective. Fare schedule exceptions shall be flagged and shall include overrides, defaults, incident mode operations and other anomalies.
857	Exceptions Report: This report shall be used to provide Operations and Maintenance staff with information regarding exceptions detected by the System with lane data to identify potential Hardware issues, Software issues or other System anomalies. The report shall include Express Lanes, the Corridor, Segment and Toll Zone and may be filtered by exception code. This report includes lane number, transactions date and time, lane status transaction number and a description of the exception.
858	Lane Operations Report: This operational report lists and summarizes vehicle transactions and Equipment messages that are generated in the lanes. This report is an audit tool that presents all lane activity for a specified location and desired transaction date and time period. Numerous selection and filter criteria shall be provided to help identify problems. Detailed information regarding the transaction and event shall be included.
859	Transponder Audit Report: This report verifies that Transponders are properly read at each roadside Toll Zone.
860	Toll Pricing Reports: These reports show the daily pricing data compared to traffic throughput; congestion and speed and shall include data from general purpose lanes for the selected intervals for the Day and any other traffic performance input into the pricing calculation as defined during the Implementation Phase.
861	Transaction Reports: Daily, weekly, monthly, quarterly, and yearly transactions and reports showing traffic payment type and payment method. Transaction reports shall be summarized and detailed:
	• Transaction Summary Reports: These reports show daily, weekly, monthly, quarterly, yearly, and comparative transaction and revenue, by occupancy, payment type and payment method. Transaction and revenue reports shall be summarized and detailed. The summary data shall drill down to the Transaction Detail Report.

	• Transaction Detail Report: The transaction details shall be provided in this report including lane status, Equipment status, transaction status and various lane flags. Users shall be able to access the bit descriptions in all cases where information is coded. The report shall be used to investigate discrepancies and issues.
862	Trip Matching Report: Such reports shall display the transactions that were generated at each Toll Zone and matched to create a trip. All unmatched transaction and exceptions shall be identified.
863	Transaction/trip Reconciliation Reports: Yearly, quarterly, monthly, weekly, and daily reports that show Transponder-Based and Image-Based Transaction/trip transmission reconciliation for all transaction generated at the Toll Zone, all trips created and all transaction/trips transmitted to the BOS. These reports shall validate that all of the Transponder-Based and Image-Based Transactions received from the lanes were posted to the RSS, were successfully matched and transmitted to the BOS unless the transaction/trip was filtered at the RSS based on Authority Approved Business Rules.
864	Accounting Revenue and Associate Traffic Report: This report shows expected revenue and traffic counts by Day for the payment types.
865	Executive Summary Traffic and Revenue Report: This report shows daily traffic counts and revenue amounts by revenue category, for example Transponder-Based and Image-Based by payment category, grouped by Corridor, peak/off-peak; weekday/weekend; selected Day totals, previous Day totals, percentage of increase/decrease and month to selected Day totals. This report is used to show the increase and/or decrease in traffic counts and revenue compared to the previous Days' totals using the breakdown by revenue types. Data in this report shall also be represented graphically to include selected Day traffic and revenue statistics; daily revenue and traffic comparisons by payment type and method including selected Day; previous Day; month to selected Day average and prior week Day.
866	Traffic and Revenue Comparison Report: This report shall provide a comparison of current year monthly traffic and revenue data with the previous year with percentage increase/decrease and includes selected Corridor. Similar to the traffic and revenue report above, the report includes a breakdown by payment category. The report is further divided into congestion and payment category, for example Transponder-Based and Image-Based by payment category, grouped by Corridor, peak/off-peak; weekday/weekend.
867	Transponder Status List Transmission Report: The TSL Transmission report shows the status of the TSL transmissions from the BOS to the RSS and to each of the zone controllers. Summary information related to the number of Transponders, time acknowledged by the zone controller and other data shall be provided to verify results and Performance Requirements. Time of receipt from the BOS, time of transmission to the zone controllers and the status of the transmission shall be displayed. Lanes not compliant to the Requirements shall be identified. A summary listing the Transponder changes (counts, and change %) for the Day from the prior Day shall be included to identify problems.

868	Image Transmission Summary Report: This operational report counts the number of images created in the lanes for a user defined image created date range and other criteria. Data displayed include the number of triggered, non-triggered and total images from the lanes and the date the images were received at the image server(s). For each received date, the total images, number of lag Days, the percentage of transactions received each Day and a cumulative percentage shall be included.
869	Image Transmission Detail Report: This operational report lists information on images from the lanes for a user defined lane created date. Capability shall be included to show image records where it took longer than a user defined number of hours for the image to arrive at the image server(s).
870	Image Processing Performance Report: The Image Processing Performance Report shall display OCR/ALPR and manual review performance statistics by Jurisdiction. Problematic lanes, toll locations and Jurisdictions shall be identified. The report shall also include a breakdown of the OCR/ALPR performance by confidence levels, if OCR/ALPR is used. The report selection criteria shall include at a minimum Jurisdiction, toll locations, lane and sortable by each selected criteria. The selected criteria shall be defined during the Implementation Phase.
871	Image/trip Review Quality Assurance Report: Image/trip Review Quality Assurance Report shall provide a summary of the number of images and trips that were queued for quality review by Day; the images and trips reviewed by the quality review staff; the results of the review; the number of days taken to complete the quality review process and the images and trips reviewed per Day. The System shall calculate the error rates for each type of review, including but not limited to; image, trip and occupancy. User shall have the ability to drill-down to detailed transaction/trip to obtain details of the transaction/trip and the image review results and performance.
872	System Exceptions Report: The System Exceptions report shall display transactions that are considered exceptions, including but not limited to duplicate transactions, RSS filtered trips/transactions, occupancy mismatch transactions and CAV mismatch transactions. Exception handling errors and the disposition of these exceptions shall also be displayed along with the transaction. Additional information may include but not limited to operational mode schedule, configuration parameters, incident/override.
873	System Audit Reports: Weekly and monthly reports shall be made available that show the user access data and modifications made and ability shall be provided to obtain the details of the modifications.
874	File Transfer Performance: This operational report lists files that have been created and sent from the RSS by component for either the created date range or sent date range selected by the user. Information displayed include, file information, created date and time, sent date and time and process time. This report verifies System compliance to Performance Requirements. File/data transmissions to the lanes shall include confirmation of successful delivery at each lane.

2.3.9.15.2 Monthly Performance Reports

875	The RSS shall automatically generate daily, weekly, and monthly performance reports as determined by Authority to measure compliance to the stated System and Maintenance Performance Requirements described in this Scope of Work and Requirements.

876	The Performance reports shall identify performance metrics that are not met for the measuring period, and provide the capability to drill down to the individual failure events.

2.3.9.16 Dashboards/Real-Time Monitoring

877	Contractor shall provide real-time Dashboards applications developed by the Contractor during the Implementation Phase to monitor the ETTM System in a pictorial and Dashboard view. The Dashboards shall include but not be limited to real-time monitoring of Toll Zone traffic, Maintenance data including device health, operational modes for the Toll Zones, Toll Rate CMS, incident modes/status and System performance monitoring. There should be at least one screen that includes monitoring data/Dashboard for all Corridors.
878	Real-time data, video and images shall have a Configurable refresh rate and such refreshes shall be automatic and seamless to the user.
879	Authorized Users shall have the capability to configure and customize their Dashboard to display the relevant data/graphs and video including layered presentations.
880	The Dashboard view shall be Configurable by Corridor and based on the Corridor the appropriate Dashboard shall be displayed.
881	All Dashboards shall have the capability to be limited to 91 Express Lanes only, I-405 Express Lanes only or combined. The System Design shall provide for similar separation and selective combining for future Authority Express Lanes Corridors.
882	Contractor shall provide Authorized Users the capability to view real time DVAS video and also playback recorded video via the Dashboard if the portable DVAS is connected to the System. The event/sensor data pertaining to the vehicle shall be displayed on the video.
883	Authorized Users shall have the capability to drill down to each lane to review and monitor detailed events as they occur for each transaction.
884	The real-time monitoring shall provide detailed real-time information about the AVI System performance, the AVD System performance, and the ICPS performance to assist in diagnosing and investigating problems. Data pertinent to traffic monitoring and Maintenance shall be displayed in real-time.
885	The Dashboard shall provide the capability to view and drill down to the following data including but not limited to:
	• individual traffic detectors;
	• full Corridor monitoring which has continuous, current monitoring information for Toll Zone, Segment, lane and traffic detector including Equipment status;
	• traffic data (speed, volume and density) on the Express Lanes and general purpose lanes with flexibility to compare trends;
	• travel time trends on the Express Lanes and general purpose lanes with flexibility to compare trends;
	• TOD pricing data for each Segment by selected intervals including indication of successful transmission to the Toll Rate CMS;
	• frames from the Toll Rate CCTV camera that help confirm the accuracy of the Toll Rate CMS display.

	• camera video shall cycle through the individual cameras based on Configurable settings.
	• transaction volumes and trends;
	• System processing trends including transaction matching, trip creation and image processing, and
	• Corridor performance trends which compares toll amounts to travel time; volume, speed and density/LOS.
886	The Toll Rate CCTV camera video shall be viewed through the Dashboard and Authorized Users. During initial setup, Authorized Users shall have the capability to remotely control the camera via the PTZ features but once the cameras are configured the PTZ shall be capable of being locked. The System shall provide the capability to save a clip of the video as needed.
887	The video from the CCTV cameras used for traffic monitoring shall be viewed through the Dashboard and Authorized Users shall have the capability to remotely control the camera via the PTZ features. The System shall provide the capability to save a clip of the video as needed.
888	Authorized Users shall have access to the detailed data and trending graphs directly from the pictorial and Dashboard view.
889	Critical events shall be made evident on monitoring screens (via use of different colors, pictures and audible Alerts) allowing for easy identification by an Authorized User.
890	Display various comparative transaction, pricing and revenue trends, and forecasts.
891	All Priority 1 MOMS alarms shall be displayed in color and shall be audible to direct attention to the failure. Operational Alerts shall also be displayed on the Dashboard.
892	If issue is observed in the Dashboard and no MOMS Alert is detected an Authorized User shall be able to initiate a MOMS work order from this interface

2.3.9.17 Maintenance Remote Operations

The System shall provide the capability for Authorized Users to remotely operate the Systems to support Authority.

2.3.9.17.1 Maintenance Remote Operations – I-405 Express Lanes

893	The System shall support remote operations, including but not limited to:
	• remote Update of security patches and Software Updates;
	• download TSL and License Plate File (CTOC or National Interoperable files) and toll rate schedules when there are issues;
	• manage power distribution systems, and
	• reboot the applicable subsystems.

2.3.9.17.2 Maintenance Remote Operations – 91 Express Lanes

894	The System shall support remote operations, including but not limited to:
	• remote Update of security patches and Software Updates;

	• download TSL and License Plate File (CTOC or National Interoperable files);
	• manage power distribution systems, and
	• reboot the applicable subsystems.

2.3.9.18 Maintenance Online Management System (MOMS)

A Maintenance Online Management System (MOMS) shall be provided as part of the RSS to manage and report all maintenance and maintenance support activities of the ETTM System. MOMS is an all-encompassing term for the monitoring and management of the ETTM System issues; however, it can be an integrated compilation of multiple COTS or custom Software products, such as ancillary health monitoring Software and tools, collectively referred to as a single/integrated MOMS.

A MOMS consists of four (4) main elements:

1. A monitoring component (that could be made up of several integrated tools) that checks status of all equipment and system processes for failures;
2. A Work Order Management System which creates work orders for predictive, Preventive and corrective Maintenance tasks. This Configurable System also schedules the assignment of work orders to staff based on the work and on-call schedule and is efficient for the maintenance technicians to utilize in receiving, managing and closing work orders;
3. An Inventory Management System which tracks the equipment at the subcomponent level from purchase through installation to final disposal. The System tracks specific attributes for each individual subcomponent including the location, serial number, date acquired and date put in service and attributes for the type of subcomponent such as ordering lead time, manufacturer, warranty terms and predictive maintenance trigger and
4. A Reporting System which calculates and reports on sub-system availability, the response time, individual time to repair by event, Mean Time to Repair by technician, priority, location, time of Day, Day of week and type of work order. Reports will also provide the expected and actual MTBF for each subcomponent, spare parts re-order notification, history of any part and warranty repair issues. The reporting system shall have the capability to be limited to 91 Express Lanes only, I-405 Express Lanes only or combined.

2.3.9.18.1 MOMS General Requirements

895	Contractor shall provide a role-based MOMS that supports Maintenance operations for all Software and Hardware provided/implemented under this Agreement.
896	The MOMS shall provide the capability to incorporate new ETTM subsystems without changes to the MOMS database schema or application Software.
897	The MOMS application shall be capable of running on any computing device, including both desktop computers and mobile browsers, with native internet browser capability, and shall adhere to the same GUI requirements as the other parts of Contractor-provided System.
898	The MOMS shall provide the capability to uniquely identify the System elements that will be monitored and prevent duplicates (for example, a duplicate lane number within the same zone).
899	The MOMS shall prevent the creation of duplicate work orders for the same fault or failure.
900	The MOMS shall provide functionality that includes but is not limited to the following:

	• screens for configuring MOMS codes, rules and parameters;
	• receiving and monitoring status messages of all ETTM Hardware and Software (or a Configurable periodic polling for status);
	• detecting faults and providing automatic system workflow exception reporting for all items that are not running, not processing correctly or are hung in the system;
	• prioritization of failures and Alerts that is Configurable through priority and severity values;
	• Alert Authorized Users when prioritization configurations are changed;
	• is capable of work order manual entry (including via email) by Authorized Users;
	• database management system that allows for data recovery and flexibility in reporting the raw data for Ad-hoc reporting;
	• tracking Hardware and Software failures and service requests;
	• assigning priorities to work orders;
	• a function for scheduling of field technicians (shift schedule);
	• automatically notifying (Configurable by event) Maintenance personnel via text and email based on events;
	• assigning work orders to Maintenance personnel (Configurable by location, shift schedule, event type);
	• reassigning (manually) work orders to other Maintenance personnel;
	• escalating (automatically) work orders to other Maintenance personnel;
	• screens displaying all work orders including comprehensive filtering capabilities, such as but not limited to, for displaying all work orders assigned to a specific Maintenance personnel;
	• recording time of failure;
	• recording time of work order creation. Time of actual problem start may be manually recorded for manually-created work orders;
	• recording time of acknowledgement by Maintenance personnel. Recording of work order status changes and actions shall be automatic, but editable by Authorized Users;
	• recording time of acknowledgement by all subsequently assigned Maintenance personnel;
	• recording when permission for Lane Closure was Approved;
	• recording time of arrival at a work location;
	• recording time of repair;
	• recording time of Equipment and process recovery;
	• recording of all actions taken to resolve the issue (including notes, equipment replacement and escalations);
	• recording time of resolution of service calls;
	• work and resolution notes and comments to work orders;

	• providing automatic Alert for work orders not acknowledged, not repaired, not closed out in specified time;
	• tracking work order status (for example 'in work', 'closed', etc.);
	• accepting and updating work orders via any computing device with native internet browser capability;
	• calculate down time, acknowledgement time and repair time from the failure time on both work orders manually created by Maintenance staff and automatically generated by the system;
	• record when a roadside cabinet is opened and closed;
	• provide screens for exclusion of certain equipment from MTBF, MTTR and availability metrics; and
	• scheduling of Preventive Maintenance through the MOMS that generates automatic work orders at the scheduled times.
901	The MOMS shall monitor, Alert and generate work orders in real-time for all issues or failures, including but not limited to:
	• communications or non-response issues;
	• file transmission issues;
	• data exceptions such as transaction exceptions or missing images;
	• Hardware issues for all Contractor-provided Hardware;
	• Software issues or failures;
	• database issues;
	• issues with jobs, processes or data flows;
	• communications network;
	• security threats or intrusions detected;
	• success/failure status messages (for example: backup, time synchronization, Software Updates and file downloads);
	• low storage space for each subsystem (Configurable thresholds);
	• CPU utilization (Configurable thresholds) and
	• CPU temperature process control.
902	The MOMS shall provide the capability to receive and track Authority initiated help desk tickets issued via email, phone, or text message.
903	All ancillary health monitoring Software and tools employed by Contractor (if any) shall be integrated and centralized with Contractor-provided MOMS.
904	The MOMS shall monitor, Alert and track in real-time unusual activity triggered by users and systems, including as a minimum:
	• Specified transaction type in a physical lane above a Configurable threshold;
	• transaction exceptions above a Configurable threshold:
	• rejected images above a Configurable threshold in a lane/camera:
	• unmatched transactions above a Configurable threshold;

	• difference between daily transponder status file above Configurable threshold, and
	• other activities as determined during the Implementation Phase that are not normal in daily toll Operations.
905	The MOMS shall keep track of all changes to the MOMS configuration parameters via logging and audit trail.
906	Contractor shall make all MOMS screens available to Authority Authorized Users.
907	The MOMS shall allow for more than one (1) Maintenance personnel to be working simultaneously on the same work order.
908	The MOMS shall provide the capability for Authorized Users to review and comment on closed work orders up to a Configurable number of days after the work order has been closed.
909	The MOMS shall allow for throttling or suppression of Alerts for specific fault types that have been determined to be over-reported or false Alert.
910	The MOMS shall provide a knowledge base utility to assist Maintenance personnel in fault isolation, decision aids, checklists, and the like. The knowledge base shall be initially populated with relevant information from the maintenance manual materials.
911	The MOMS shall provide an electronic configuration management application that tracks all hardware and software changes to the ETTM System.

2.3.9.18.2 MOMS Diagnostics

912	In order to ensure that all Roadside Systems are functional, all systems are operational, all processes are working and data transfers are successful, Authorized Users shall have access to MOMS screens that can verify the status of tolling locations, the System and various data transfers. Such functionality shall include, as a minimum:
	• Toll Zone, Segments, Corridors and System status shown in a pictorial view;
	• drilldown by Toll Zone, Segment and device to the equipment level;
	• list view by work order or event/Alert generated by the various subsystems including comprehensive filtering capabilities;
	• selecting Toll Zone(s) and/or lane(s) and viewing lane "up" or "down" status;
	• selection of a pictorial representation of an error takes the Authorized User to the detailed event/Alert or work order;
	• examining any or all Equipment from any computer connected to Authority ETTM Communications Network; and
	• displaying the current real-time health status of the Roadside System sites with the ability to drill down to specific equipment and subsystems on the user's screen.
913	The Roadside System shall generate a MOMS Alert when the database replication interface to the RSS is unhealthy (as detected by the database management system).
914	The MOMS screen shall show date/time of last full and incremental update of TSL and License Plate File for each lane.
915	The MOMS shall provide Authorized Users the capability to re-initiate a TSL and License Plate File update to a lane in the event of failure.

916	Access to application error logs shall be provided to Authorized Users to assist in the problem investigation and resolution.
917	Access to troubleshooting diagnostic tools shall be provided to Authorized Users for each deployed subsystem.
918	MOMS Alert shall be issues if network connection to the sites, systems or interfaces are lost for a Configurable duration.

2.3.9.18.3 MOMS Inventory Management

The MOMS shall track all Contractor-provided Hardware (installed and spares), serialized or bulk, within the inventory management module.

919	The MOMS inventory management shall provide functionality, including but not be limited to:
	• ordering;
	• receiving;
	• returned material authorizations (RMAs);
	• shipping;
	• parts management including add, update (including versioning), replace and scrap/dispose;
	• bill of material management;
	• location management;
	• tracking of part movement between locations. Serialized parts shall be tracked individually, while bulk items shall be tracked at a count level;
	• detailed inventory levels tracking (by part, location, on order, backorder);
	• reorder functionality (automatic re-order notification, Configurable reorder levels and reorder amounts);
	• vendor list and contact information;
	• Supplier provided lead time/estimated delivery; and
	• Maintenance, service agreements and warranty tracking.

2.3.9.18.4 MOMS Reports

920	All MOMS reports shall have the capability to be limited to 91 Express Lanes only, I-405 Express Lanes only or combined. The System Design shall provide for similar separation and selective combining for future Authority Express Lanes Corridors.
921	Contractor shall, as a minimum, provide the following MOMS reports:
	• Work Orders (all details) for specified date/time range;
	• Alert Details (all Alerts from lanes regardless of work orders) for specified date/time range;
	• Field Inventory – installed serialized parts by location;
	• Warehouse Inventory – available serialized and consumable parts by location;

	• Purchase request/purchase order – detailed records for all purchase requests and orders;
	• MOMS Configuration (Corridor/Toll Zone/lane and Corridor/Segment/device) – configured hierarchical structure within MOMS for Corridor, Toll Zone, lanes;
	• PM Schedule and Completion Status by Installed location and component;
	• Part and Supplier List- Suppliers by Part Type including contact info and supplier part number;
	• MTBF by Part Type for specified date/time range;
	• MTTR by Part Type and Corridor/Toll Zone for specified date/time range;
	• Travel Lane Availability by Corridor and Toll Zone and date/time range and
	• System and Maintenance Performance Reports;
	• an exceptions report summarizing all unusual or significant occurrences during the period;
	• trend analysis for repetitive failure;
	• Technician Schedule for specified date/time range.

2.3.10 I-405 Express Lanes Traffic Simulator and Modeling

Contractor shall provide a Traffic Simulator and Modeling (TS&M) application to emulate the traffic conditions on I-405 Express Lanes and general purpose lanes. The TS&M application serves the purpose of both testing and refining the Shadow DPS and TOD pricing before installation and regularly evaluating the Express Lanes pricing's effectiveness in managing traffic within the Express Lanes.

922	Contractor shall provide Traffic Simulator and Modeling (TS&M) application to emulate the traffic conditions on both the I-405 Express Lanes and general purpose lanes.
923	The TS&M application shall allow for modeling the I-405 Express Lanes TOD pricing and the Shadow DPS. The TS&M shall provide Configurable parameters and functionality to model and test the effectiveness of the toll pricing. The TS&M shall serve the following purposes:
	• provide simulated traffic for testing, assessing and validating ETTM System functionality and requirements during FAT;
	• model traffic volumes prior to Go-Live;
	• model pricing changes; and
	• and monitor demand management impacts to traffic volumes on the I-405 Express Lanes.
924	The TS&M application shall provide a means for a more detailed assessment of the revenue-generating potential of the I-405 Express Lanes. The outcome of the simulation in terms of revenue generation can be used to:
	• calibrate the model (by comparing to existing traffic conditions), and
	• provide insight regarding the balance between revenue generation and operational traffic volumes.

925	Contractor shall use the TS&M application to establish and assess changes to the toll rates for TOD pricing.
926	Initial demand management TOD pricing shall be supported via simulation which provides a method for identification of the appropriate values for these parameters.
927	Contractor shall develop the TS&M application using a COTS software package (i.e. Vissim, Paramics, TransModeler, etc.).
928	The TS&M application shall encompass the following:
	• The entirety of the I-405 Express Lanes limits;
	• All intermediate interchanges shall be modeled to the point of connection with cross roadways;
	• All interchange ramps from the point of connection to the I-405 Express Lanes and general purpose lanes to their point of connection with the crossing roadways (or one-half mile, whichever is shorter). The TS&M application need not incorporate any signalized or unsignalized intersections with crossing roadways;
	• All intermediate Express Lanes points of access, egress, and weave locations.
929	Contractor shall model the following traffic scenarios:
	• Scenario 1: Opening Year – Existing Conditions – Eastbound (EB) Peak
	• Scenario 2: Opening Year – Existing Conditions – Westbound (WB) Peak
	• Scenario 3: Opening Year – Express Lanes Operational – EB Peak
	• Scenario 4: Opening Year – Express Lanes Operational – WB Peak
930	Contractor shall calibrate the TS&M application to existing conditions prior to incorporating Express Lanes. The TS&M application shall be calibrated in such a way that average speeds through the Corridor, both end to end and between consecutive interchanges, are within 10% of current operating conditions.
931	The TS&M application for Scenarios 3 and 4 shall utilize the calibrated and Authority-Approved Scenario 1 and Scenario 2 models as a basis for model development.
932	The TS&M application shall include an array of virtual sensors that will perform the same function for the ETTM System, gathering data on speeds and volumes as required. The array of sensors should replicate what will be available within the Corridor. The TS&M application shall be capable of simulating the dynamic price-setting process based on traffic data inputs from multiple sources to simulate each TDS.
933	The TS&M application shall provide outputs that show the communicated rates to drivers at designated decision points, providing drivers with the information needed to make their decisions regarding whether to use the Express Lanes or general purpose lanes. The points at which toll rate information is communicated to drivers in the model shall correspond to specified locations at which Toll Rate CMS will communicate prices to the driving public.
934	The TS&M application shall be developed such that simulated drivers make route choice decisions based (in part) upon toll rate information communicated to drivers at key decision points. In other words, route choice shall be dynamic (influenced by pricing), not static.
935	The Shadow DPS programmed into the TS&M application shall reflect all key relevant policy-related decisions, including the minimum toll rate, the maximum toll rate (if

	applicable), the maximum allowable change in tolls, and other key variables that will be pertinent to the capacity to manage traffic and generate revenue.
936	The TS&M application shall employ the same user interface and reporting capabilities as the ATMS.
937	The TS&M application shall emulate live operations to the maximum practical extent.
938	Contractor shall model, test, and optimize the Shadow DPS within the TS&M application. It is anticipated that this effort will involve several iterations in which various combinations of the Shadow DPS's Configurable parameters will be refined to fine-tune the performance of the Express Lanes.
939	Contractor shall prepare and submit the modeling and testing outputs to Authority for review and Approval prior to Go-Live, including:
	• Assessment whether the Shadow DPS logic proposed by Contractor has been properly coded into the TS&M application;
	• Assessment whether Shadow DPS and TOD pricing is effectively meeting Authority's requirements for managing traffic operations on I-405 Express Lanes;
	• Assessment to the extent to which the Shadow DPS and TOD pricing is able to meet he most recent revenue forecasts provided for the facility.
940	Contractor shall use the TS&M application to gather operational information to inform Authority of expected traffic conditions for the I-405 Express Lanes and general purpose lanes prior to Go-Live.
941	Contractor shall develop and update the TS&M application with actual data gathered from the field in order to calibrate the model and to employ it as a tool for informing future pricing decisions.
942	Contractor shall monitor and refine the model after Go-Live in order to calibrate to actual traffic and revenue conditions. The model shall be refined on a monthly basis for twelve months following Go-Live, or until Approved by Authority, whichever comes first.
943	Contractor shall annually calibrate and update the TS&M application to accurately reflect traffic conditions and revenue generation as follows:
	• Prior to Go-Live, an "existing conditions" version of the TS&M application shall be calibrated in such a way that travel times and speeds along the Corridor, both end to end and between consecutive interchanges, are within 10% of current operating conditions.
	• After Go-Live, the TS&M application shall be refined such that (a) express lane traffic volumes and speeds are within 10% of tolled operating conditions, and (b) systemwide toll revenue is within 10% of actual revenue collected.

2.3.11 I-405 Express Lanes Advanced Traffic Management System

Contractor shall provide an ATMS widely used for traffic management and operations or a Contractor developed application integrated into the RSS that performs the functions of the ATMS. The I-405 ATMS shall integrate to the I-405 ETTM System and allow I-405 Express Lanes TOC Operations staff to monitor the traffic conditions. Dashboards provided shall display the traffic detector data and operations staff shall have full control over CCTV video. The ATMS shall project CCTV video, and allow ATMS screens to be projected, on the video wall. Supplied workstation monitors shall be capable of viewing and controlling all ETTM CCTV cameras. The

ATMS video system shall provide 24/7 IP digital recording capabilities for all cameras. Video wall display sufficient for displaying 27 traffic video cameras, 9 Toll Rate CMS video cameras and supporting additional video feeds from CCTV cameras monitoring field equipment and security feeds.

944	Contractor shall provide a secure web-based ATMS product that is compliant to the latest NTCIP requirements to support real-time monitoring of the Express Lanes network traffic and CCTV cameras.
945	The ATMS shall provide the capability to display video feeds from multiple Corridors and sources, including but not limited to:
	• CCTV cameras installed on the Corridors to monitor traffic;
	• Toll Rate CCTV cameras;
	• Security cameras installed at the Toll Zones, and
	• DVAS cameras when connected.
946	CCTV cameras are controlled by the I-405 Express Lane TOC using the ATMS, however, Authorized Users can request for secondary control of the camera. The ATMS shall provide the I-405 Express Lane TOC with Primary control at all times and prevent secondary control by Authorized Users or others requesting it.
947	Authorized Users shall have access the application from any device (workstations, laptops, tablets) connected to the web and shall be supported by the browsers listed in this Scope of Work and Requirements.
948	Authorized Users shall have the capability to view multiple Dashboards and be visibly Alerted of operational conditions that require immediate attention. All display of colors shall be in compliance with standard traffic operations.
949	Dashboards provided shall allow Authorized Users to view the operational status of the Express Lanes network and drill into each of the Corridors, Segments, Toll Zones, lanes and to the individual device.
950	Authorized Users shall have the ability to maintain and manage their profile allowing them to Configure the display templates including but not limited to presentation of the Dashboards, Alert conditions, Alert management, and enhancement tools.
951	Traffic and Operational Reports and Graphs shall be provided that allows operations to view trends, evaluate traffic conditions and analyze traffic patterns. Capability shall be provided to export the report data into standard formats listed in this Scope of Work and Requirements.
952	The ATMS shall record the beginning and ending times of all Lane Closures.
953	Failure of the ATMS shall be detected and reports to MOMS.
954	The ATMS shall provide the TOC Operations staff with direct control of the pan/tilt/zoom (PTZ) features of all CCTV cameras to scan and observe activity.
955	The video system shall provide users the ability to view and control all permitted applications from any workstation connected to the system.
956	The video system shall provide dynamic scaling and display placement of content on the LCD wall displays and other LCD monitors.

957	The video system shall be capable of placing any input video source at any location on the LCD wall displays or other LCD monitors.
958	The video system shall have a video capture and recording capability.
959	The video system shall provide 24/7 IP digital recording capabilities for all cameras with a minimum of 14 Days' storage capacity and video indexing.
960	The video system shall have the following video recorder capabilities:
	• Record and playback simultaneously.
	• Export segments of recordings to standard non-proprietary video formats compatible and playable on universal video players.
	• Identity and export specific time periods and locations to various video formats.

2.3.12 I-405 Express Lanes Toll Operation Center (TOC) Operations

961	Contractor shall staff the I-405 Express Lanes TOC 24 hours a day, 7 days a week.
962	Contractor shall Design, install, commission and operate the I-405 Express Lanes TOC to achieve the following functions:
	• Monitor and control all Equipment, Roadside Systems, and RSS, as part of the ETTM System implementation; and
	• Monitor traffic conditions through the full Project limits, responding to accidents and/or incidents, as required, both within the Express Lanes, and the general purpose lanes, per the Approved Operations Plan.

2.3.13 Performance Requirements

Contractor shall provide an ETTM System that is designed to meet the accuracy, performance and throughput requirements set forth in this Scope of Work and Requirements. The testing logistics required to prove adherence to these requirements shall be detailed in the Master Test Plan and the test procedures as set forth in this Scope of Work and Requirements. The sample size for each requirement shall be the greater of N = log (1 - C) / log (A); or 20,000 transactions for the Operational Acceptance Test; where:

* N = Number in the sample
* C = Confidence level
* A = Accuracy

A value of 80% shall be used for the confidence level. Accuracy and confidence levels are expressed as decimals.

2.3.13.1 General Performance Requirements

963	Contractor shall provide an ETTM System that meets the accuracy requirements described below. Contractor shall validate System compliance to the Performance Requirements by collecting data to the required sample size in live traffic operations as described below for each requirement.
964	Data collection shall include the use of live traffic and controlled vehicles intermingled with live traffic emulating normal operations as specified below for each requirement.

965	Prior to the start of testing the System shall be confirmed and certified by the Contactor to be fully operational, compliant to this Scope of Work and Requirements and ready for testing.
966	Transactions and trips that fail to meet the requirements shall be reviewed and audited and anomalies investigated.

2.3.13.2 Vehicle Detection and Transaction Framing

2.3.13.2.1 Transponder Capture Rate

967	A Transponder mounted in accordance with the manufacturer mounting instructions shall be captured by the AVI System under all conditions within the Design specification described in this Scope of Work and Requirements with an accuracy of 99.97 percent (no more than three (3) missed reads or incorrect captures in ten thousand (10,000) equipped vehicle passages).
968	This requirement applies to all Corridors and Toll Zones based upon the Transponder mix collected during the testing period for the given sample size. Testing shall require the use of controlled vehicles with known “good” Transponders intermixing with live traffic to create the required sample size.

2.3.13.2.2 Transponder Reporting Accuracy

969	For all transactions classified to have a successful 'read' of the Transponder data by the AVI System, the AVI System shall report all required data fields to the zone controller with 99.999% accuracy under all conditions within the Design specification described in this Scope of Work and Requirements. Testing shall require the use of Transponder reads collected during live traffic operations.

2.3.13.2.3 Vehicle Detection Accuracy

970	The zone controller shall detect and report all vehicles traveling through the Toll Zone with an accuracy of 99.99% under all conditions within the Design specification described in this Scope of Work and Requirements. Testing shall require the use of vehicle data collected during live traffic operations.

2.3.13.2.4 Transponder Association Accuracy

971	Every Transponder that is reported to the zone controller shall be assigned to the correct vehicle with an accuracy of 99.95% under all conditions within the Design specification described in this Scope of Work and Requirements. Testing shall require the use of controlled vehicles intermixing with live traffic.

2.3.13.2.5 Image Capture and Reporting Accuracy

972	The ICPS shall capture and report all vehicle images to the zone controller as defined in Authority Business Rules with an accuracy of 99.95% under all conditions within the Design specification described in this Scope of Work and Requirements. Testing shall require the use of vehicle data collected during live traffic operations.

2.3.13.2.6 Image Association Accuracy

973	The System shall correctly associate 100% of all captured images to the correct vehicle as defined in Authority Business Rules with an accuracy of 99.95% under all conditions within the Design specification described in this Scope of Work and Requirements. Testing shall require the use of vehicle data collected during live traffic operations.

2.3.13.2.7 License Plate Extraction Automation Accuracy

974	The System shall perform automated license extraction on at least 70% of the captured images to obtain the license plate, Jurisdictions and plate type with 99.95% accuracy for all standard and special plates for the States of California, Nevada, Arizona, Illinois, Texas, Washington, and Utah. Testing shall require the use of vehicle data collected during live traffic operations.

2.3.13.2.8 Overall Image Accuracy

975	Contractor shall provide an accurate automated and manual review process which result in the extraction of the license plate, plate type, and Jurisdiction with an accuracy of 99.95% on all Image-Based Transactions that are included in the calculation, as defined below** and are human readable. Testing shall require the use of vehicle data collected during live traffic operations.

*2.3.13.2.9 **License Plates Excluded from the Overall Image Accuracy Calculations*

976	A plate shall be considered excluded from the Overall Image Accuracy calculation only when:
	• the vehicle has no plate;
	• plate is not in the normal camera field of view because it is not mounted in accordance with State laws;
	• the plate is damaged so that numbers/letters are not human readable.
977	A license plate is not considered excluded when plate characters are infringed upon by a license plate frame and license plate characters are human readable.

2.3.13.2.10 Accuracy of Rejection and Categorization of Rejected Image

978	Contractor shall provide an ETTM System that correctly rejects images and categorizes rejected images with an accuracy of 99.75% for all images reviewed (images reviewed through the manual review process).

2.3.13.3 Image and Transaction Processing

2.3.13.3.1 Transaction Processing and Transmission Requirements

979	All transactions generated by the zone controllers in accordance with the above accuracy requirements and Authority Business Rules shall be reported and transmitted to the RSS with an accuracy of 100% under all conditions within the Design specification described in this Scope of Work and Requirements. Testing shall require the use of vehicle data collected during live traffic operations.

2.3.13.3.2 False Read Processing

980	The false read processing (example cross lane reads, general purpose reads and duplicate reads) shall be less than 0.001% of the Transponder-Based Transactions under all conditions within the Design specification described in this Scope of Work and Requirements. Testing shall require the use of vehicle data collected during live traffic operations and test results will be verified by System queries, monitoring the trip creation and BOS reported issues for accurate Account posting.

2.3.13.3.3 Image Processing and Transmission Requirements

981	All images/data from the Roadside System captured and saved in accordance with the above accuracy requirements and Authority Business Rules shall be transmitted to the RSS with an accuracy of 100% under all conditions within the Design specification described in this Scope of Work and Requirements. Testing shall require the use of vehicle data collected during live traffic operations.

2.3.13.4 Trip Management Accuracy

982	All Transponder-Based Transactions and Image-Based Transactions generated with the above accuracy requirements shall be assembled into Trip Transactions under all conditions within the Design specification described in this Scope of Work and Requirements and Authority Business Rules with an accuracy of 99.995%. Testing shall require the use of vehicle data collected during live traffic operations.
983	All Transponder-Based Transactions, Image-Based Transactions, associated images, and Trip Transactions created with the above accuracy requirements at the RSS shall be transmitted to the BOS with an accuracy of 100%.
984	All Trip Transaction corrections generated at the RSS shall be transmitted to the BOS with an accuracy of 100%.

2.3.13.5 Audit and Reconciliation Requirements

985	100% of the transactions, images generated in the lanes and 100% of the trips created at the RSS shall be auditable and reconcilable through System Reports and the final assembly of a transaction to a trip, and the final transmission status of the transaction/trip to the BOS shall be tracked and reported.

2.3.13.6 Vehicle Throughput Requirements

986	The Roadside System shall process at minimum 2,400 vehicles per hour per lane at vehicle speeds of 0 to 100 mph.

2.3.13.7 Mean Time Between Failure (MTBF)

987	The ETTM System shall be required to meet specific minimum duration without failure requirements for components and subsystems in continuous operation. This duration requirement is defined as the MTBF. Contractor shall provide all third-party MTBF data on individual components used in the System.
988	MTBF requirements for all components of the Roadside System shall meet the MTBF as specified below in ***Table 2-1: MTBF Requirements***.

Table 2-1: MTBF Requirements

Component or Subsystem	**MTBF (hours)**
Zone Controller	30,000 hours
Automatic Vehicle Identification (AVI) System	30,000 hours
Automatic Vehicle Detection (AVD) System	20,000 hours
Image Capture Processing System (ICPS)	30,000 hours

989	The reliability of the System components shall be calculated based on the following MTBF calculation:

$$\text{MTBF} = \frac{\text{\# of components/subsystems x test period (hours)}}{\text{\# of Chargeable Failures}}$$

Chargeable Failures are defined in this Scope of Work and Requirements.

2.3.13.8 Availability

990	Contractor shall meet availability requirements specified in ***Table 2-2: Availability Requirements*** for the following elements of the ETTM System:

Table 2-2: Availability Requirements

Availability Requirements (Monthly)	
Express Lanes (Each Lane)	99.90%
Core Roadway Support System	99.95%

991	The availability requirements shall be separately calculated and applied as follows:

	• An available lane is defined as the overall in-lanes system with all of its subsystems properly functioning and available to collect revenue and send required transactions and images to the RSS.
	• An available RSS is defined as those critical functions of the RSS functioning and operating and in compliance with the Performance Requirements, including interface to the all systems as specified in this Scope of Work and Requirement; license plate extraction; transaction matching and trip assembly; DPS; RSS application; Reporting; MOMS and data posting. The RSS shall be considered unavailable (System downtime) if the RSS is severely degraded causing loss of functionality; causing application errors for multiple users; interfaces are not operational, and preventing access to operations staff and users.
992	Availability shall be calculated based on the following calculation: Availability = 100% - [Hours Downtime / (# of Days in time period measured * 24)]

2.3.13.9 Chargeable and Non-Chargeable Failures

For purposes of calculating MTBF and Availability Performance Requirements for testing, as detailed above, and for Maintenance performance, chargeable and Non-Chargeable Failures are defined as follows:

2.3.13.9.1 Chargeable Failures

993	Chargeable Failures include any failures that are not specifically identified as Non-Chargeable Failures, including, but not limited to, the following:
	• A malfunction which prevents the RSS component (Hardware or Software) from performing its designated function, when used and operated under its intended operational and environmental conditions as detailed in this Scope of Work and Requirements.
	• System downtime caused by Upgrades, Updates and Software releases to RSS Software and environment not authorized by Authority.
	• A malfunction that poses a threat to the safety of the RSS components, customers, employees or others.
	• An occurrence where data is not successfully transmitted between the Roadside Systems and the RSS and images from the lanes to the RSS.
	• A failure of Equipment or Software that allows data loss to occur on the ETTM System.
	• A failure of Equipment or Software that allows revenue loss to occur on the ETTM System that is not already accounted for as a separate performance failure.
	• Software anomalies and bugs that affect the performance and operation of the ETTM System.
	• Shutdown or unavailability of the ETTM System unless specifically directed by Authority for reasons not under the control of Contractor.

	• Failure to properly register or report a transaction.
	• Failure to properly reconcile the ETTM System.
	• Failure to electronically send or receive transaction information.
	• Failure to generate the reports required to reconcile and audit the System.

2.3.13.9.2 Non-Chargeable Failures

994	Non-Chargeable Failures shall include:
	• Force Majeure, as defined in the Agreement;
	• vandalism;
	• failure of a test facility or test instrumentation;
	• ETTM System component failures caused by environmental or operating conditions outside of this Scope of Work and Requirements;
	• normal operating adjustments as allowed in the Test Procedure or Maintenance Plan, as applicable, and
	• failures where Authority has Approved to waive a Chargeable Failure in advance and
	• failures that are customer or Authority user induced, or are caused by a Third-Party Service Provider not under Contractor's control as determined by Authority.

2.4 91 Express Lanes Electronic Toll and Traffic Management System Transitions

Contractor shall install the new ETTM System and assist Authority and the Existing BOS Contractor in transitioning from the current ETTM systems to the new ETTM System. Once in operation, Contractor shall assist with the design, testing and transition from the Existing BOS Contractor to a New BOS Contractor, to be procured under separate contract.

2.4.1 91 Express Lanes Roadside System Installation and Transition – General Requirements

995	Contractor shall commence installation activities on the 91 Express Lanes only after Authority Approval of the Transition Plan.
996	The installation of the new ETTM System and its transition to revenue collection shall not adversely impact the Operations of the existing ETTM System beyond the levels stated and detailed in the Installation Plan and/or the Transition Plan. It is Contractor's responsibility to make sure there is sufficient infrastructure (space, power, etc.) to support both systems to the maximum extent possible and in accordance to the plans.
997	Contractor may be allowed to decommission parts of the existing ETTM System to provide gantry space for the new Equipment. Any such steps shall be clearly detailed in the Installation Plan and/or Transition Plan and subject to Authority review and approval. It is the intention of Authority to continue to collect tolls using the existing system until the new system is ready for final cutover.
998	Contractor shall provide additional conduits and mounting structures as needed for the installation of the new Equipment. Temporary ancillaries may be used as detailed in the Installation Plan and Transition Plan.
999	Final cutover of toll collection shall include the cessation of toll collection through the existing ETTM System and commencement of toll collection and enforcement through the new ETTM System. Contractor shall plan the final cutover to minimize impact on toll collection (e.g. schedule overnight when traffic is minimal).
1000	Transition of any ETTM Toll CCTV Camera Sites from existing to new configurations shall be coordinated to minimize downtime. New ITS Equipment shall be integrated with the existing 91 Express Lanes ATMS prior to placement in operational position.
1001	Contractor's implementation process shall accommodate all onsite testing as detailed in Section 2.7.
1002	Contractor shall be responsible for scheduling the required Lane Closures during the Roadside System installation and transition as Approved by Authority and otherwise provided in the Contract.

2.4.2 91 Express Lanes BOS System Transition – General Requirements

1003	Contractor shall commence any transitions activities from the Existing BOS to the New BOS only after Authority approval, and in coordination with the New BOS Contractor.
1004	Contractor shall plan the transition to the New BOS such that no information received, processed, stored, or archived in the ETTM System shall be lost, or become unavailable per the Approved plans and procedures.

1005	Contractor shall plan the transition to the New BOS to minimize disruption to toll collection and overall Operations of the existing 91 Express Lanes.
1006	Contractor shall test and certify all communication lines, physical and logical, between the existing 91 Express Lanes ETTM System and the New BOS prior to commencement of transition.
1007	Contractor shall support the New BOS Contractor with testing of the New BOS prior to the final transition and cutover, so long as this support does not impact existing Operations and system performance.
1008	Contractor shall test all ETTM System functions when integrated with the New BOS prior to final cutover and disconnection of the interfaces to the Existing BOS.

2.4.3 91 Express Lanes ETTM System Testing and Transition

1009	Contractor shall complete ETTM System testing in accordance with the Section 2.7 and all applicable individual test plans.
1010	Upon the successful completion of the FAT, Contractor will be authorized to begin installation of the ETTM System in accordance with the Approved Master Test Plan and Onsite Installation Test (OIT) Plan.
1011	The OIT shall be conducted for all installed Equipment and the functions of the ETTM System shall be verified, including but not limited to:
	• the MOMS shall be configured and tested including inventory recorded; technicians scheduled, and notifications set up;
	• the DVAS shall be installed and validated and Authorized Authority personnel shall have access to the DVAS;
	• all associated TDS locations shall be installed and tested, and
	• all associated CCTV locations shall be installed and tested.
1012	As part of the OIT, Contractor shall exercise and demonstrate the functionality of the new Toll Collection and Enforcement System and the exchange of transactions, images, data and files, including but not limited to:
	• the Existing BOS;
	• the new Roadside Systems, and
	• the Advanced Traffic Management System.
1013	Upon the Approval of the OIT, Contractor will be given the authorization to process to final cutover, replacing the existing Corridor server and Commission the RSS in revenue collection in accordance with the Approved Baseline Implementation Schedule and Transition Plan.
1014	After each site is transitioned to the new ETTM System, Contractor shall monitor and maintain the Equipment and systems and the entire ETTM System until and through the Operations and Maintenance Phase.
1015	In order to ensure a seamless transition, the following activities shall take place:
	• upon Approval to proceed with installations and transitions, Contractor shall coordinate with the Existing BOS Contractor and install Equipment at each site, and conduct a Commissioning test at each site;

	• the MOMS shall be configured for Go-Live; inventory recorded; technicians scheduled, and notifications set up;
	• the DVAS shall be installed and validated and Authorized Users shall have access to the DVAS; and
	• an end-to-end test shall be conducted in the RSS and BOS to validate the flow of transactions and images from the Roadside System to the BOS.
1016	All Equipment shall be configured and tuned to their optimal performance prior to the start of the Operational Test. The Operational Test shall not commence until Contractor meets the Operational Test entry criteria.
1017	Contractor shall decommission each ETTM Site and coordinate disposal of all existing equipment with Authority in accordance with Approved decommissioning plan. Contractor shall be responsible for the following tasks, including but not limited to:
	• the removal of all existing equipment, mounting arms, cabinets and enclosures and coordinate their disposal;
	• coordinate with the Existing ETTM Contractor (or Authority, as applicable) prior to the removal of any equipment;
	• verify that all data and/or images has been transferred and is secured;
	• erase all data from all storage devices, pending Authority approval; and
	• securely destroy all storage devices and dispose of all equipment safely in accordance with applicable laws and regulations.

2.4.4 91 Express Lanes ETTM Transition Plan – Roadside

1018	Contractor shall provide a 91 Express Lanes ETTM Transition Plan for Authority Approval, covering the two Roadside implementations, and addresses the transition of the Roadside and RSS into revenue collection, replacing the existing ETTM system.
1019	The Transition Plan shall address all critical transition elements and activities associated with the installation and implementation of the Roadway System, including the Roadside Systems; RSS, and interfaces to the Existing BOS, existing roadway systems, Caltrans and the existing ATMS.
1020	The Transition Plan shall address the integration and interface of the RSS to the Existing BOS.
1021	The Transition Plan shall address, by location, the transition from the current toll collection equipment to new toll collection Operations. All temporary changes and modifications to the infrastructure to accommodate the transition shall be described.
1022	If data on existing RSS required as part of the transition process, the details of the migration or duplication shall be included in the Transition Plan.
1023	The Transition Plan shall address Contractor's plan for decommissioning of the existing equipment and their disposal.
1024	The Transition Plan shall, at a minimum, include the installation, OIT, Commissioning, revenue collection and Acceptance of the new ETTM System.
1025	The Transition Plan shall describe Contractor's approach to use the existing ETTM System Infrastructure at the ETTM Sites, including installation that will have minimal impact on current Operations.

1026	The Transition Plan shall detail the temporary processes implemented to support the transition of the ETTM Sites and concurrent operations of new and existing ETTM Systems, including eventual replacement process and decommissioning on the existing system.
1027	The Transition Plan shall clearly identify all points of coordination or reliance on third-party Deliverables.
1028	The Transition Plan shall detail plans for testing and uploading of fully formed transactions to the BOS, including the methodology for transferring any functionality from the Existing BOS to the ETTM System – for example providing fully formed and priced transactions.
1029	All ETTM System transition activities shall be coordinated with Authority and the Existing BOS Contractor and Approved by Authority in order to minimize interference with on-going and continuing Maintenance and operational Requirements.

2.4.5 91 Express Lanes Dismantle Unused ETTM Equipment

1030	Contractor shall coordinate with Authority and dismantle all unused existing equipment at the 91 Express Lanes ETTM Sites following the transition and commissioning of the new ETTM System.
1031	Contractor shall be responsible for coordinating with Authority the disposal of dismantled equipment, and shall comply with applicable environmental and safety requirements as it relates to the handling of hazardous materials.

2.4.6 91 Express Lanes ETTM Transition Plan – BOS

1032	Contractor shall provide a 91 Express Lanes ETTM Transition Plan for Authority Approval, covering the integration of the ETTM System with the New BOS, to be procured and commissioned in 2022.
1033	The Transition Plan shall address all critical transition elements and activities associated with the integration and operations of the ETTM System, including the Roadside Systems; RSS, toll collection processes and real-time traffic operations of the 91 Express Lanes.
1034	The Transition Plan shall address the integration and interface of the RSS to the New BOS.
1035	The Transition Plan shall address the transition of the operating Equipment to the New BOS and toll collection Operations. All temporary changes and modifications to infrastructure or any other Equipment to accommodate the transition shall be described.
1036	The Transition Plan shall include any changes, temporary or permanent, required in the RSS before, during, and after the transition.
1037	Any temporary processes implemented to support the transition of the ETTM System and concurrent operations shall be documented in detail in the Transition Plan including removal or decommissioning of existing system, components, and interfaces.
1038	All points of coordination or reliance on third-party Deliverable shall be clearly identified in the Transition Plan.
1039	All ETTM Transition activities shall be coordinated with Authority, the Existing BOS Contractor, the New BOS Contractor and Approved by Authority in order to minimize interference with on-going and continuing Maintenance and operational Requirements.

2.5 Electronic Toll and Traffic Management System Installation Requirements

This section details the Requirements for the installation of the new ETTM System. Unless Approved by Authority, no System installation at any ETTM Site or in any facility shall occur prior to the satisfactory Approval of Installation Design and the FAT.

2.5.1 Installation Program

Contractor shall prepare and submit an Installation Program to Authority for review and approval that addresses all aspects of the installation of the ETTM System, including all installation Design, submissions, and coordination.

1040	Contractor is responsible for the Design, procurement, installation, cabling, configuration, check-off, and testing of all Hardware, Equipment, communications, Software and fixtures provided by Contractor as part of the ETTM System at each ETTM Site.
1041	At ETTM Sites where Contractor is integrating existing equipment into the ETTM System, Contractor's Services will include, in addition to the above for new equipment, verification of operational status of existing equipment. Contractor shall report to Authority if any equipment is found to be not fully operational.
1042	In the event Contractor decides to re-use existing conduits and junction boxes, Contractor is responsible for ensuring that such elements are in their fully operational condition and will meet this Scope of Work and Requirements for the Agreement Term. If these elements are currently in use, Contractor shall employ due care as to not damage existing cables or impact existing Operations.
1043	Contractor shall ensure that Contractor's installation activities do not interrupt or interfere with the existing Operations without prior permission from Authority.
1044	Contractor shall familiarize with MUTCD requirements and shall coordinate all lane closure activities with Authority staff and/or consultants overseeing construction/installation/testing, Design-Builder, other civil contractors, the 91 Express Lanes BOS Contractor, CHP, and Caltrans, as applicable.
1045	Contractor shall install and tune the all Equipment to vendor specifications, to meet performance measures specified, and in compliance with Authority Interoperable Agency requirements.
1046	Contractor shall be responsible for providing secure work areas and shall protect all equipment and materials from theft and vandalism during the Implementation Phase.

2.5.1.1 Installation Program – 91 Express Lanes

1047	Other than for Disaster Recovery for the 91 Express Lanes, Contractor shall install the ETTM System servers and Hardware in Contractor-provided cabinets and in existing facilities as provided by Authority, including the two 91 Express Lanes Toll Plaza Buildings.
1048	Contractor shall work with Authority and the Existing BOS Contractor to test the fiber WAN and the connections between the Roadside and the RSS locations, as applicable. Testing shall include expected traffic loads and all types of production operation data.

2.5.1.2 Installation Program – I-405 Express Lanes

1049	Other than for Disaster Recovery for the I-405 Express Lane, Contractor shall install the ETTM System servers and Hardware in Contractor-provided cabinets and the Design-Builder-provided I-405 Express Lanes Toll Equipment Building (TEB), as provided by Authority through the DB contract.
1050	Contractor shall work with Authority, Caltrans, and the Design-Builder to test the fiber WAN and the connections between the Roadside and the RSS locations, as applicable. Testing shall include expected traffic loads and all types of production operation data.

2.5.2 Installation and Construction Coordination and Meetings

During the Project Design, development and installation periods there shall be a series of meetings between Contractor and the Existing BOS Contractor and the Design-Builder. As the two Corridors have separate implementation periods, requirements and constraints, it is expected the meetings will be separate. During these meetings it shall be required that Authority be represented to clearly define and develop the installation Requirements, methodology, timetables, test Plans, roles, and contingency Plans. Contractor is responsible for coordinating and scheduling all meetings necessary to complete the Implementation Phase of the Project.

1051	Contractor shall schedule, manage and attend weekly installation meetings during the Implementation Phases of the Project and report on progress of the installation. Contractor shall identify and communicate any issues regarding System construction and installation immediately upon discovery to the 91 Express Lanes BOS Contractor or Design-Builder and Authority.
1052	Contractor shall ensure that the appropriate personnel are present at these meetings who can represent Contractor's interest and provide the information necessary in a meaningful manner.
1053	Prior to the meeting, Contractor shall update the installation schedule based on the construction schedule and all changes shall be identified.
1054	Contractor shall prepare and distribute a meeting agenda at least forty-eight (48) hours prior to the scheduled meeting. The meeting agenda shall consist of those items pertaining to the installation and schedule for the previous and current week's installation efforts and for an agreed to "look ahead" period. The meeting agenda should include any potential risk items identified and corresponding mitigation efforts.
1055	It is Contractor's responsibility to make sure all issues that arose during the installation activity for the week are addressed and resolved or is scheduled for resolution.
1056	At these meetings, Contractor shall also be prepared to address any issues or questions raised by the 91 Express Lanes BOS Contractor, Design-Builder, other Contractors, and Authority.
1057	Contractor shall document the meeting discussions and distribute the meeting minutes within one Day to everyone from the team invited to the meeting. It shall be up to the recipients of the meeting minutes to distribute to other interested parties. Contractor shall also record and maintain an action items list that tracks all installation related issues.

2.5.3 General Installation Requirements

1058	Contractor shall be responsible for procurement, installation, cabling, termination configuration, testing, and check-off of all Equipment and Software required meeting this Scope of Work and Requirements.
1059	Procurement, installation, configuration, and testing of local area communications Equipment and connection to Contractor installed network Equipment shall be the responsibility of Contractor as further set forth in this Scope of Work and Requirements.
1060	Contractor shall be responsible for procurement, installation, configuration, and testing of all appropriate RSS servers, Equipment and Software required by the ETTM System at Authority provided locations (i.e. 91 Express Lanes TOC and I-405 Express Lanes TOC) and validating communications to its interfacing systems shall be the responsibility of Contractor as further set forth in this Scope of Work and Requirements.

2.5.3.1 General Installation Requirements – 91 Express Lanes

1061	Contractor shall install all appropriate Roadside servers and Equipment.
1062	Contractor shall be responsible for taking over the existing electrical meters at each ETTM Site and shall size the ETTM System's power requirements at each ETTM Site. Contractor shall be responsible for any changes in power requirements, including coordination with utility provider and replacement of wiring.

2.5.3.2 General Installation Requirements – I-405 Express Lanes

1063	Contractor shall install all appropriate Roadside servers and Equipment, except where stipulated that Contractor shall provide Equipment to be installed by the Design-Builder.

2.5.4 Toll Operations Centers (TOC)

2.5.4.1 91 Express Lanes Toll Operations Center

1064	The current 91 Express Lanes TOC is staffed and operated by the Existing BOS Contractor, and operations will remain in their current or modified form until, at least, the termination of the existing BOS/CSC contract on June 30, 2021. Contractor shall install and integrate any required system in the existing 91 Express Lanes TOC in collaboration with the Existing BOS Contractor.
1065	Contractor shall provide a center-to-center communications connection for the display of I-405 Express Lane ATMS data on the 91 Express Lane TOC video wall, including Toll CCTV camera video and TDS data.

2.5.4.2 I-405 Express Lanes Toll Operations Center

1066	Contractor shall commission a TOC for the I-405 Express Lanes in a facility provided by Authority. The facility includes a space for the TOC as well as an adjacent equipment/server room. The space shall include wall space for at least twelve (12) 55" displays, and there is a false ceiling connecting it with the adjacent equipment/server room. The equipment/server room can accommodate 3 standard server racks.

1067	Contractor shall procure, install, configure, and test all I-405 Express Lanes TOC components including video wall, Traffic Operator workstations, communications equipment, and any peripheral equipment and components required to facilitate traffic and toll collection Operations as further set forth in this Scope of Work and Requirements.
1068	Contractor shall Design, install, and commission the I-405 Express Lanes TOC to achieve the following functions:
	• Workstations and video monitors shall provide access to real-time traffic data, camera video feeds and any other supporting information required by TOC Operators.
	• The video wall display shall be Configurable and able to display various combinations of Toll CCTV camera video feeds, Toll Rate CCTV camera video feeds, TDS maps and data, and Operational status.
	• The video wall display shall be sufficiently large to simultaneously display three 55” (48” x 27”) CCTV camera feeds, eighteen 27.5” (24” x 13.5”) CCTV camera feeds, six 27.5” (24” x 13.5”) Toll Rate CCTV camera feeds, and one 48” x 81” Corridor map showing traffic conditions as well as various overlay ATMS data and user selected data. The video wall shall be capable of cycling TCS CCTV camera and Toll Rate CMS camera video feeds.
1069	Contractor is responsible to procure, commission and maintain communication systems (internal and external) and services required to operate the TOC. These include phone, internet, data connection to the Roadside, link to DR location, and any other link required. Options for external communications can be any one, or combination, of the following:
	• Dedicated landline circuit;
	• Wireless; and
	• Microwave point-to-point/multipoint.
1070	Contractor shall provide and submit a I-405 TOC Design Requirements Document to Authority for Approval no later than 180 Days after NTP1. The I-405 TOC Design Requirements Document shall include specific requirements for the I-405 TOC space (e.g. electrical supply, HVAC etc.). Contractor is prohibited from modifying major building elements (e.g. walls) and must forward any such requests to Authority, which shall be granted or denied in Authority’s sole discretion. Contractor is allowed to add support elements such as raised floors, platforms, electrical ducting, and to add holes and openings within the existing structure to facilitate the installation and operation of the TOC systems.
1071	Contractor shall provide all equipment and configuration Services required to establish the interface between the I-405 Express Lanes TOC and the New BOS, procured through a separate contract by Authority, as further set forth in this Scope of Work and Requirements.
1072	Contractor shall provide capability and all equipment necessary to share CCTV camera video between the I-405 Express Lanes TOC and other transportation agencies, as further set forth in this Scope of Work and Requirements.
1073	Contractor shall provide a center-to-center communications connection for the display of 91 Express Lane ATMS data on the I-405 Express Lane TOC video wall, including Toll CCTV camera video.

2.5.5 Compliance to Standards

Contractor shall adhere to all installation standards, applicable laws, ordinances and codes as required.

1074	Contractor shall meet all electrical codes, traffic control, seismic considerations, calibration, configuration, and environmental Requirements of and including but not limited to:
	• Equipment manufacturer's;
	• NEC;
	• UL standards;
	• Authority;
	• Caltrans (TEES);
	• FHWA;
	• MUTCD;
	• IEEE (Institute of Electrical and Electronics Engineers);
	• OSHA Requirements, and
	• any local authorities having jurisdiction.
1075	Contractor shall adhere to latest Caltrans Standard Plans which complies with the Sixth edition of the AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals. Contractor shall also comply with Caltrans Standard Drawings Specification, Encroachment Permits for all Contractor work on the Corridors.
1076	Contractor shall be responsible for all costs associated with any permits, plan reviews, and inspections related to ETTM System work.
1077	It shall also be Contractor's responsibility to prepare all Documentation required to install and adhere to the proper installation standards, law, ordinance, or codes.
1078	Contractor shall procure Services of Subcontractors qualified to work in this industry. If a vendor's component requires a vendor approved installer, Contractor shall use an approved component installer, including qualified vendor staff.

2.5.6 ETTM System Installation Requirements – Roadside Systems

1079	The Contractor's installation responsibilities for the Roadside Systems shall include but not be limited to the following, unless otherwise specified in the sub-sections below. Scope that is not defined but is deemed necessary to facilitate full operation and performance of the ETTM System as detailed in this Scope of Work and Requirements, shall be considered as part of the Agreement.
	• furnish new HVACs, and equipment cabinets, and external generators will be provided by Contractor, where existing generators are not re-used. Contractor shall furnish and install clean, uninterruptible power to all Equipment on the overhead structures/toll gantries, in cabinets and in the Equipment vaults.
	• furnish and install clean, uninterruptible power to all Equipment on the overhead structures/toll gantries and in Contractor-provided roadside cabinets.

	• furnish and install all connecting conduit from wire ways and conduits provided and installed by others and/or stub conduits to the Equipment. The Design-Builder will install the conduits from the Equipment vaults to the demarcation point on the overhead structures/toll gantries*.*
	• furnish and install separate ground wires for the ETTM System, surge protection devices (SPD), junction boxes, pull boxes, conduits, and other such items as required by the installation standards and Requirements.
	• furnish and install all wiring for all Roadside System Equipment and connections to the Equipment racks in the vaults and/or to the roadside cabinets. This includes the proper termination of all power, communication, and RF cables and/or wiring (copper or fiber optic) required to connect the individual components into a fully operational System as specified in the Design Documentation.
	• furnish and install all Equipment racks required for the in-lane System electronics in the vault.
	• furnish and install all controller computers and other servers (Hardware and Software) into the Equipment racks and test the connection between the controllers and the RSS.
	• furnish and install any additional servers (if required) in the Equipment racks, including Software, and test their respective connection to site controllers and the RSS.
	• furnish and install all electronics and other devices in their respective Equipment racks as required to provide a fully operational ETTM System.
	• furnish and install all Equipment mounting brackets or support structures for the installation of all Equipment on the mounting arms on overhead structures/toll gantries.
	• furnish and install the AVD System Equipment, including in-pavement sensors and overhead mounted Equipment and controllers as specified in the Design Documentation. Includes all Authority Approved materials, Equipment and supplies required for saw-cutting, wiring and sealing of wires in the Roadside.
	• Furnish and install the AVI System Equipment, including antennas, readers, related Equipment, cables, and any support brackets required. All AVI mounting Hardware, junction boxes, and cables shall be procured and supplied by Contractor.
	• furnish and install the ICPS Equipment, including cameras, ICPS illumination, and any video Equipment, sensors, Software, controllers/servers, or specialty Equipment associated with the ICPS.
	• validate all cable, wire and fiber terminations via a test process to ensure that the cable is connected to the correct location on each end and that the cable/wire/fiber is properly terminated.
	• power up and provide a field check out/installation Acceptance test of all systems, to be witnessed and Approved by Authority. Provide the completed installation checklist as described in this Scope of Work and Requirements.
	• furnish, install, calibrate and test the DVAS cameras and Equipment.
	• integrate, calibrate and test the toll-related ETTM ITS elements

	• furnish, install, configure and test all other items, materials, and Equipment to complete installation in accordance with the Agreement.

2.5.6.1 ETTM Installation Requirements – Roadside Systems - 91 Express Lanes

1080	Contractor shall install the ETTM System at the two (2) existing ETTM Toll Collection and Enforcement Sites. The sites currently support a toll collection and enforcement system which utilizes a dual gantry configuration.
1081	Contractor-provided ETTM System is permitted to utilize the existing gantries at the ETTM Toll Collection and Enforcement Sites, however the existing system shall not be decommissioned for that purpose. Contractor's approach may include removal from service of subsystems of the existing ETTM System to create space for installation on Contractor-provided ETTM System, so long as the AVI functionality on the existing system is not impacted until the final stages of the new system installation.
1082	The three (3) ETTM Transponder Read Sites shall be re-built to the final configuration and performance as outlined in Section 2.2. Any existing Equipment currently installed at those sites shall be dismantled and disposed of.
1083	All cameras in the existing ETTM Toll CCTV Camera Sites shall be replaced with new CCTV cameras as outlined in Section 2.2 and integrated with the existing ATMS operated by the Existing BOS Contractor. Support structures, conduits and junction boxes, and in-pavement traffic detectors at these sites are allowed to be re-used. Equipment supporting the traffic detectors may be re-used if it can integrate into the ATMS. All other ancillary components are to be removed and disposed of.
1084	All ETTM Toll Traffic Detector Sites shall be integrated into the existing ATMS. Any equipment replacement required to facilitate this shall be performed by Contractor.
1085	Toll Rate CMSs on the 91 Express Lanes do not require replacement or upgrade. Contractor shall not be required to integrate ETTM Toll Rate CMS Sites into the ATMS.

2.5.6.2 ETTM Installation Requirements – Roadside Systems - I-405 Express Lanes

1086	Contractor shall install the ETTM System at the six (6) ETTM Toll Collection and Enforcement Sites. Contractor shall install all Equipment and configuration items as defined in this Scope of Work and Requirements with the exception of the primary roadside cabinet. This cabinet shall be provided to the Design-Builder for installation.
1087	Contractor shall design, furnish, and install Equipment at the six (6) ETTM Transponder Read Sites. Contractor shall install all Equipment and configuration items as defined in this Scope of Work and Requirements with the exception of the primary roadside cabinet. This cabinet shall be provided to the Design-Builder for installation.
1088	Contractor shall design, furnish, and install Equipment at the nine (9) ETTM Toll Rate CMS Sites. Contractor shall install all Equipment and configuration items as defined in this Scope of Work and Requirements with the exception of the primary roadside cabinet. This cabinet shall be provided to the Design-Builder for installation.

1089	Contractor shall design, furnish, and install Equipment at 29 ETTM Toll CCTV Camera Sites and 51 ETTM Traffic Detection System Sites. The location of the sites shall be determined by the Design-Builder to comply with camera coverage (full facility coverage) and traffic detection (every 0.5 mile) requirements. Contractor shall install all Equipment and configuration items as defined in this Scope of Work and Requirements with the exception of the primary roadside cabinet. This cabinet shall be provided to the Design-Builder for installation.
1090	Contractor shall provide a design for any specialized arm, bracket, plate and any other ancillary used for mounting Equipment on any above-grade support structure to the Design-Builder. The Design-Builder will furnish and install the mounting items as part of the support structure installation.
1091	Contractor shall install power distribution (including breakers and panels), UPS, generator, fire suppression and security system in the TEB facility. Some Contractor-provided equipment may be installed by the Design-Builder, as outlined in ***Attachment 10: I-405 EL ETTM System Responsibility Matrix – Design-Builder and TSI*** and this Scope of Work and Requirements.
1092	Utility power shall be provided to all ETTM Sites by the Design-Builder. This will include all cabling and related infrastructure up to and including, the primary roadside cabinet in each site. The Design-Builder shall terminate power supply cables in the primary roadside cabinet on Contractor-provided termination panels.
1093	The ETTM Communications Network between all ETTM Sites (including the TEB) shall be provided by the Design-Builder. This will include fibers and all related infrastructure up to, and including, the primary roadside cabinet in each site. Contractor shall terminate fibers in the primary roadside cabinet on Contractor-provided termination panels.
1094	The Design-Builder shall notify Contractor a minimum of 120 Days in advance of all scheduled Design-Builder-provided ETTM System infrastructure construction and installation activities that require Contractor-provided equipment or coordination.
1095	Contractor shall coordinate with the Design-Builder any in-pavement installation within the Express Lanes roadway. Contractor shall be notified by the Design-Builder at least 60 Days prior to paving of Express Lanes roadway.
1096	Any Contractor-provided equipment that is to be installed by the Design-Builder (e.g. cabinets) shall be provided to the Design-Builder no more than 42 Days after receiving notification from the Design-Builder about a pick-up date for the equipment. Delivery of the equipment shall be at a location within a 25-mile radius of the project.
1097	Contractor shall be able to commence installations only after ETTM Sites have been turned-over to Contractor. All ETTM Sites shall be turned-over to Contractor from the Design-Builder after issuance of a “Certificate of ETTM System Infrastructure Turnover” by Authority.

2.5.7 ETTM System Installation Requirements – Roadway Support Systems (RSS)

Contractor is responsible for installation of all Equipment associated with the RSS and Operations at the primary RSS and Disaster Recovery (DR) locations identified in this Scope of Work and Requirements.

1098	Contractor shall install all RSS, including Host servers, TOC, and MOMS at the primary RSS and DR locations specified in this Scope of Work and Requirements and Approved by Authority.
1099	All servers, storage devices, communications Equipment, and other RSS Hardware shall be installed in the designated locations as prescribed in the drawings submitted by Contractor and Approved by Authority.
1100	Contractor is responsible for the following activities, including but not limited to:
	• furnish, install, configure and test the necessary servers in accordance with the Approved Design documents;
	• furnish, install and test the storage units and back-up devices;
	• furnish, install and test the network Equipment at the primary RSS and DR locations;
	• validate communications to the network Equipment at the vaults;
	• establish and validate communications from the RSS to all controllers at all ETTM Sites;
	• establish and validate communications from the RSS to the BOS. This applies both to the Existing BOS as well as the New BOS to be procured by Authority through separate procurement;
	• furnish, install and validate third-party Software and Contractor Software on all servers and Equipment required to support the RSS;
	• furnish, install, configure and test all servers and Equipment for correct point-to-point installation, proper connectivity, acceptable termination of all cables and successful communications linkage;
	• Configure the RSS support interfaces as defined in the Approved ICDs, and
	• furnish, install, configure and test all other items, materials, Equipment and Software required to complete installation of a fully functional RSS in accordance with the Agreement.

2.5.7.1 ETTM System Installation Requirements – RSS - 91 Express Lanes

1101	Contractor shall coordinate all RSS installations and testing of the LAN/WAN and interfaces to new or existing systems with Authority and the Existing BOS Contractor, as applicable.
1102	Contractor-provided RSS installations shall not require the removal of existing operational Equipment from any Authority facility/location, prior to decommissioning of such Equipment, following the transition of the ETTM System to the RSS.

2.5.7.2 ETTM System Installation Requirements – RSS - I-405 Express Lanes

1103	Contractor shall coordinate all new RSS installations and testing of the LAN/WAN and interfaces to new or existing systems with Authority and the New BOS Contractor, as applicable.

1104	In the case the existing Host and MOMS commissioned during the 91 Express Lanes ETTM System implementation are to be used for the I-405 Express Lanes ETTM System, any installation, modification, or integration tasks planned shall be coordinated with the BOS Contractor (future or existing, whichever applies).

2.5.8 Installation Plan

Contractor shall submit an Installation Plan that identifies its approach to installation and drawing package submissions, and covers the major elements of the installation, including coordination with relevant Contractors and existing systems.

1105	Contractor shall develop an Installation Plan for each ETTM Site that documents all installation related activities for the Project. The Installation Plan shall be the master document from which the elements of the System shall be installed.
1106	The Installation Plan shall include and define, at a minimum, the following items:
	• The installation schedule detailing all activities, shifts and resources for the installation of the ETTM System, including third-party and Contractor activities. Once the Baseline Implementation Schedule is Approved by Authority, Updates during the installation periods identifying all schedule changes and Work progress in the form of percentage completions shall be submitted to Authority for Approval;
	• The minimum resource allocation requirement for any installation phase and segment;
	• How Contractor manages delivery and staging of the Equipment to be installed, including any staging, installation and testing performed at Contractor or third-party facilities and their subsequent delivery and installation at the ETTM Sites;
	• The coordination between Contractor and any other contractor, including Design-Builder, service utility providers for establishment of electrical and phone services for supporting the operation of all ETTM System locations as necessary;
	• Transportation Management Plan (TMP) in accordance with Caltrans standards, including all MOT design for Lane Closures of Express Lanes, general purpose lanes, and ramps and connectors;
	• Coordination of Lane Closures with Authority or Design-Builder for each phase of the Project;
	• Coordination with Authority or Design-Builder for the installation of cabinets and generators, as applicable;
	• The Civil Site Acceptance Checklist to be used to inspect the Design-Builder's work;
	• The Communications Network Acceptance Checklist to be used to inspect the Design-Builder's work;
	• All Upgrades and changes required at each ETTM Site prior to installation to make sure the infrastructure meets the requirements of the Agreement and the System, unless previously coordinated or provided via an Authority-contracted civil contractor.

	• Coordination activities as applicable with other third-party entities for the various interfaces;
	• Testing of Contractor-provided WAN communications for connection to RSS and the BOS and ensuring that the network capacity is adequate;
	• Quality Control, Quality Assurance, inspection, and testing processes including validation of Contractor installation is per the installation drawings;
	• The order in which Equipment items are to be installed with estimated durations;
	• Special or unique installation Requirements;
	• A detailed component list and a description of how each item version number and serial number shall be recorded for each installation and configuration into the MOMS;
	• Organization Chart defining Key Team Personnel, roles and responsibilities and contact information. All Subcontractors shall be identified, and
	• Contingency Plan.

2.5.9 Installation Checklist

1107	Contractor shall develop an installation checklist that tracks the progress and completion of all ETTM System, installation activities for the ETTM System installation and the primary RSS and DR System facilities installation.
1108	The checklist shall be the document detailing those items required for the installation crew and technical team to complete the installation process for all Equipment and components, including terminations, connections, configurations, and installation crew/technical team that completed the installation.
1109	A copy of the checklist signed and approved by Contractor, attesting to the completeness of the installation, shall be provided to Authority after the completion of the installation activities for each site, for both Roadside and support facilities.
1110	Contractor shall conduct a final inspection of all installations and certify the installation Work.
1111	Authority reserves the right to obtain the services of a certified engineer to witness Contractor inspection and conduct an independent inspection. Contractor shall coordinate and support such inspections at each applicable site.
1112	The checklist shall identify all non-conformances, discrepancies and exceptions and Contractor shall be responsible for all corrections.
1113	The checklist shall document all changes identified during the installation process and all such changes shall be Approved by Authority.

2.5.10 Electrical Work

1114	Electrical Work to be performed under this Agreement shall include, but not be limited to the following general items of Work:
	• Provide and install surge protection devices as required to protect the all ETTM Systems and electronics.

	• Install junction boxes and terminate new cable and conduit attachment devices, where applicable.
	• Bond all conduits, manhole frames, and other conductive items to the grounding System in conformance with the NEC.
1115	All electrical Work shall be performed in accordance with the applicable regulations and Approved by Authority. Appropriate NEC compliance shall be adhered to with all electrical articles for installation pertaining to wiring, enclosures, and other electrical Equipment in hazardous locations. UL labels shall be provided for all electrical panel boards, enclosures, and accessories.
1116	Contractor shall verify that provided power feeds at each ETTM Site are appropriate for use with Contractor-provided Equipment. Electrical load calculations for each ETTM Site shall be submitted to Authority prior to installation.
1117	All electrical Equipment must be inspected prior to installation for defects that could damage the Equipment or harm personnel. Any Equipment found to have defects shall not be installed but shall instead be replaced with a fully functioning replacement.
1118	All electrical Equipment shall be properly grounded for safety. Equipment shall be furnished with grounding pads or grounding lugs. All ground connections shall be cleaned immediately prior to connection and protected from corrosion or rust if exposed to the elements.
1119	Contractor shall provide all grounding material required for installation and all installations shall be in compliance with the applicable standards and manufacturer's specifications.
1120	Contractor shall employ measures to prevent theft of cables during non-work hours, including securing junction boxes with locking mechanisms and properly labeling cables and junction boxes with cable types (e.g. fiber, aluminum, if applicable).

2.5.11 Work Standards and Requirements

1121	The System Equipment installation shall be performed to an Approved set of Plans, which has previously been submitted and Approved by Authority.
1122	Contractor shall provide Project management and oversight of all Work performed. At all times when installation Work is taking place, Contractor shall have an individual designated site manager onsite to supervise the installation.
1123	Contractor shall install the Equipment using experienced and knowledgeable personnel. For example, journeyman electricians shall terminate all cables, wiring, or fiber optic cables.
1124	All tools such as crimpers, fiber optic termination tools, and test Equipment shall have been properly calibrated prior to being used.
1125	Contractor shall provide a safe environment for the installation process in accordance with all applicable local, State and federal requirements, as well as any Authority policies. Examples include but are not limited to the following:
	• safety harnesses shall be included and employed on all lifts, and the personnel trained on their use;
	• hard hats and safety vest shall be worn in all construction areas;

	• safety toe shoes shall be worn in construction areas and around active Roadsides while performing installation processes;
	• Contractor issued identification badges shall be worn at all times; and
	• regular safety meetings shall be scheduled to review safety procedures.

2.5.12 Design and Documentation during Construction and Installation

2.5.12.1 Engineering Design

1126	Contractor shall secure the services of a fully-qualified engineering design firm(s) for the purpose of performing any necessary infrastructure related Engineering Design (civil, structural, electrical, mechanical, and architectural) and the preparation of related plans and Documentation under the Agreement for any Design that impacts life safety.
1127	All Design Work shall be performed under the direct supervision of a Licensed Engineer of the appropriate discipline in the State of California. All design professionals shall be licensed and authorized to practice in the State of California.
1128	If the Engineering Design effort is performed by Contractor, Contractor shall submit Documentation showing that Contractor has met the required qualifications described in this section.
1129	All services provided under this Scope of Work shall meet or exceed the Project Standards as defined in ***Attachment 9: OCTA Project Standards***.

2.5.12.2 Installation Design and Drawings

1130	Contractor's civil, mechanical, and electrical engineering installation drawings shall require a professional engineer (PE) approval and signature and shall be sealed by a PE in the appropriate discipline with a State of California license.
1131	Contractor shall submit shop drawings detailing the installation Design that shall be used onsite for installation Work. Detailed drawings shall be provided for each site where Equipment procured and supplied under the Agreement shall be installed.
1132	Contractor shall submit the following Design drawings as part of the drawing package in accordance with Authority submission Requirements for each ETTM Site where Equipment is installed, including but not limited to:
	• detailed installation drawing for each piece of Equipment;
	• detailed drawing showing the Equipment mounting brackets and details of their installation to the mounting arm;
	• details related to the range of Equipment adjustments;
	• detailed electrical schematics;
	• power panel schedules;
	• all junction boxes and panels;
	• detailed Equipment rack layout and interconnections drawings;
	• detailed communications layout;
	• detailed conduit layout for power and communications;
	• power and communications cabling schedules and

	• pavement installation details for in-pavement sensor installations.
1133	Contractor shall use only the latest Approved drawing version for installation.
1134	During installation, Contractor shall maintain a red line version of the drawing package that is submitted to Authority upon the completion of the installation.
1135	Documentation shall include memos denoting changes or modification to Requirements.
1136	Contractor shall submit detailed component level network drawings showing all WAN, LAN and VLAN connections, including connection to the Roadside Systems, the RSS, the BOS, the TOCs, and other transportation agencies as determined during the Implementation Phase.
1137	Contractor shall utilize a predefined range of IP addresses provided by Authority and an IP schematic shall be submitted that shows all the IP addresses for all Contractor supplied Equipment on the network.
1138	Contractor shall submit detailed component level primary and DR server configuration instructions, including storage device mirroring, back-up devices and configuration, and network configuration and testing.
1139	Contractor shall submit detailed instructions on the installation and configuration of the operating System, database, third-party Software, and application Software on the servers as customized for Authority.
1140	All testing required to verify successful installation and operation shall also be documented.

2.5.12.3 As-Built Drawings/Documents

1141	Contractor shall update the latest drawings with red-lines as changes are incorporated during the installation and check-out process. At the completion of the installation of the ETTM System, Contractor shall gather all red line drawings into a single package.
1142	The red line drawings shall be verified and then incorporated into a final As-Built Drawing package. This final As-Built Drawing package shall include installation detail drawings, wiring diagrams, any mechanical drawings design or modified, manufacture's cable recommendations with detailed specifications, block diagrams, assembly diagrams, shop drawings and sketches, and other drawing types that may have been used to install the Roadside System.
1143	All other Documentation used regarding the installation shall be also be finalized and submitted as part of the As-Built Drawing Submittal ninety (90) Days after the last ETTM Site has been commissioned. This requirement shall apply separately to the 91 Express Lanes and the I-405 Express Lanes.

2.6 Electronic Toll and Traffic Management System Project Requirements

2.6.1 Roadside System Project Management

Contractor shall develop and employ a Project Management Plan (PMP) in accordance with Project Management Institute (PMI) Project Management Body of Knowledge (PMBOK) latest edition that is sufficiently detailed to enable Authority to review and confirm that Contractor has the necessary management, staff, and controls in place to meet the terms and conditions of the Agreement.

2.6.1.1 Program Management and Project Management Plan

The PMP describes how Contractor shall deliver, implement and manage the Project, including staffing, scheduling and communication procedures for controlling all correspondence, Submittals, and other communications between Contractor and Authority, as well as communications with other third-party entities. The PMP shall be in accordance with system engineering methodology wherever applicable.

1144	Contractor shall submit a complete PMP in a format acceptable to Authority for Approval thirty (30) Days after NTP1 as required in this Scope of Work and Requirements.
1145	The PMP shall include, but is not limited to:
	• Project Services and key Deliverables, tracked using a numbered Contract Deliverables Requirements List (CDRL);
	• a description of the staff management and organization of the Project, an organization chart, identification of Key Team Personnel and their associated responsibilities, and identification of the resources to be used in fulfilling the Requirements of the Contract;
	• a description of the Project planning, documenting and reporting methods to be utilized, both for use within Contractor's staff and externally with Authority;
	• approach to issue management, including communication, escalation and resolution of Project issues with Authority;
	• approach to communication management, including meeting schedules and team meetings;
	• the detailed Baseline Implementation Schedule, detailing all activities for the Implementation Phase, including third-parties and Subcontractors.
	• a description of the process for reporting and tracking the Approved Baseline Implementation Schedule and Project performance;
	• a description of the ETTM System Design and coordination process with Authority and Existing BOS Contractor during the Implementation Phase;
	• approach to change control management, consistent with terms and conditions of the Agreement, including a description of the process for documenting and submitting change requests, the Approval process and how the change control management approach shall be integrated into day-to-day Project management;
	• approach to document control, including utilizing Authority-provided electronic document management system (EDMS) that is accessible to the project team by username and password Software (Authority shall have the capability to download documents using this Software) and tools Authority will use and have access to via the Web;
	• approach to risk management;
	• approach to Quality Assurance and Quality Control;
	• approach to coordination with BOS Contractors;
	• approach to subcontractor management, including how issues with subcontractors will be resolved in a timely manner;

	• approach to procurement management;
	• documenting the invoice submission; invoice backup information; verification, and Approval process; including separate invoicing for the 91 Express Lanes and the I-405 Express Lanes;
	• a section with all Approved Project forms;
	• approach to Project Closeout; and
	• an emergency contact list as described further below.
1146	Contractor shall provide as a part of the PMP and then maintain a current emergency contact list for Authority use at all times for handling emergencies and escalations. The emergency contact list shall name Contractor's points of contact in order of preference, and shall include, at a minimum, Contractor's Project Principal, Project Manager, Deputy Project Manager and other relevant ETTM System support staff. The purpose of the emergency contact list is to ensure Contractor can be reached outside normal working hours to address urgent matters.
1147	Contractor shall obtain from Authority and then maintain and keep current an Authority emergency contact list at all times for notifying Authority in case of an emergency. The emergency contact list shall name primary and secondary (multiple secondary contacts as applicable) Authority's points of contact for each anticipated event or emergency.
1148	Contractor shall identify the tools and products used to manage the Project and the internal controls instituted by Contractor to guarantee successful delivery of the Project.
1149	Contractor shall develop and submit the communication procedures to Authority for review and Approval that address the following, including but not limited to:
	• Correspondence: correspondence shall be identified as to originator and designated receiver;
	• Document control: tracking of document versions and changes;
	• Invoices: all invoices shall be submitted with accompanying backup information in accordance with the Agreement's Payment Article;
	• Submittals: all Submittals shall be delivered as an enclosure to Contractor's Submittal letter. Each Submittal letter shall be limited to a single subject or item. Contractor's letter shall identify the Agreement number, Agreement name and subject of the Submittal; and
	• Agreement number and Agreement name: all items of correspondence, invoices, Submittals and Documentation shall contain the Agreement number and the designated Agreement name.

2.6.1.2 Monthly Report and Progress Meeting During the Implementation Phase

Monthly Project reports and progress meetings shall enable Authority and Contractor to monitor the status, progress, and quality of the Work performed on the Project and to take proactive steps to ensure successful delivery of the Project.

1150	Contractor shall provide and maintain a schedule for monthly progress meetings (in addition to periodic meetings such as Design/installation meetings during the active Design/installation periods) at a location designated by Authority. The meeting shall be scheduled no later than the 15th Day of the month immediately following the month under review.
1151	No less than seven (7) Days prior to the meeting, Contractor shall submit a draft monthly progress report to Authority for the period covering the previous month. Authority shall review and comment on the progress report prior to the meeting.
1152	The format of the monthly progress report shall be agreed upon as one of the initial Project tasks upon NTP1 and shall be incorporated by Contractor into the Project Management Plan.
1153	Contractor shall manage, facilitate and conduct the meetings in accordance with the agreed to format.
1154	The monthly progress report includes but is not limited to:
	• a summary outlining progress and status, and percentage of Work performed for each task as compared to planned activities in the Approved Baseline Implementation Schedule. Comments shall be included where appropriate. The summary should be a Dashboard-style report and shall identify status of key milestones;
	• an analysis of all critical path tasks, potential risks associated with the tasks and proposed contingency/work around plans to circumvent or mitigate delays to the Project;
	• identification of any Approved changes to Approved milestone dates and Approved Baseline Implementation Schedule, clearly noting the details and identifying the Agreement Amendment;
	• discussion of schedule compliance and an updated Baseline Implementation Schedule showing current status against the Approved Baseline Implementation Schedule;
	• construction/installation coordination status;
	• a risk log that tracks the status of all outstanding risks that need decision/resolution;
	• an updated action items list that tracks the status of all outstanding Deliverables (CDRL), activities and issues that need decision/resolution;
	• open payment requests, if applicable. For the Implementation Phase, payment requests must identify the payment milestone, number and dollar amount. Payments requests shall be made for completed and Approved milestone payments only. For Operations and Maintenance Phase, progress report shall include the invoice based on the Approved monthly Performance Report package.
	• a list of Approved and pending change requests (Contractor and Authority initiated) and their status;
	• the previous monthly final meeting minutes; and
	• a six (6) week look-ahead schedule; and

	• budget status and outlook for Authority Approved project milestones and work authorizations.
1155	No more than seven (7) Days after the meeting, Contractor shall submit the draft meeting minutes for Authority's review and Approval.

2.6.1.3 Project Meetings

1156	In addition to the Monthly Project Reports and Progress Meeting, weekly or bi-weekly Project status meetings, as applicable and Approved by Authority, and other regularly scheduled installation and ad-hoc Project meetings shall be required during the course of the Project to address specific Deliverables, work items, maintenance procedures and issues as they arise. The meetings shall include Authority, Caltrans (I-405 EL all meetings, 91 EL if necessary), the Design-Builder (I-405 EL only), and the BOS Contractor as required based on meeting content.
1157	Contractor shall perform the following tasks related to all meetings, including but not limited to:
	• develop and coordinate the Project meeting schedule;
	• manage, facilitate and conduct the meetings;
	• distribute Notices of Project meetings in accordance with document control Requirements;
	• prepare the agenda in coordination with Authority and distribute at least two (2) Days prior to the meeting;
	• attend the meeting with all required staff in attendance;
	• prepare minutes of the meeting and forward them to Authority within seven (7) Days after the Day of the meeting and
	• maintain an action item list for each type of meeting, identifying issues that need to be resolved at the Project level.

2.6.1.4 Baseline Implementation Schedule

The Baseline Implementation Schedule is a comprehensive list of Project milestones, activities and Deliverables, with planned start and finish dates, including a detailed Work Breakdown Structure (WBS) that identifies Project tasks down to the work package level and the activities required to complete the Work package Deliverables.

1158	Contractor shall provide and maintain a detailed Baseline Implementation Schedule for the Project for the ETTM System in Microsoft Project format (Project 2010 or Approved equivalent) that lists all Project activities and tasks for all Phases of the Project, including but not limited to:
	• planning;
	• design;
	• development;
	• Hardware and Software acquisition;
	• Documentation;

	• testing;
	• installation;
	• transition and
	• deployment and Acceptance of the System at the various tolling locations.
1159	The Baseline Implementation Schedule shall include coordination with the Design-Builder (I-405 EL only), Third-Party Service Providers, Business Partners and Authority and shall clearly document all interfacing tasks.
1160	The Baseline Implementation Schedule shall identify all milestones and tasks, starting with the NTP1 through the date of Acceptance for each Project phase. Sufficient information shall be shown on the Baseline Implementation Schedule to enable proper control and monitoring of the task and subtasks in this Scope of Work and Requirements.
1161	The Baseline Implementation Schedule shall be organized in accordance with the Work Breakdown Structure (WBS). Each Baseline Implementation Schedule activity shall be mapped to one and only one of the WBS elements.
1162	A unique identification number shall be used for each Project Implementation Schedule activity. Changes to activity IDs shall not be permitted. Consistent activity identification numbers, textual descriptions, and codes in all Baseline Implementation Schedule Submittals shall be used, in a way acceptable to Authority. Each Baseline Implementation Schedule Submittal shall be clearly identified. Resubmissions of Baseline Implementation Schedules shall use the same revision number as the original submission individually identified by a sequential appended letter (A, B, etc.), as an indication of a revised version.
1163	The Baseline Implementation Schedule shall be resource loaded, shall include all draft submissions and review cycles and shall include all tasks required of Authority and other third parties with critical tasks.
1164	The Baseline Implementation Schedule shall identify all critical path tasks and dependencies between tasks and shall be used to manage the Project. There shall be at least one continuous critical path in the Baseline Implementation Schedule, using the longest path definition that starts at the earliest occurring schedule activity in the network and ends at the latest occurring schedule activity in the network.
1165	The Baseline Implementation Schedule shall clearly define significant interaction points with Authority, Design-Builder, other civil contractors, and other entities such as Subcontractors, vendors and Suppliers, Caltrans, utilities, and local agencies.
1166	The Baseline Implementation Schedule shall clearly and uniquely define each activity description so Implementation Phase Work is readily identifiable and the progress on each activity can be readily verified without measuring.
1167	The Baseline Implementation Schedule shall use the retained logic method of calculating the critical path and show the order in which Contractor proposes to carry out the Implementation Phase Work with logical links between Implementation Phase Work activities and Design-Builder interfaces.
1168	The Baseline Implementation Schedule shall use schedule milestones to define significant contractual events, such as NTPs; Completion Deadlines; completion of Implementation Phase Work (by ETTM System Infrastructure Turnover area); and coordination points with outside entities.

1169	The Baseline Implementation Schedule shall include activities for design and design reviews that are broken down into sufficient detail that they may be monitored. Include third party reviews and Design-Builder reviews.
1170	The Baseline Implementation Schedule shall include interface milestones to denote the transition of work from one contractor to another. Contractor activities that relate to Design-Builder activities shall be preceded and/or followed by an interface milestone. This interface milestone shall be used to link Design-Builder activities to Contractor activities. Contractor shall work with Design-Builder to define interface milestones.
1171	The Baseline Implementation Schedule shall be submitted in a format acceptable to Authority for Approval fifteen (15) Days after NTP1 and shall be developed based on the Preliminary Implementation Schedule included in the Agreement, subject to changes Approved by Authority.
1172	Contractor shall update progress against the Baseline Implementation Schedule on a monthly basis, as identified in the Requirements for the monthly progress report. Reports shall include a compare of the last month's schedule to the current month's updated schedule. The date of the schedule shall be the last Day of the reporting month.
1173	Contractor shall use the Baseline Implementation Schedule as the basis for all subsequent schedules and updates throughout the duration of the Project.
1174	Contractor shall obtain Approval from Authority for any and all changes to the Approved Baseline Implementation Schedule and associated milestones in accordance with the Agreement.

2.6.1.5 Document Control

Document control is an integral part of Authority's proactive project management process for all Authority projects. Contractor shall provide and utilize an electronic document management system (EDMS) to submit, track, and manage all Project-related documents and drawings.

2.6.1.5.1 Electronic Document Management System (EDMS)

1175	Contractor shall provide and utilize an EDMS to track and manage all Project-related documents and drawings. The EDMS shall not be a proprietary system and shall be compatible with Authority's current EDMS. Contractor shall work with Authority to ensure that Contractor's EDMS is compatible with Authority's EDMS and processes are compatible. Contractor's EDMS is subject to Authority review and approval.
1176	Contractor shall establish a EDMS no later than 30 Days after NTP1 and shall maintain the EDMS throughout the Agreement Term.
1177	Contractor shall submit a file structure and index for the electronic documents for Authority review and approval. Online instructions and procedures for use of the EDMS shall also be provided and submitted for Authority review and approval. The file structure, index and online instructions shall be updated and kept current throughout the Agreement Term.
1178	Authority and Authorized Users shall be able to access the EDMS.
1179	Contractor shall provide training and EDMS support to Authority and other Authorized Users who require access to the EDMS, including all reviewers of project documents. If applicable, the Contractor shall provide all licenses for Authority use of the EDMS.

1180	The EDMS shall ensure that all incoming and outgoing Project-related Documentation is electronically and physically accounted for and filed.
1181	Each document shall be properly titled (per an agreed upon naming convention), date updated, numbered by revision and version and shall incorporate signature blocks for authorship and approvals.
1182	All Documentation regarding the Roadside System Equipment and RSS Equipment installation shall be maintained by Contractor. All drawings and other such Documentation shall be made accessible to Authority for review on a periodic basis as Approved by Authority. Contractor shall identify and track the status of all Deliverables/Submittals on the Project via the use of a Contract Deliverables Requirements List (CDRL) maintained by Contractor.
1183	Contractor shall maintain all non-conformance reports (NCR) submitted by Authority and document the correction and resolution of all issues identified.

2.6.1.5.2 Document Submittal and Review

1184	Contractor and Authority shall use the EDMS to track, electronically manage, exchange, and store all Documentation, drawings, technical reports, specifications, calculations, control of materials, meeting minutes, correspondence to and from Authority, and other Project-related documents. Contractor shall also establish document routing, filing, control, and retrieval methods that are compatible with Authority's EDMS. Document control, storage, and retrieval methods shall include the use of both hard copies and electronic records.
1185	Contractor shall be required to submit certain Deliverables and Documentation to the Design-Builder and review Design-Builder's deliverables. Contractor shall use Design-Builder's EDMS (Aconex) to exchange all Deliverables, Documentation, drawings, and other Project-related documents with Design-Builder. Contractor shall comment using Design-Builder's deliverable review form for each Design-Builder deliverable.
1186	Contractor shall submit Deliverables to Authority in accordance with the Approved Baseline Implementation Schedule. If a Deliverable is submitted on a date other than that shown on the Approved Baseline Implementation Schedule (either prior to or after Submittal date shown in Approved Baseline Implementation Schedule), Contractor shall notify Authority of the updated Submittal date at least 14 Days prior to submitting the Deliverable.
1187	Contractor may request an informal over the shoulder Deliverable review meeting in advance of any Submittal. The purpose of informal over the shoulder Deliverable review meetings is for Contractor to introduce their proposed approach and get feedback from the Authority to expedite reviews. Conducting an over the shoulder Deliverable review meeting does not relieve Authority of any review durations as defined herein.

1188	Contractor shall provide a Customer Review Form (CRF) with each submitted document. Authority shall populate the CRF and provide Contractor with written comments on all submitted documents. Contractor shall respond in writing to all comments through the CRF. Contractor may schedule and conduct meetings to clarify and resolve any remaining questions and issues concerning the comments and responses provided. Contractor shall prepare a revised version of the document for Approval by Authority. The Submittal document shall not be considered Approved until all written comments are addressed to the satisfaction of the Authority in their sole discretion. Such lack of Approval shall be considered a rejection until such time as the comments are fully resolved.
1189	Authority may reject any Submittal where information submitted is considered, by Authority, in its sole discretion, insufficient to conduct a proper review or actions arising from the review require significant revisions or otherwise not in accordance with the Agreement. Contractor shall be responsible for making necessary corrections to the Submittal and resubmitting it to Authority.
1190	For documents containing less than 100 pages, Authority shall have 30 Days after receipt of the Submittal, to Approve, comment or reject the Submittal. For the System Detailed Design Document, Requirements Traceability Matrix, and other documents containing 100 or more pages, Authority shall have 45 Days after receipt of the Submittal, to Approve, comment or reject the Submittal. The process shall continue until the Submittal is Approved by Authority.
1191	If a Deliverable is submitted to Authority without 14 Days notice, Authority shall have 7 additional Days after receipt of the Submittal to Approve, comment, or reject the Submittal.
1192	Authority may request supplemental supporting information to any Submittal under review. Contractor shall supply such information in the form and within the timeframe requested by Authority. Authority may reject a Submittal if supplemental supporting information requested by Authority is not provided by Contractor.

2.6.1.5.3 Document Review Constraints

Documents shall be submitted for review by Authority per ***Table 2-3: Submittal Constraints.***

Table 2-3: Submittal Constraints

Deliverable	***Allowable number of Submittals per week***	***Total number of Submittals allowed in the aggregate pending review at any given time***
System Detailed Design Document	1	1
Requirements Traceability Matrix	1	
All Other Deliverables	2	2

2.6.1.5.4 Document Control Work Plan

1193	Contractor shall prepare and submit a Document Control Work Plan to Authority for review and obtain Approval no later than 30 Days after NTP1. The Document Control Work Plan shall describe how documents are named, tracked, submitted, routed and reviewed and shall include the following, at a minimum:

	• File structure and relationship with the WBS;
	• Naming convention and resubmittal naming convention;
	• EDMS procedures, including incorporation of documents into the EDMS, document deletion procedures, and EDMS backup and recovery;
	• Flow charts depicting the routing and processing of documents;
	• Persons involved in document control and their responsibilities;
	• The handling and filing of hard copy documents;
	• Comment log; and
	• Submittal log in EDMS.

2.6.1.5.5 Document Delivery

1194	Prior to Project Acceptance, Contractor shall deliver a full and complete backup of the EDMS to Authority. This backup shall include all files in electronic format.
1195	Annually, and as part of the Annual Certification testing, Contractor shall deliver a full and complete backup of the EDMS to Authority.
1196	Contractor shall prepare and submit Deliverables which shall, at a minimum, comply with the following:
	• All Deliverable documents shall be submitted in the EDMS;
	• All Deliverable documents shall be submitted in the native editable format (i.e. Microsoft, pdf, etc.);
	• Contractor shall submit all Deliverable documents in the English language. All Deliverable documents shall be maintained in formats found in the Microsoft Office suite;
	• Documents may be combined with pre-approval from Authority;
	• All documents shall include a title block that states the version number, required reviewers, date submitted, and approval status;
	• Each resubmittal shall include an Authority comment review log filled out with how Contractor addressed Authority's comments;
	• All updated submissions of a document also shall include a red-lined version showing all revisions to the document since the last submission;
	• Contractor shall maintain a Deliverable tracking list that includes provisions for submissions, review of comments, resubmissions and final approval; and
	• Contractor is responsible for submitting as many drafts as necessary to resolve Authority comments.

2.6.2 End of Contract Transition

Contractor acknowledges that the Services it provides under the terms of the Agreement are vital to the successful operation of the ETTM System and that said Services shall be continued without interruption. Upon expiration or termination of the Agreement by any of the parties, a successor may be responsible for providing these Services. Contractor agrees to exercise its best efforts and cooperation to affect an orderly and efficient transition to a successor.

1197	Contractor shall develop an End of Contract Transition Plan describing the nature and extent of transition Services required.
1198	The End of Contract Transition Plan and dates for transferring responsibilities for each division/element of Work shall be submitted to Authority within 180 Days of Authority's Acceptance of the ETTM System. Upon completion of Authority's review, both parties shall meet and resolve any additional Requirements/differences.
1199	The End of Contract Transition Plan is considered a living document; Contractor shall amend and submit changes to the End of Contract Transition Plan for approval by Authority as changes occur to the ETTM System.
1200	During the transition from Contractor to another Contractor, and upon Authority's written Notice, Contractor shall provide transition Services for a period of one year, or until all transition activities are completed, as defined by Authority and as further set forth in the Special Conditions of the Agreement.
1201	Contractor shall update the End of Contract Transition Plan with the successor within 90 Days of notification of the successor.
1202	Contractor shall provide sufficient experienced personnel in each division/element of Work during the entire transition period to ensure that the quality of Services are maintained at the levels required by this Agreement.
1203	Contractor shall provide sufficient staff to help the successor maintain the continuity and consistency of the Services required by the Agreement.
1204	Contractor shall provide the necessary Software and Systems support Services to assist the successor Contractor in setting up the systems, transferring of appropriate licenses and third-party Software, and transition of all ETTM System data required to sustain uninterrupted service in areas in which Contractor is responsible for the Work.
1205	Contractor shall support Authority during the procurement process by updating all system Documentation and providing new Documentation as required that details the current system.
1206	Contractor shall make all necessary provisions for transferring any leases or sub-leases held by Contractor to Authority, including without limitation, all keys; security codes and other codes and other facility access information or devices.
1207	Contractor shall make all other records, documents, data and Software (including cloud-based, if applicable) which is licensed to Authority and pertaining to the Services rendered for this Agreement available within thirty (30) Days upon written Notice or as otherwise provided in the executed License Agreement.
1208	Contractor shall make all operational records, documents, data, Systems, specialty tools, spares and Equipment, and facilities (including cloud-based, if applicable) required to support and maintain Day-to-Day Services being rendered under this Agreement available before the date of such termination, suspension, or expiration.

2.6.3 Software Design and Development Requirements

To ensure the Design Requirements for the ETTM System are fully understood by Authority and Contractor, a series of Requirements and Design review steps are specified following a sequential Design process. The Agreement Conformed Scope of Work and Requirements Document (CSWRD) shall be the basis for Contractor to develop a Requirements Traceability Matrix (RTM).

The RTM shall allow for verification that each of the Requirements in the CSWRD have been addressed in the Design and documented in the System Detailed Design Document (SDDD) and the Master Test Plan (MTP) and its test procedures. The RTM shall be the basis for all Design, development and testing efforts and Documentation to be developed by Contractor.

1209	Contractor shall establish and maintain a Software Design and development program to ensure compliance with this Scope of Work and Requirements.
1210	Contractor shall employ appropriate techniques and methodologies to develop the ETTM System Requirements and ensure compliance with the Business Rules for the Project.
1211	Prior to conducting any workshops, Requirements reviews, focus group meetings or Design reviews, Contractor shall develop the necessary Documentation for Authority to review and shall submit the Documentation for review no less than fourteen (14) Days prior to such meetings.

2.6.3.1 System Requirements Review (SRR)

Contractor shall conduct a series of System Requirements Review meetings with Authority (the BOS Contractor shall attend as required based on meeting content) to validate all Requirements and ensure Contractor's understanding of the Requirements.

1212	Contractor shall manage, facilitate, and conduct a series of System Requirements review meetings with Authority to outline how this Scope of Work and Requirements shall be met. The outcome of these meetings shall be a Requirements Traceability Matrix (RTM) that shall be used to validate each Requirement against a Design item(s), Design Documentation and testing procedure(s).
1213	Contractor shall present lane logic, transaction framing rules, trip construction and pricing rules of the solution.

2.6.3.2 Business Rules Development

Contractor shall conduct a series of Business Rules workshops with Authority and the BOS Contractor to develop and update the Business Rules document. Contractor shall be responsible for making updates to the Business Rules which pertain to ETTM System; however, Authority will maintain ownership of the Business Rules Document. The Business Rules will be presented in a narrative format describing each Business Rule and the Business Rules will include enough granularity to clearly identify rules and constraints which govern business operations.

1214	Contractor shall manage, facilitate, and conduct Business Rules review workshops with Authority for each Roadside Project phase to modify the Business Rules for the ETTM System, including the Roadside System and the RSS, against the current baseline.
1215	the Business Rules workshops can occur concurrent to the System Requirements reviews and shall be an iterative process.
1216	the Business Rules review workshops shall include Contractor and Authority staff who will provide expertise on the current and future business operations.
1217	Contractor shall conduct a minimum of three Business Rules workshops.
1218	Contractor shall utilize the current Business Rules as a baseline and facilitate discussions to verify and update the Business Rules to reflect current business functions.

1219	The Business Rules shall include enough granularity to clearly identify rules and constraints which govern business operations.
1220	The iterative series of workshops and demonstrations shall continue until the above Business Rules Requirements are satisfied and the Business Rules are Approved by Authority.
1221	Contractor shall provide Business Rules utilized at other AET Facilities and Express Lanes Toll Facilities; however, they shall be tailored to meet Authority's Requirements and shall comply with this Scope of Work and Requirements.
1222	Contractor shall track the design, development and testing of the Business Rules through the RTM.
1223	Contractor shall proof all Business Rules against the system requirements

2.6.3.3 Use Cases Workshops

Contractor shall conduct a series of use case workshops with Authority and BOS Contractor to develop use cases. The outcome of these meetings shall be a series of use case documents that shall be used in conjunction with the Business Rules and test procedures to validate the Requirements.

1224	Contractor shall manage, facilitate and conduct a minimum of three use case workshops with Authority to develop the use cases that shall be used in conjunction with test procedures to validate this Scope of Work and Requirements have been met.
1225	The iterative series of workshops and demonstrations shall continue until the above use case Requirements are satisfied and the use cases are Approved by Authority.

2.6.3.4 System Detailed Design Review Meetings and Workshops

Based on the RTM and Business Rules documents, Contractor shall design the ETTM System and submit a preliminary design document for Authority to review and provide comments. Contractor shall then conduct a series of design meetings and workshops with Authority and the BOS Contractor to address the comments and to create the SDDD, defining how the System Design shall meet the Requirements. Upon the Submittal of an updated SDDD another review cycle shall take place.

1226	the Business Rules document and the RTM shall be used to develop the System Design and the SDDD.
1227	Contractor shall schedule design meetings with Authority to review and fully understand the Design Requirements.
1228	Contractor shall manage, facilitate and conduct the workshops and meetings.
1229	Contractor shall support a phased design process to support the anticipated phased implementation of the ETTM System on Authority Roadsides. The Design process shall accommodate for the changes in technology that is inevitable given the duration of the Project.
1230	Contractor shall demonstrate pre-production working products (such as, beta versions) during the design review process, and stakeholders shall be walked through the workflow, utilizing screens and data flow diagrams.

1231	Contractor shall explain how the System Design meets the RTM, the Business Rules and this Scope of Work and Requirements.
1232	Contractor shall conduct as many meetings and submission review cycles as deemed necessary by Authority to address all design issues to Authority's satisfaction.

2.6.3.5 Reports Design Workshops

Contractor shall conduct a series of workshops with Authority and the BOS Contractor (as needed) to facilitate the design of the ETTM System reports required by Authority.

1233	Contractor shall manage, facilitate, and conduct a minimum of three reports design workshops.
1234	One report design workshop shall be designated for the development of reporting monthly and annual system certification KPI results.
1235	The reports design process shall be iterative and Contractor shall conduct multiple workshops with Authority's stakeholders sufficient to obtain Authority's informed input. Contractor shall bring its subject matter experts (SMEs) to the workshops, including as example, maintenance and finance/accounting staff, as appropriate for the report type(s) being reviewed during the meeting. The iterative series of workshops and demonstrations shall continue until the above reports Requirements are satisfied and the reports are Approved by Authority.
1236	Subject matter experts shall provide a means for fully explaining each report, its intended purpose, columns, fields and components and its connection with other reconciling and validating reports.
1237	Upon receiving feedback from Authority, Contractor shall develop/modify the reports and submit the updated reports for review.
1238	The modified and new reports shall be demonstrated to Authority using accurate and reconciled data. Reports that are expected to reconcile to one another shall be demonstrated together.

2.6.3.6 Software Walkthroughs

The intent of the Software walkthrough is to provide an overall status on Contractor's Software development progress to ensure Contractor is on track to deliver the Project on schedule and to obtain Authority's feedback on the direction of the development prior to the full rollout of the Software. Lastly it allows Authority to observe the ETTM System in operation. Unlike Software detailed design reviews, these walkthroughs shall demonstrate actual transactions/trips in a test environment.

1239	Contractor shall manage, facilitate and conduct the walkthroughs.
1240	Contractor shall conduct a series of Software walkthroughs including product demonstrations to solicit input from Authority during the development of the ETTM System. Contractor shall segment each meeting by functional area and schedule each walkthrough meeting to align with the participants' availability. No less than four (4), four (4) hour meetings will be conducted; however, if more meetings are required Contractor shall conduct as many meetings as necessary to cover all Software.

1241	Prior to the Software walkthrough, Contractor shall develop and submit the use cases that shall be demonstrated to Authority for review and Approval. Real transactions/trips and images from each of Authority's Roadways shall be utilized for the walkthrough. The walkthrough shall follow the process flow and emulate normal Operations.
1242	The product shall be demonstrated in a test environment that allows data to flow as it will in the final integrated System.
1243	The Software walkthrough shall demonstrate to Authority that the developed Software product meets this Scope of Work and Requirements.
1244	Comments and feedback provided during the Software walkthrough shall be documented and resolved by Contractor and the resolution shall be Approved by Authority.
1245	Contractor shall be responsible for identifying and correcting any Software issues or defects in its Design or product that impact Contractor's ability to deliver the ETTM System that meets this Scope of Work and Requirements. This shall apply to issues or defects found during or after Software walkthrough or in the subsequent testing and Implementation. Any such changes to address these issues shall be Approved by Authority in writing.

2.6.4 Documentation

Contractor is required to provide Documentation, including but not limited to Documentation for Hardware; Software; Requirements; Business Rules; Design; testing; installation and Maintenance, both Contractor-developed Documentation and third-party Documentation. Contractor's Documentation Requirements and Documentation schedule shall be as set out in Contractor's Approved Project Management Plan and Contractor's Approved Baseline Implementation Schedule, in accordance with this Scope of Work and Requirements. All Documentation provided under this Agreement shall meet the Requirements described below.

1246	Contractor shall prepare and submit all Documentation to Authority for review and approval in accordance with the Approved Baseline Implementation Schedule.
1247	Each document shall be properly titled, date updated, numbered by revision, revision history, and version, and shall incorporate signature blocks for authorship and Approvals.
1248	Contractor shall utilize acceptable standards agreed upon by Contractor and Authority when updating documents and submitting revisions.
1249	All Documentation submitted by Contractor under this Agreement shall be accurate and comply with the terms and conditions of the Agreement.
1250	A table of contents, for all Documentation that includes multiple pages and/or multiple sections, shall be submitted by Contractor to Authority for review and comment prior to the submission of the preliminary draft as part of the Deliverables Expectation Document.
1251	The Deliverables Expectation Document shall include all subsections and a summary narrative for each section describing the assumptions and approach.
1252	Contractor shall submit preliminary draft and final draft documents to Authority for review and comment, followed by 100 percent complete documents that incorporate all Authority's review comments.

1253	Authority shall have the right to require additional interim drafts from Contractor at no additional cost should the draft Documentation submitted not be of adequate quality, have missing or incorrect information or if it does not satisfactorily address Authority's review comments.
1254	Contractor shall submit two (2) hard copies and the electronic version of all Contractor developed Documentation for Authority review and Approval unless directed by Authority. Acceptable electronic formats are Microsoft Office 2010 Suite (or higher), unsecured and indexed Portable Document Format (PDF), Excel (as appropriate), and professional CAD applications for Contractor-prepared Documentation.
1255	Contractor shall update Documentation as changes occur through the Implementation Phase and the Operations and Maintenance Phase. All changes shall be submitted to Authority for Approval. Contractor shall maintain a document Submittals list on the Authority-provided EDMS identifying all versions of documents, the date submitted, the nature of changes and identify what changes are within the Documentation.
1256	The Documentation package for all Submittals as applicable shall include all required CDs or USB drives with applicable Software to install, operate and maintain the System/Deliverable/document being supplied.
1257	All Documentation submitted by Contractor under this Agreement shall be the property of Authority and shall not be marked with "Proprietary", "Confidential" or other limiting designation unless agreed to by Authority.

2.6.4.1 Requirements Traceability Matrix (RTM)

1258	Upon completion of the System Requirements review process Contractor shall develop and submit an RTM to Authority for Approval that details all the technical and functional Requirements for the ETTM System.
1259	Contractor shall develop and submit an RTM that identifies each Requirement and where it is addressed in the design and testing, including but not limited to:
	• listing and multiple levels of categorization (e.g., functional, interfaces, Modules, etc.) of all Requirements;
	• identification of the source of all Requirements;
	• identification of the design section of the SDDD that addresses the Requirement;
	• identification of the test procedures that address the Requirement;
	• identification of the test method to validate the Requirement (e.g., via inspection, demonstration, analysis, test) and
	• identification of any Business Rules associated with each Requirement.
1260	The RTM shall build on the specifications documented in the CSWRD and shall capture all user needs identified during the Requirements review process.
1261	During the design and development of the Software, Contractor shall update the RTM to reflect any changes to the Requirements that have been Approved by Authority through the project's change control management process.
1262	During Design and testing, the RTM shall be used to verify the System compliance to this Scope of Work and Requirements.

1263	Upon Approval of the RTM, this document shall be the basis for functional verification of Design, development and testing.

2.6.4.2 Business Rules Document

As an outcome of the Business Rules workshops, Contractor shall provide a Business Rules Document.

1264	Contractor shall submit a Business Rules Document (leveraged from a current baseline provided by Authority) to Authority for Approval that includes but is not limited to:
	• detailed Business Rules for all aspects of the ETTM System, including policies and processes developed by Contractor and Approved by Authority;
	• detailed description of all System Configurable options, ranges and thresholds (Configurable within the System or Configurable by Authorized User) for each Business Rule (if applicable);
	• categorization of all Business Rules, providing indication for the source of the Business Rule;
	• cross-referencing of all Business Rules to the underlying Requirements, SDDD; and
	• System and operational impacts of each Business Rule.
1265	Contractor shall provide updates to the Business Rules document to Authority and/or the BOS Contractor for the remainder of the Agreement Term with any changes to the ETTM System.

2.6.4.3 System Detailed Design Document (SDDD)

Contractor shall submit a SDDD to the Authority for the Design and Implementation of 91 Express Lanes ETTM System. Contractor shall submit revised SDDD to the Authority for the Design and Implementation of I-405 Express Lanes ETTM System, if applicable.

1266	Contractor shall engage with the Design-Builder immediately upon NTP1 to develop Roadside System Design plans in coordination with the Design-Builder's I-405 ETTM System Infrastructure Design.
1267	Contractor shall develop and submit a SDDD to Authority for Approval that describes the design specifications of all Hardware and Software provided as part of the ETTM System to meet this Scope of Work and Requirements. The SDDD shall demonstrate that Contractor understands the functional, technical and Performance Requirements of the ETTM System and has the processes, Hardware and Software design in place to provide a high-quality and reliable product that meets this Scope of Work and Requirements.
1268	The SDDD shall be clear, well-written and organized, as well as clearly differentiate and document differences between the 91 Express Lanes and the I-405 Express Lanes in all areas;
1269	The SDDD shall include the use of diagrams, figures, tables and examples, and it shall apply to all environments, including production, Data Warehouse, Disaster Recovery, training, testing, and post Go-Live manual and Authority issued help desk tickets (issued by email, phone, or text message) to the MOMS.
1270	The SDDD shall include but not be limited to:

	• physical and logical diagrams that identifies such items as, but not limited to: the systems, how they're linked, where they're located, interfaces, etc.;
	• System architecture (cloud-based architecture, if applicable), including equipment layout diagrams;
	• in-lane Equipment layout for each ETTM Site type,
	• physical connections and interfaces to the ETTM System Infrastructure;
	• placement of the Equipment on the toll gantry;
	• lane layout electrical and logic diagrams;
	• Shadow dynamic pricing algorithm details including handling of various traffic scenarios and failures;
	• methodology, logic, process flows and confidence level thresholds (for license plate number, jurisdiction and license plate type) related to automated OCR/ALPR image processing and manual image review, including image review screens;
	• Dashboard layouts and design;
	• details on the interface to the Toll Rate CMS and handling of failures;
	• the Requirements for all peripheral device interfaces and control;
	• Roadside server design, including sizing and processing calculations;
	• storage system design, including sizing and processing calculations;
	• data backup Systems design, including sizing and processing calculations;
	• network sizing and design details including IP scheme;
	• cabinet/hub/Equipment rack layout and interconnections;
	• cabinet/hub/Equipment rack space Requirements;
	• UPS sizing information detailing all Equipment on the UPS(s) and their total power Requirements;
	• high System availability design, including servers, storage, network, database and application;
	• Disaster Recovery design, including servers, storage, secondary RSS, network, database, data resiliency and application;
	• Hardware dependencies and inter-dependencies;
	• detailed primary and Disaster Recovery locations rack and server placement Design;
	• detailed infrastructure Software design,
	• detailed operating systems design;
	• detailed peripherals configurations, including Requirements for all peripheral device interfaces and control;
	• all internal System interfaces;
	• all custom developed Software;
	• all Software provided by Contractor or a third-party;
	• Software dependencies and inter-dependencies;

	• detailed database design, schema and data modeling, including sizing and processing calculations;
	• Entity Relationship Diagram (ERD):
	• data flow diagrams, state diagrams and data queues;
	• Module level descriptions and interaction among various Modules;
	• detailed description to the Module and/or process level for all of the functions according to the functional Requirements of the System;
	• lane logic and vehicle framing design and rules with illustrations;
	• degraded mode of Operations and impacts of failures on System Operations;
	• transaction audit and pre-processing;
	• transaction processing design, including sizing and processing calculations;
	• detailed interface specifications between all Software components;
	• Design of all System interfaces (both sides of the interface), including electronic interface to the RSS and BOS.
	• detailed data management design and processes, including summarization, archiving and purging;
	• all user interfaces (including reports and screen formats);
	• System data dictionaries;
	• application performance monitoring design;
	• access/identity security methodology;
	• Access Control and Security Monitoring System layout and interconnections;
	• environmental specifications;
	• specification sheets for all Equipment;
	• complete Bill of Materials, including Hardware, Software and support/Maintenance agreements, and
	• A logical division and an index of all contents within the SDDD.
1271	Upon the completion of the Software development, and prior to the start of the Roadside System formal testing, Contractor shall submit the final updated SDDD that includes all changes/clarifications made during the Software development and testing phases.

2.6.4.4 ETTM System Installation Design Package

Contractor shall submit an ETTM System Installation Design Package to the Authority for the Design and Implementation of 91 Express Lanes ETTM System. Contractor shall submit revised ETTM System Installation Design Package to the Authority for the Design and Implementation of I-405 Express Lanes ETTM System, if applicable.

1272	Contractor shall submit an ETTM System Installation Design Package to Authority for Approval.

1273	Generally speaking, Contractor's design Submittals will not be required to be signed / sealed by a licensed engineer. However, should Contractor provide custom manufactured infrastructure that is structural in nature or other structure(s) or appurtenances (e.g. Equipment mounting brackets, Equipment arms, etc.) that have the potential to impact life safety Contractor shall secure the services of a fully-qualified engineering design firm(s) licensed in California for the purpose of performing engineering design and the preparation of related Plans and Documentation under the Agreement.
1274	Contractor shall develop a half-size (11'' by 17") set of drawings providing sufficient and accurate detail to install the System components.
1275	In addition, the drawing shall contain notes and other detail defining specific processes that cannot be graphically depicted. The notes shall also be used to delineate specifications, tolerances, special conditions, or any other factor required to install and integrate a fully functional System.
1276	The drawings shall include but not be limited to the following:
	• lane geometry and dimensions of actual size and placement of all Roadside Equipment;
	• details on all existing equipment, conduits, junction boxes and panels that will be re-used clearly identifying any temporary installations;
	• Equipment bracket mounting detail to the mounting arm;
	• specifications and tolerances;
	• conduit and cable schedule showing all conduits, cables and wires used for each ETTM Site;
	• placement of in-road components;
	• size and depth of loop cuts;
	• loop tolerances (induction, resistance, impedance, Q factor);
	• any specific infrastructure limitations (i.e. proximity of rebar);
	• any specific requirement of how the loop cable is placed into the cuts;
	• all homeruns from loops;
	• any cable twist requirements for loop homeruns;
	• placement of overhead sensors;
	• details describing termination process for each termination;
	• lightning and surge suppression system;
	• a graphical diagram of the network connectivity and data flow;
	• detailed interconnection diagrams for all Systems;
	• detailed electrical schematics, and
	• detailed communications layout.

2.6.4.5 Roadway Support Systems (RSS) Installation Design Documentation

Contractor shall submit a RSS Installation Design Documentation to the Authority for the Design and Implementation of 91 Express Lanes ETTM System. Contractor shall submit revised RSS

Installation Design Documentation to the Authority for the Design and Implementation of I-405 Express Lanes ETTM System, if applicable.

1277	Contractor shall submit RSS Installation Design Documentation to Authority for Approval.
1278	Contractor shall develop a half-size set of drawings (11'' by 17") providing sufficient and accurate detail to install the System components.
1279	The drawings shall include but not be limited to the following:
	• detailed interconnection diagrams for all Systems;
	• detailed electrical schematics;
	• detailed communications layout;
	• UPS sizing specifications;
	• Equipment rack layout, including power panels and connection to the UPS;
	• a detailed diagram of the network connectivity, including IP scheme;
	• server set-up and configuration;
	• other RSS Hardware installation and connections and
	• floor loading calculations.
1280	Contractor shall provide the installation requirements for the Equipment, including all related Plans and documents. Contractor shall certify the installation requirements provided as accurate and appropriate for its intended purpose, to the satisfaction and Approval of Authority.
1281	Contractor shall submit server room drawings that show the location of the Equipment racks for all RSS Equipment at the primary facility. The layout of the server components, storage devices and communication Equipment inside the cabinets shall be clearly presented with actual measurements shown.
1282	Contractor shall submit server room drawings that show the location of the Equipment racks for all RSS Equipment at the Disaster Recovery location. The layout of the server components, storage devices and communication Equipment inside the cabinets shall be clearly presented with actual measurements shown.
1283	Contractor shall submit UPS sizing information for the primary and Disaster Recovery locations, detailing all Equipment on the UPS and their power specifications.
1284	Contractor shall submit detailed network drawings showing all WAN, LAN and VLAN connections, including all interface connections and IP addresses for all Equipment on the network.
1285	Contractor shall submit detailed server configuration instructions, including the configuration of storage devices, back-up devices and network connectivity.

2.6.4.6 Quality Assurance Plan

The Quality Assurance (QA) Plan shall include how to address errors (quality-related events) and how to make improvements before an error occurs (continuous quality improvement).

1286	Contractor shall develop and submit a QA Plan to Authority for Approval that details Contractor's QA Program in a concise manner customized to this project, and clearly describing the processes Contractor shall follow.

1287	The QA Plan shall include Contractor's QA Program through design; development; production; purchasing; testing; installation; Commissioning; transition and Acceptance of all Hardware and Software provided under this Agreement.
1288	The QA Plan shall describe the Quality Assurance procedures and methodology for the Project, including but not limited to:
	• quality management and organizational structure;
	• System design;
	• Software development;
	• installation including engineering installation sign-off;
	• data migration and transition;
	• Equipment purchase, delivery and validation;
	• inspection and verification for in-process, final assembly, unit tests and System testing;
	• configuration management;
	• change management and change control process, including recommended forms and processes for change management;
	• description of system and tools used for configuration management during both implementation and maintenance;
	• training and safety;
	• quality management documentation;
	• quality review and verification and
	• reporting and metrics.
1289	The QA Plan shall be submitted for Approval by Authority 65 Days after NTP1.

2.6.4.7 Software Development Plan (SDP)

1290	Contractor shall develop and submit a Software Development Plan (SDP) to Authority for Approval that includes but is not limited to:
	• Documentation of the Software development approach to the application architecture, behavior, architecture, business processes, security and data structures;
	• approach System design and Development given the Roadside System Project phasing;
	• development resources and responsibilities, such as Software developers, system engineers, security engineers, test engineers, Quality Assurance and Quality Control personnel, configuration management administrator, Documentation specialists and Project management staff;
	• describe natural segregation of development areas or teams, such as development of user interfaces, development of reports, development of the functionality and development of interfaces;
	• Software development standards;

	• security standards;
	• Software development methodology, such as use cases, modeling and other development tools;
	• Software development language strategy, platforms and technologies related to both development and Software Maintenance;
	• description of the Software Development Life-Cycle and Maintenance;
	• approach to segregation of environments (development, testing and deployment) and the number of environments;
	• Maintenance of standard and baseline codes and management of major releases;
	• gap analysis of baseline code to Contractor Requirements;
	• development problem reporting, defect tracking and remediation;
	• code reviews and code development standards;
	• source control;
	• informal and internal testing methodology;
	• regression testing and security and vulnerability testing;
	• development and integration approach for the major functional modules;
	• Software Quality Control processes;
	• Software end-user Documentation review and usability;
	• development Documentation;
	• technical Software code Documentation and standards for all code;
	• Software configuration and change management approach and standards, including recommended forms and processes for change management;
	• description of system and tools used for configuration management during both implementation and maintenance;
	• samples of detailed Software Documentation for both external and in-line Documentation;
	• Software deployment approach, release management and validation and
	• detailed Documentation of the development environment, including enough information that the environment could be completely replicated.

2.6.4.8 Disaster Recovery Plan

The Disaster Recovery Plan (DRP) shall be a comprehensive, documented statement of actions to be taken before, during and after a disaster to protect and recover the information technology data, assets and facilities of the ETTM System.

1291	Contractor shall develop, test, and submit a DRP to Authority for Approval and subsequent DR Procedures that describe the approach, as well as activities and procedures that take place in the event of a disaster for each element of the ETTM System.
1292	Contractor shall coordinate the development and testing of the DRP and DR Procedures with the BOS Contractor.

1293	The DRP shall document Contractor's approach to recovering from a disaster, including but not limited to:
	• Define what constitutes a disaster and severity levels and timeframes to address each disaster (e.g., earthquake, flood, electrical outage, general loss of access to building, etc.);
	• assessment of disaster risks;
	• mitigation of disaster risks;
	• preparations in the event of a disaster;
	• disaster declaration and DR process to invoke;
	• organization chart illustrating DR team members, roles and responsibilities;
	• notification contact list, including contact information;
	• notification protocol;
	• sites and Equipment for DR, presented in a diagram format;
	• DR process initiation and completion checklist;
	• Software and data replication processes;
	• detailed logistical processes for activation of DR site and systems;
	• detailed technical processes for activation of DR site and systems;
	• detailed procedures for failover and failback of the RSS including a check list for ensuring that it failed over and failed back properly;
	• detailed operational functions for activation of DR site and
	• detailed technical processes for reactivation of primary site (or moving to a new primary site if the original primary site is destroyed) for systems and coordination with Authority and BOS Contractor.
1294	The DRP shall be tested and updated by Contractor annually.
1295	The Disaster Recovery location shall be at a secondary location which meets the specifications outlined in the Agreement.
1296	The DRP shall include a Business Continuity Plan (BCP) that details Contractor's approach to accommodating the staffing capabilities, alternative locations, equipment, systems, network, applications and data components required to ensure the continuity and resumption of critical ETTM System processes.
1297	The BCP shall include but not be limited to:
	• recovery point objective (RPO) maximum acceptable amount of data loss for all critical ETTM System Services after an unplanned data-loss incident;
	• recovery time objective (RTO) maximum acceptable amount of time for restoring a critical ETTM System Services and regaining access to data after an unplanned disruption;
	• level of service (LOS) the combination of throughput and functionality required to sustain ETTM System business Operations;
	• detailed description of how site and System security shall be maintained to ensure continued compliance with security Requirements; and

	• response plan in the event of a security breach or cyber-attack at the roadside network, or either RSS sites in accordance with Authority Information Technology Services policies and standards.
1298	Changes to the BCP shall be reflected in the Plan within thirty (30) Days of Approval. Contractor shall distribute the BCP to Authority and BOS Contractor.
1299	Contractor shall coordinate with the BOS Contractor to ensure that the BOS, the DRP and the BCP will work to efficiently support Authority's continued operations.
1300	The BCP shall be submitted for Approval by Authority as a part of the DRP in accordance with the Approved Baseline Implementaton Schedule.
1301	Contractor shall participate in the annual Business Continuity testing with the BOS Contractor.

2.6.4.9 Master Test Plan (MTP) and Test Procedures

Contractor shall develop and submit a comprehensive testing plan that describes the different test phases, Contractor's testing concepts and approach and the administration of each test. The Master Test Plan (MTP) outlines the scope and testing concepts to be used to validate the ETTM System compliance to this Scope of Work and Requirements, including integration to the BOS, external entities and Interoperable Agencies, compliance to all standards and migration and transition of the ETTM System.

1302	Contractor shall develop and submit an MTP to Authority' for Approval that details the testing methodology utilized by Contractor to demonstrate that the ETTM System satisfies the requirements of this Scope of Work.
1303	The MTP shall cover testing of all aspects of the ETTM System and shall describe all test phases, scope and procedures to validate the ETTM System compliance to the Requirements, including but not limited to:
	• overall approach to testing;
	• approach for each test;
	• detailed schedule for each test, identifying each test activity and resource;
	• methodology for testing the Performance Requirements and sample size for each phase of testing;
	• approach for how data sets for each test are created including data needed to simulate logical days and cycles;
	• Software test automation tools utilized for each test;
	• purpose, scope, location, system environment, and duration of each test;
	• approach to validating all System Requirements through the testing methodology;
	• approach to validating all System Business Rules through the testing methodology;
	• describe the entry and exit criteria for each test;
	• document the severity and Priority descriptions and levels for each test;
	• include a detailed schedule for each test identifying each test activity and resource;
	• describe the methodology for testing the Performance Requirements and sample size for each phase of testing;

	• describe the methodology for load testing;
	• describe the purpose; scope; duration; System resources, and human resources for all tests identified in this Scope of Work and Requirements;
	• approach to validating all reporting Requirements;
	• approach to end-to-end testing, validation and Reconciliation;
	• approach to data migration testing, compliance to standards, correction of defects and Software release;
	• log testing to ensure the appropriate level of information logging is occurring, particularly when exceptions occur. The MTP needs to identify which tests validate the logging Requirements;
	• end-to-end testing to ensure processes, transactions/trips and their interaction are tested through their final stages or disposition;
	• approach to interface testing to BOS, Interoperable Agencies and Third-Party Service Providers and Business Partners;
	• system performance and adherence to Performance Requirements;
	• redundancy/failover aspects;
	• DR aspects;
	• cross-channel testing to ensure testing is not only performed for each interface individually, but also that testing is performed across each interface to ensure consistent presentation and processing;
	• describe the entry and exit criteria for each test;
	• document the severity and priority descriptions and levels for each test;
	• document how defects shall be triaged; tracked; reported; resolved, and retested, including tools used to document defects, and
	• a set of regression test procedures that shall be exercised each time Software changes are made after the Approval of the FAT.
1304	Contractor shall provide a detailed Test Plan for Authority's Approval for each testing phase outlined in the Requirements and Approved MTP, including but not limited to:
	• test logistics including test vehicles; drivers and test Equipment;
	• inventory of test cases for manual tests and/or test scripts for automated tests;
	• test entry and exit criteria;
	• test preparation;
	• test data creation;
	• periodic status meetings;
	• All necessary facilities; materials and supplies as applicable;
	• all necessary personnel and
	• all necessary Hardware and Software.
1305	Contractor shall provide test cases for Authority's Approval for each testing phase outlined in the Requirements and Approved MTP, including but not limited to:
	• test case ID;

	• test case description;
	• related requirements;
	• assumptions:
	• test data (variables and their values);
	• steps to be executed;
	• expected results;
	• actual results;
	• pass/fail; and
	• comments.
1306	Authority's Approval of any aspect of testing shall not relieve Contractor of its responsibility to meet the full terms and conditions of the Agreement.
1307	Contractor shall update the RTM linking every Requirement to a set of test cases to demonstrate the Requirement has been satisfied and which test satisfied the Requirement.

2.6.4.10 Health and Safety Plan

1308	Contractor shall develop, implement, and maintain a comprehensive task-specific written Health and Safety Plan and shall fully describe in the Health and Safety Plan the Contractor's policies, plans, training programs, worksite controls, incident response plans and enforcement for the health and safety of personnel involved in the Services and the general public affected by the Services during the Agreement Term.
1309	The Health and Safety Plan shall be consistent with the insurance requirements for the Services.
1310	Contractor shall develop and submit the Health and Safety Plan to Authority for Approval that documents Contractor's approach to health and safety as set forth in this Scope of Work and Requirements, include but not be limited to:
	• describe the participation of safety personnel in all Work activities;
	• describe Contractor's plan to comply with Design-Builder's safety and security procedures;
	• delineate administrative responsibilities for implementing the safety program;
	• identify responsibilities and accountability;
	• identify safety professionals or managers covering all Services;
	• describe the process of conducting safety orientation for all employees;
	• describe the Contractor's drug policy, including the policy at the Site and any pre-job Site and post-incident drug testing to satisfy Agreement insurance requirements. Provide policy for promoting a safe, drug and alcohol abuse-free workplace. The policy must be consistent, fair, manageable, and subject to audit. Allow for disciplinary action or termination for an employee reporting for performance of the Services under the influence of alcohol or a prohibited substance or possession of a prohibited substance;
	• describe employee health and safety training requirements;

	• describe safety inspection procedures of Work areas, materials, and equipment to ensure compliance with the safety program, methods of record keeping, and correction of deficiencies;
	• describe incident and emergency response procedures for all potential incident types and locations, including response capabilities, evacuation and egress, responsibilities for reporting and investigating incidents, exposures, contingency plans, and the maintenance of safety-related logs;
	• describe incident reporting procedures;
	• describe Contractor's Site control policy and plans for maintaining Site cleanup, on-Site first aid facilities or medical clinic and safe access;
	• identify public safety requirements (e.g., fencing, signs, barricades);
	• describe Contractor's hazard communication program;
	• describe Contractor's method of tracking open safety issues;
	• describe hazard analysis, tracking, reduction of risk, logs, and mapping procedures;
	• describe personal protective equipment (PPE) requirements and policy; and
	• describe safety procedures for Contractor's employees working around and handling hazardous materials.
1311	The Health and Safety Plan shall clearly establish the specific chain of command and specify the lines of authority, responsibility, and communication with regard to safety compliance activities. The Health and Safety Plan shall specify which onsite personnel have the authority to stop onsite activities when unanticipated and/or uncontrolled hazards are recognized and also address those personnel with the authority to restart Site activities after the previously unrecognized hazards have been controlled. The Contractor Project Manager and Operations and Maintenance Manager shall be responsible for safety, health, and environmental performance. The Health and Safety Plan shall specifically define the safety responsibilities of each level of supervision.
1312	Contactor shall establish standard operating procedures to guide employees in safe Work practices. Contractor shall train and provide instruction to all employees, including managers and supervisors, on general and job-specific safety and health practices. Workplace safety and health training practices must include, at a minimum, the following:
	• measures for reporting any unsafe conditions, Work practices, and injuries;
	• use of appropriate clothing, including gloves, footwear, and PPE;
	• information about chemical hazards to which employees could be exposed and other hazard communication program information;
	• availability of toilet, hand-washing, and drinking water facilities; and
	• provisions for medical services and first aid, including emergency procedures.

1313	The Health and Safety Plan shall provide safety and health policies and procedures that clearly communicate and are understood by all employees, and that require all employees use safe Work practices; follow all safety directives, policies, and procedures; and play an active role in maintaining a safe Work environment. Managers and supervisors will enforce the rules fairly and uniformly. The Health and Safety Plan shall provide, and Contractor shall implement, a disciplinary policy for all employees who fail to comply with safe and healthful work practices.
1314	The Health and Safety Plan shall include emergency action procedures for each identified potential emergency, notification requirements, and training, and shall identify those individuals responsible for implementing the procedures in the event that the emergency is realized. The potential for an emergency (fire, explosion, chemical release, etc.) exists on all Sites or areas where the Work is being performed. The emergency action procedures must identify the various response activities necessary to minimize the dangers and confusion associated with an emergency. The emergency action procedures must address fire, explosions hazardous materials, natural disasters, and civil disruptions.
1315	The Health and Safety Plan shall include a section describing the policies and procedures to be implemented to protect employees, the public, property, equipment, and Services supplies.
1316	As part of the Health and Safety Plan, Contactor shall an Office Safety Plan to Authority for review and Approval. The Office Safety Plan shall describe Contractor's policies, plans, training programs, emergency response plans and enforcement of safety throughout the Operations and Maintenance Phase. The Office Safety Plan shall include at a minimum the following information:
	• standard procedures to guide employees in safe Work practices;
	• description of the process of conducting safety orientation for all employees;
	• employee training requirements;
	• drug policy, including the policy at the Site and any pre-employment and post-incident drug testing;
	• consistency with the Contract insurance requirements and any other applicable Contract requirements;
	• description of accident prevention plans; and
	• emergency management and evacuation procedures.
1317	As part of the Health and Safety Plan, Contactor shall a Roadside Safety Plan to Authority for review and Approval. The Roadside Safety Plan shall comply with all applicable Governmental Rules and best management practices for any roadside maintenance and operations activities performed by Contractor. The Roadside Safety Plan shall include the following, at a minimum:
	• Standard Operating Procedures to guide employees in safe work practices;
	• demonstration of consistency with Agreement insurance requirements and any other applicable Contract requirements;
	• participation of safety personnel and competent persons in all roadside maintenance activities;
	• employee training requirements and description of the safety orientation process;

	• incident reporting procedures and method of tracking safety issues;
	• method of identifying and tracking safety hazards;
	• identification of any public safety requirements;
	• cell phone safety;
	• required safety training and certification processes;
	• drug policy, including the policy at the roadside site and any pre-employment and post-incident drug testing; and
	• personal protective equipment requirements.

2.6.4.11 Maintenance Plan

Contractor shall submit a Maintenance Plan comprised on the plans listed below that describe how Contractor plans to perform Maintenance of the ETTM System in accordance with the terms and conditions of the Agreement. Contractor shall have appropriate Documentation available to all Operations and Maintenance personnel, as required to perform their respective duties.

2.6.4.11.1 System Maintenance Plan

1318	Contractor shall develop and submit the System Maintenance Plan to Authority for Approval that defines the approach to services, staffing and resources to fulfill the System Maintenance Requirements. Contractor shall identify Contractor's maintenance responsibilities and shall include but not be limited to:
	• organizational structure, organizational chart and job descriptions and responsibilities;
	• staffing Plan;
	• approach to training;
	• detailed System monitoring Requirements;
	• staff schedule and locations;
	• third-party system support agreements overview;
	• schedule of all System Maintenance activities, including Preventive Maintenance and anticipated Enhancement releases;
	• description of all System Maintenance related communication methods;
	• Maintenance procedures, communication protocols and approval processes for System Upgrades, Software deployments, scheduled Preventive Maintenance activities, change management and scheduled downtime;
	• Maintenance procedures and communications protocols for unscheduled downtime;
	• communication protocol for coordination with Interoperable Agencies, Third-Party Service Providers, Business Partners, Authority, and others, as directed by Authority;
	• communication protocol for coordination with Authority's other toll system vendors;
	• trouble reporting processes, notification protocols for issues and failures, and maintenance reporting processes;

	• prioritization, response, escalation, and repair processes;
	• spare parts quantities, Software warranty tracking, and returned material processes;
	• monitoring the MOMS Dashboard;
	• monitoring Maintenance performance for compliance with Performance Requirements;
	• sample Maintenance reports and reporting processes;
	• safety procedures and personal protective equipment;
	• processes for supporting internal and external audits;
	• security policies, including remote access, laptop access, etc.
	• system intrusion monitoring and safeguards;
	• equipment replacement/refresh schedule;
	• Upgrades to third-party Software and tools;
	• process in place to meet Maintenance Performance Requirements;
	• Traffic Management Plan; and
	• Annual System Certification Plan.

2.6.4.11.2 Software Maintenance and Warranty Plan

1319	Contractor shall develop and submit a Software Maintenance and Warranty Plan that defines the approach to services, staffing and resources to fulfill the Software Maintenance and warranty provisions as set forth in the Agreement, including but not limited to:
	• organizational structure, organizational chart and job descriptions and responsibilities;
	• staffing Plan;
	• approach to staffing and training;
	• approach to receiving and prioritizing Software defects (bugs);
	• reporting, categorization, prioritization, and disposition of Software defects;
	• coverage and personnel locations;
	• all Software Maintenance related communication methods;
	• Maintenance procedures, communication protocols and approval processes for Software Upgrades, scheduled Maintenance activities, change management and scheduled downtime;
	• Documented change control procedures;
	• Maintenance procedures and communications protocols for unscheduled downtime;
	• trouble reporting processes;
	• escalation processes;
	• sample Maintenance reports;

	• Software Updates and testing to comply with Interoperable Agencies' specification changes, and third-party interface changes;
	• Software and security Updates, remediation and testing to be compliant to PCI and Authority Audit Requirements and
	• process in place to meet Maintenance Performance Requirements.

2.6.4.12 Operations Plan

1320	Contractor shall develop and submit an Operations Plan to Authority for Approval that documents Contractor's approach to all aspects of the operations of the ETTM System in as set forth in this Scope of Work and Requirements, include but not be limited to:
	• identification of each Service and activity to be provided;
	• details for performing the Operations and Maintenance Phase Services (staffing levels, equipment lists, supplies list, use of Subcontractors, other service contracts, etc.);
	• description of how Performance Requirements are monitored, attained and maintained in accordance with the QA Plan;
	• description of how business emergencies (including higher level of expected phone calls, degraded mode) will be addressed including notification, coordination with BOS, manual work-arounds, back-up procedures and emergency approvals;
	• general guidelines and organization of Standard Operating Procedures (SOPs), and training manuals;
	• report structures, schedules, and deliverables;
	• coordination with Authority;
	• pre-Go-Live schedule;
	• Go-Live checklist;
	• ramp up plan;
	• identification of efficiencies and process for implementation;
	• management commitment to ongoing service;
	• adjustment of staffing levels based on increases or decreases in the volume of manual image reviews, maintenance work, etc; and
	• QA/QC and continuous improvement processes
1321	As part of the Operations Plan, Contactor shall submit written Standard Operating Procedures (SOPs) to Authority for Approval. The SOPs shall detail all procedures necessary for administration and operations of the ETTM System. SOPs shall be organized to include, at a minimum, the following:
	• ETTM System administration and support;
	• ETTM System Maintenance;
	• BOS interface, human interaction and issue resolution;
	• trip building;
	• manual image review and

	• TOC Operations
1322	Contractor shall update the SOPs annually throughout the Operations and Maintenance Phase or more frequently as necessary to reflect any changes to the procedures and Business Rules. Contractor shall keep a running list of changes to SOPs. Annual updates to the SOPs shall be reviewed and Approved by Authority.
1323	As part of the Operations Plan, Contractor shall prepare and submit an Incident Management Plan to Authority for review and Approval. The Incident Management Plan shall be designed to assist in providing timely, safe and effective management of and response to vehicle accidents and other significant incidents that occur in the Express Lanes or affect the operation of the ETTM System. The Incident Management Plan shall, at a minimum, account for varying incident scenarios and include solutions and strategies for each scenario. The Incident Management Plan shall clearly define roles and responsibilities along with procedures, and timeframes. The Incident Management Plan shall be developed through workshops, coordinated by Contractor, with Caltrans, CHP, local first responders and other interested stakeholders. The Incident Management Plan will clearly define the actions to be taken for incidents: changing the messages on the Toll Rate CMS, coordination of updates to the customer website, coordinating Toll Rate CMS and other CMS messages with Caltrans, CHP and the Freeway Service Patrol. The Incident Management Plan shall address the steps taken to restore full operations, report on the incident including gathering information about any third parties that have caused or contributed a loss in toll revenue and/or damage to the facility or Equipment.
1324	As part of the Operations Plan, Contractor shall prepare and submit an Express Lanes Performance Monitoring Plan to Authority for review and Approval. The Express Lanes Performance Monitoring Plan shall identify Contractor's procedures for monitoring speeds, throughput and traffic flow and shall describe, at a minimum, how Contractor will manage unanticipated events. Average hourly speeds and volumes shall be plotted throughout the day relative to the minimum allowed speed. The Express Lanes Performance Monitoring Plan shall enumerate the various types of reporting that will be provided on a monthly, quarterly and annual basis that includes trends on: traffic volumes, speeds, travel times, HOV 3+ usage, incidents, toll rate variations, and anticipated revenue collection compared to latest forecasted traffic and revenue estimates.
1325	As part of the Operations Plan, Contractor shall prepare and submit a KPI Reporting and Management Plan to Authority for review and Approval. The KPI Reporting and Management Plan shall describe how Contractor shall monitor, calculate, audit, report and handle KPIs. The KPI Reporting and Management Plan shall detail how the daily, weekly, and monthly indicators are measured and reported. The KPI Reporting and Management Plan shall include, at a minimum, strategies for mitigation where KPIs are not being met and remediation measures for meeting KPIs.

2.6.4.13 Training Plan

Contractor shall provide a train-the-trainer program to educate Authority, the BOS Contractor, and others on the ETTM System and operations. Contractor is responsible for providing a Training Plan that describes the approach to training activities. The Training Plan shall include all aspects related to training, including details of all training techniques, schedule, training materials, and all activities required for initial training prior to Go-Live and remedial training after Go-Live.

1326	Contractor shall develop and submit a Training Plan to Authority for Approval.
1327	The Training Plan shall describe the plan for a train-the-trainer program for BOS Contractor and other Authority-designated individuals and shall outline the required operational/Maintenance and System knowledge for each position to be gained from the training.
1328	For each position/user type, the plan shall include a training instructor guide, training manual and other materials to be used in training. The Training Plan also shall include a schedule for follow-up training and continuing education for staff.
1329	The Training Plan shall provide a plan for cross-training staff from other areas of Operations or management for peak period, emergency or temporary assignments to provide for staff redundancy. The Training Plan also shall include the training schedule for regular staff training and continuing education/training.
1330	Contractor shall submit a Training Plan that shall address the following areas including but not limited to:
	• overall description of the training program;
	• training techniques;
	• training delivery schedule;
	• names and descriptions of each training class;
	• purpose of each training class;
	• who should attend the class;
	• qualification requirements for trainer;
	• minimum qualifications for personnel attending the class;
	• duration of the class;
	• training materials, including syllabus, schedule, training goals, manuals, guides, other support materials and techniques to be used;
	• data preparation, such as users and test transactions/trips;
	• required Equipment and
	• facility requirements.
1331	Courses shall be limited to a maximum of eight (8) hours per Day.
1332	The Training Plan shall consider the need for Authority to maintain existing operations on existing systems while training existing operations staff on Contractor's System; Contractor shall hold multiple sessions of each training Module such that some Authority staff can attend training while others are handling existing operations.
1333	Contractor shall be responsible for maintaining a training database baseline and supporting data files that can be restored at the beginning of each training session.
1334	The Training Plan and training materials shall be updated if the system is modified after installation.
1335	Contractor shall be responsible for providing training for any changes in the system.
1336	Contractor shall be responsible for providing remedial training as needed to ensure that staff are knowledgeable about the Program.

2.6.4.14 Third-Party Documentation

Third-party Documentation includes standard commercial Documentation for third-party provided Hardware, Software, Services and materials.

1337	Contractor shall provide and maintain standard, commercially available, updated Documentation for third-party provided Hardware, Software, Services and materials provided under this Agreement. This set of third-party Documentations shall be available upon request.
1338	An electronic copy of all third-party Commercial Off-the-Shelf (COTS) Hardware and Software installation and user manuals, with updates, shall be provided to Authority. Acceptable electronic formats are Microsoft Office 2010 Suite or higher, unsecured Portable Document Format (PDF) and professional CAD applications.
1339	Contractor shall provide one (1) hard copy of all Hardware and Software installation and user manuals for custom-developed (non-COTS) third-party products and services.

2.6.4.14.1 Third-Party Software Documentation

1340	Contractor shall provide third-party Software Documentation, including but not limited to:
	• all user manuals;
	• programmer's reference manuals;
	• warranty Documentation;
	• installation manuals;
	• Interface documents;
	• Maintenance manuals and
	• any other information required to utilize the Software, such as the operating System, utilities, programming languages, application Software and communications Software.
1341	The third-party Software Documentation shall be provided by Contractor in a standard and organized format, with appropriate labels, tabs and cross references to allow Authority to easily access and reference information on each Software component on the System.

2.6.4.14.2 Third-Party Hardware Documentation

1342	Contractor shall provide third-party Hardware Documentation, including but not limited to:
	• all technical manuals;
	• operator's guides;
	• installation guides;
	• warranty Documentation;
	• Hardware reference manuals;
	• available options and versions;
	• catalogs, components and
	• illustrated parts lists.

1343	Contractor shall provide all third-party Hardware Documentation in a standard and organized format, with appropriate labels, tabs and cross references to allow Authority to easily access and reference Hardware information on each Equipment component.
1344	Third-party Hardware Documentation shall include sufficient detail to describe the configuration of the Hardware as it was installed by Contractor for the ETTM System.

2.6.5 Manual Requirements

Various manuals shall be provided as described below to allow Authority to understand the Operations of the ETTM System, including the Roadside System and RSS. New manuals developed under this Agreement that are not standard commercial catalogs or manuals, shall meet the Requirements set forth in this section.

1345	Contractor shall submit the Project manuals to Authority for review and Approval in accordance with the Approved Baseline Implementation Schedule.
1346	Whenever possible, all data shall be printed on 8-1/2" x 11" sheets; foldouts shall be 11" x 17".
1347	Each manual shall include, but not be limited to:
	• a title sheet;
	• revision history;
	• table of contents;
	• list of illustrations (if applicable);
	• list of reference drawings and Exhibits (if applicable) and
	• a parts list (if applicable).
1348	All manuals shall have a consistent look and feel and shall be professionally written and presented in clear and organized fashion.
1349	All manuals prepared for Authority under this Agreement shall be produced, or editable, using Microsoft Office 2010 Suite (or higher). In addition, electronic copies of manuals shall be provided in native file format and unsecured and indexed PDF, if requested by Authority.
1350	Any special Software required to produce scalable typefaces or other graphs shall be provided by Contractor as part of the Documentation for the manuals.
1351	All manuals shall be submitted and Approved as a condition of Go-Live.

2.6.5.1 Manual Submissions and Quantities

1352	Contractor shall submit one (1) hard copy of each of the manuals listed below.
1353	Contractor shall submit electronic copies of all manuals in the Authority-provided EDMS.
1354	Contractor shall be responsible for producing an additional quantity of the manuals for Contractor's use, sufficient to fulfill Contractor's Requirements under the Agreement.
1355	Contractor shall submit the draft and final manuals described below for Authority's review and comment, in accordance with the Approved Project Implementation schedule. All final versions of manuals shall be provided and Approved before Go-Live.

2.6.5.2 Manuals to be Submitted

2.6.5.2.1 ETTM System Maintenance Manual

1356	Contractor shall develop and submit an ETTM System Maintenance Manual prepared for properly trained technical personnel (including Authority personnel) assigned to the Maintenance of the Hardware and Software installed under this Agreement. The Maintenance Manual shall be based on and consistent with the Maintenance Plan.
1357	The ETTM System Maintenance Manual shall document information required to support Roadside Maintenance and repair activities, including but not limited to:
	• lane Equipment layout for each ETTM Site type;
	• schematics and layouts of the Hardware in the lane cabinets, Equipment racks and the interconnection diagrams;
	• parts lists required to service each piece of Hardware installed under this Contract;
	• general and detailed description and concepts of lane Operations and functions;
	• detailed lane monitoring activities, specialty tools and schedule;
	• detailed Software monitoring activities and troubleshooting procedures;
	• Maintenance instructions to repair and replace parts and modules;
	• mechanical functions and installation of all Hardware;
	• listing of all event and error logs;
	• testing and basic troubleshooting procedures and
	• Preventative, pervasive and corrective Maintenance procedures.
1358	The ETTM System Maintenance Manual shall document information required to support RSS monitoring, including but not limited to:
	• all Dashboards, monitoring screens, notifications and data that needs to be checked;
	• listing of all jobs/process, their dependencies and their schedule;
	• listing of all folders and directories that need to be checked;
	• details related to the activity that needs to be checked;
	• frequency of the validations;
	• actions to take when results are not as expected;
	• notification and escalation process;
	• basic troubleshooting procedures, and
	• creation of work orders in MOMS.
1359	The ETTM System Maintenance Manual shall provide a description about the tools and Software for personnel to record the monitoring activity and instructions to use the tools/Software.
1360	The ETTM System Maintenance Manual shall document information required to support RSS Maintenance and repair activities including but not limited to:
	• detailed Hardware Maintenance activities and schedule;
	• detailed database Maintenance activities and schedule;

	• detailed Software monitoring activities and schedule;
	• detailed monitoring procedures for file transfers and exception handling;
	• detailed procedures and processes for all Maintenance activities;
	• detailed procedures for backup, archiving and purging of data;
	• detailed procedures for testing DR systems;
	• detailed schedule for desktop and peripheral Preventive Maintenance activities;
	• detailed schedule for all Preventive Maintenance activities;
	• technical contact lists for all external interfaces and Authority staff;
	• technical contact lists for Hardware and Software providers and
	• details and copies of all third-party System support agreements.
1361	Standard service manuals for commercial products used for the equipment shall be acceptable if they contain sufficient information to properly service the equipment.
1362	Large-size logic diagrams and mechanical assembly diagrams do not have to be reduced or incorporated into the manuals if these drawings are provided with the manuals and presented in a useable and durable form.
1363	Photographic Documentation of Equipment with appropriate labels and call-outs are satisfactory if they contain sufficient information to properly identify components, parts and features.

2.6.5.2.2 Reconciliation and Audit Manual

1364	The Reconciliation and Audit Manual shall detail all procedures used to reconcile the System and audit the toll collection Operations.
1365	The reconciliation of electronic transactions and revenue within the System and reconciliation of transactions to the BOS shall be fully described.
1366	Investigation of variances, discrepancies and exceptions processing shall be described.
1367	A detailed description of the screens, reports, and functions shall be provided that will allow a qualified auditor to access, understand and work with the all financial aspects of the System.
1368	A complete description of all audit procedures and a non-technical description of the screens, reports, and functions shall be provided.
1369	The manual shall contain illustrations and pictorial diagrams to demonstrate the step-by-step Operations required for performing the audit and reconciliation functions.
1370	The manual shall contain Quality Control and audit procedures to ensure Systems, Maintenance, and Operations meet the Performance Requirements.
1371	Samples of all reports shall be included in an attachment to the manual with any specific instructions that may be applicable to a given report. Reports included in the Submittal shall have correct and accurate data and this manual shall be used to train the auditors to validate the System.

2.6.5.2.3 Roadway Support Systems (RSS) Administrators Manual

1372	Contractor shall provide an RSS Administration Manual that serves as a guide to the overall management and administration of the RSS and shall include:
	• description of the programs and processes that need to be monitored to ensure that the System is operational;
	• procedures for validating tasks, processes and jobs have successfully completed, and errors and exceptions encountered;
	• procedures for validating the successful transfer and receipt of files for all interfaces, including RSS and BOS;
	• a listing of all the error codes, their meaning and potential associated problems shall be included in the manual, with a step by step guide to troubleshooting and correcting the problem, including any specialty tools and/or Software currently in use to debug, validate and correct the problem;
	• all database Design, and database Maintenance activities required to keep the System operational shall also be clearly documented, including the scheduling of such activities;
	• detailed procedures for backup, archiving and purging data;
	• detailed schedule for all Preventive Maintenance activities;
	• technical contact lists for Hardware and Software providers;
	• detailed procedures for monitoring System security;
	• details and copies of all third-party System support agreements;
	• ad-hoc reporting tools and use of the tools to generate ad-hoc reports shall be documented, and
	• details of monitoring tools supplied by Contractor to include but not be limited to Roadside and MOMS Dashboards and MOMS.

2.6.5.2.4 ETTM System User Manual

Contractor shall develop and provide a comprehensive set of System Documentation and user manuals for the ETTM System users. At a minimum, the Documentation shall include all user and training manuals, screen layouts, reports definitions and data flow diagrams.

1373	Contractor shall develop and submit ETTM System User Manuals to be used by Authority staff to operate the ETTM System and for training purposes.
1374	Contractor shall develop a separate manual for each job category that details all the processes, procedures and policies developed by Contractor and Approved by Authority required to fulfill the Requirements of each specific job description.
1375	The manual shall include screen images detailing the step-by-step activities that need to be completed in order to fulfill a specific functionality.
1376	The manual shall not include any information that could jeopardize the integrity of toll collection Operations or the ETTM System.
1377	Each User Manual shall include but not be limited to:
	• step-by-step actions to take to complete an operation;

	• screen images detailing the step-by-step activities needed to fulfill a specific functionality;
	• flowcharts to provide Authority staff a clear understanding of the workflow;
	• all screens, reports and data fields, clearly explained using sample formats applicable to the RSS; and
	• samples of all reports, included in the manual or as an attachment to the manual, with any specific instructions that may apply to a given report.

2.6.5.3 As-Built Documentation

Prior to Authority Acceptance of each Corridor, Contractor shall provide Documentation of each Corridor. Within 90 Days of Go-Live, Contractor shall provide As-Built Documentation that documents the final Roadside System Design and implementation.

2.6.5.3.1 System Detailed Design Document

1378	After the Approval of the Operational and Acceptance Test for each Roadside System and prior to Authority Acceptance of the ETTM System, Contractor shall submit the As-Built SDDD that includes all Software and Hardware changes made during the System development, implementation, and testing phases.
1379	Contractor shall submit two (2) hard copies in addition to the electronic version of the As-Built SDDD.

2.6.5.3.2 As-Built Drawings

1380	Contractor shall provide to Authority a complete set of As-Built Drawings which shall be delivered as two (2) full-size and five (5) half-size complete sets of prints, and shall deliver the same in electronic format for all Equipment installed and furnished under this Agreement.
1381	As material changes are made to the System Contractor shall update the As-Built Drawings to reflect the current status.
1382	The sets shall include, but not be limited to:
	• all schematics;
	• logic diagrams;
	• layouts;
	• wiring diagrams;
	• interconnection diagrams;
	• all attachment Hardware details;
	• installation diagrams;
	• cable schedule;
	• Interface details;
	• facility installation details and
	• network diagrams, so as to provide a complete record of the As-Built status of the Equipment.

1383	All drawing revisions to standard commercial assemblies or components of the Equipment shall be included in the As-Built Drawing set.
1384	All As-Built Drawings shall contain a table of contents that shall include a listing of all drawings with headings for drawing number, drawing title, revisions number and date, and the type of material list, wiring diagram, wire list, specification control drawing, or similar categories.
1385	Contractor shall update the latest drawings with red lines as changes are incorporated during the installation process. At the completion of the installation, Contractor shall gather all red line drawings.
1386	The red line drawings shall be verified and incorporated into a final As-Built Drawing package. This final As-Built Drawing package shall include all updated installation drawings, shop drawings and sketches, Plans and other drawing types that were used to install the Roadside System.
1387	All other Documentation used regarding the installation also shall be finalized and submitted as part of the As-Built Drawing Submittal.

2.6.6 Quality Assurance Program

Contractor shall establish and maintain an effective Quality Assurance (QA) program on all aspects of the Project to ensure compliance with the Agreement. This Quality Assurance Plan shall detail the process and procedures instituted by Contractor to ensure the QA program is in place.

1388	Contractor shall establish and maintain an effective Quality Assurance (QA) program that ensures adequate quality throughout all areas of Project performance.
1389	All supplies and Services under this Agreement, whether manufactured or performed within Contractor's facilities or at any other source, shall be controlled by Contractor at all points necessary to ensure conformance to the terms and conditions of the Agreement.
1390	Purchase, delivery, verification, testing and assembly of Equipment, Hardware and Software conducted within Contractor’s facilities and onsite shall be controlled completely by Contractor.
1391	Delivery, verification, testing and assembly of servers and network Equipment conducted within Contractor’s facilities shall be controlled completely by Contractor.
1392	The QA program shall provide for the prevention and early detection of discrepancies and for timely and positive corrective action.
1393	The QA program shall include effective Quality Control of purchased materials and Subcontracted Work.
1394	Contractor shall make objective evidence of quality conformance readily available to Authority, and Authority shall have the right to review and verify Contractor’s compliance to the process.

2.6.6.1 Records

1395	Contractor shall maintain records or data essential to providing objective evidence of quality until the expiration of the Agreement and these records shall be made available to Authority upon request.

1396	Quality-related records and data shall include but not be limited to:
	• inspection and test results;
	• records of Subcontractor QA programs;
	• cost records pertinent to Acceptance of nonconforming material;
	• inspection check-off of Constructor work;
	• change request Documentation;
	• Design reviews and walkthroughs and
	• results of internal and Contractor audits.
1397	Records shall be maintained in a manner that allows for easy access and analysis of the status of the overall QA Program.

2.6.6.2 Control of Purchase

1398	Contractor shall be responsible for ensuring that all supplies, components, developmental tools, assemblies, subassemblies, and Services procured from Subcontractors and vendors conform to the technical requirements and Agreement.
1399	Contractor shall have a Quality Control process in place for tracking and handling non-conforming Equipment and products.
1400	Contractor's responsibility includes the establishment of procedures for the selection of qualified Suppliers. In selecting qualified Suppliers, Contractor shall ensure that the Subcontractors and vendors control the quality of the supplies and Services provided.

2.6.6.3 Handling, Storage and Delivery

1401	Contractor shall document the approach to assembly of the Equipment, including the location where Equipment and Systems are assembled.
1402	Contractor's QA Program shall provide for adequate and documented handling, storage, preservation, packaging, and shipping instructions to protect the quality of products.
1403	All Authority assets shall be tracked and entered into the MOMS inventory and the location of each asset shall be recorded. The assets shall have a phone number where they can reach Contractor if they have questions about the Equipment.
1404	Contractor shall identify and bring to Authority's attention any unique or special requirements applicable to procured items. In addition, these special requirements should be noted in the bill of materials, purchase orders or other appropriate Documentation.
1405	Contractor shall provide all procurement documents to Authority upon request.

2.6.6.4 Inspection at Subcontractor-Vendor Facilities

1406	Authority reserves the right to inspect, at the source, supplies or Services not fabricated or performed within Contractor's facility.
1407	Authority's inspection shall not constitute Acceptance, nor shall it in any way replace Contractor's inspection activity or relieve Contractor of the responsibility to furnish an acceptable end product.

2.6.6.5 Access to/Inspection of Contractor's Facilities

1408	Authority reserves the right to inspect Contractor's facilities unannounced. Access to Contractor's facilities shall be limited to normal business hours, unless arrangements with Contractor have been made in advance.
1409	Authority reserves the right to inspect, at the source, supplies or services not manufactured or performed within Contractor's facility.
1410	Authority's access to Contractor's facilities shall be restricted to those portions of the facilities and personnel involved with or who are otherwise performing Work under this Agreement.
1411	Authority's inspection shall not constitute Acceptance or Approval, nor shall it in any way replace Contractor's inspection activity or relieve Contractor of the responsibility to furnish an acceptable end product.

2.6.7 Training

Contractor shall provide comprehensive training for all aspects of the ETTM System, including but not limited to the Operations, System monitoring, problem detection and resolution, reconciliation and audit, and Maintenance of the ETTM System. The training program will recognize and incorporate the plan for Authority to operate the ETTM System. As such Authority staff will be fully trained to successfully perform all aspects of the toll collection Operations. Training shall be delivered to Authority's personnel and Contractor's personnel. Training shall be ongoing throughout the entire Agreement Term.

Contractor shall provide "Train the Trainer" classes to enable Contractor to deliver training to its resources. Contractor shall train Contractor's designated trainers on an Approved, periodic basis, and whenever new functionality is made available in the ETTM System.

2.6.7.1 Overview of Training Program

1412	Contractor shall be solely responsible for supplying all items necessary, including but not limited to training Documentation, Software, Hardware and any other Equipment required to complete the delivery of the training program.
1413	Contractor's program shall include but not be limited to instruction, models/devices, manuals, diagrams and component manuals and catalogs as required.
1414	Where practical and useful, Contractor's training shall be hands on and use actual Hardware and Software in the training environment.
1415	Contractor shall produce all training materials, documents and manuals in hard copies sufficient to provide one (1) copy to each student. Additionally, one (1) reproducible set of the latest documentation shall be provided in electronic form to be used and printed for future training sessions.
1416	Authority shall have the right to attend any training sessions, to be provided all training materials and to make recordings and copies of all training program materials for their use in training new employees.
1417	Contractor shall obtain releases from all employees/Subcontractors to allow unlimited, royalty free use and copies of PII compliant recordings and provide the same to Authority upon request.

1418	Training must be conducted by an experienced training manager with at least five (5) years of experience developing a training curriculum and conducting training.

2.6.7.2 Training Requirements

1419	Contractor shall provide the training courses listed below for Authority's personnel in accordance with the Approved Training Plan, including but not limited to the provision of all training manuals (including Contractor-provided manuals or relevant portions thereof), guides, training aids, as well as student and instructor work books accompanying the courses listed in the sections below.
1420	Authority may require additional courses be offered or additional personnel be provided training. Contractor shall accommodate these requests to the extent possible with onsite personnel and Documentation that is readily available.
1421	Lane level training shall include toll collection training and an overview of toll collection Operations and lane peripherals and creation of transaction data and their flow through the System.
1422	All RSS training shall include a review and description of each of the appropriate RSS processes and procedures with actual RSS Software. All students shall have their own workstation and interact directly with the training environment.

2.6.7.2.1 System Operation Overview

1423	Contractor shall provide a System operation overview training course for Authority's management personnel who require a general understanding of all aspects of the operation, including but not limited to personnel from senior management, procurement, information technology, marketing and public information.
1424	The System Operations training shall include an overview of all aspects of the ETTM System including System architecture, roadside devices, lane Operations, security access and monitoring, RSS Operations, DVAS, MOMS, System Operations, TOD pricing, Occupancy Violation Verification, trip review Verification interface to the BOS network, and any other operational area of the ETTM System.
1425	System Operation Overview training will be conducted in one session with a class size of up to fifteen (15) people, for a minimum of four (4) hours.

2.6.7.2.2 Audit and Reconciliation and Roadway Support Systems (RSS) Operations

1426	Contractor shall provide an audit and reconciliation training course for Authority's Operations and auditing staff to understand all aspects of the operation, particularly those related to audit and reconciliation.
1427	Training shall include step-by-step description of the use of the System application to perform the audit and reconciliation functions.
1428	Course shall include training all personnel who require a detailed understanding of the Operations of the RSS and how to access and view information and reports from the System on items such as status, alarms, performance, transactions and revenue.
1429	Audit and reconciliation and Operations training will be conducted in one (1) session with a class size of up to five (5) people, for a minimum of four (4) hours.

2.6.7.2.3 BOS/CSC Operations

1430	The BOS/CSC Operations training shall be attended by BOS Contractor staff responsible for all Day-to-Day customer service operations and customer interactions. Authority staff may also attend these class sessions. The training shall include instruction, review and description of the processes and procedures relating to BOS/CSC operations activities to ensure that BOS Contractor's staff are able to review ETTM System information normally related to a customer disputes.
1431	Real traffic data and images shall be setup in a training database and sufficient workstations for each training participant shall be used to create real-life examples to reinforce the training activity.
1432	Participants shall be trained on scenarios which may occur on the Express Lanes that could result in customer dispute, including but not limited to, tolls charged for the customer trip; Clean Air Vehicle tolls; operational mode of the lane, and occupancy identification.
1433	Multiple sessions of this course, at varying times to accommodate different shifts, will be required with a class size of up to 12 (twelve) people with a minimum of four (4) hours per training class.

2.6.7.2.4 Image Review Operations

1434	The image review Operations training shall be attended by Contractor staff responsible for the manual image review and verification of compliance with Performance Requirements, including image review clerks, supervisors, and QA staff. BOS Contractor's staff will also attend these class sessions. The training shall include instruction, review and description of the processes and procedures relating to image review Operations activities to ensure that image review Performance Requirements are met.
1435	Real traffic data and images shall be setup in a training database and sufficient workstations for each training participant shall be used to create real-life examples to reinforce the training activity.
1436	Participants shall be trained on image review and trip review verification.
1437	Multiple sessions of this course, at varying times to accommodate different shifts, will be required with a class size of up to 12 (twelve) people with a minimum of eight (8) hours per training class.

2.6.7.2.5 ETTM System Maintenance

1438	To be attended by all Maintenance personnel and Authority staff who require a detailed understanding of the Maintenance and troubleshooting for the ETTM System, including the Roadside System and RSS (DVAS, MOMS, central image servers, etc.). Training shall be a combination of class room and on the job training (OJT).
1439	ETTM System Maintenance training will be conducted in two (2) sessions with a class size of up to eight (8) people, for a minimum of forty (40) hours per session.

2.6.7.2.6 System Monitoring and Roadway Support Systems (RSS) Administration

1440	Contractor shall provide a System Monitoring and Administration training course for all personnel who require a detailed understanding of the System monitoring functions and management and administration of the interfaces, Software, database, applications, configurations and architecture of the RSS.
1441	Contractor shall provide various training programs that include but are not limited to:
	• an in-depth explanation of the System Operations, including all interfaces, file/data transfers and interconnections;
	• functions of the monitoring and tools used to manage monitoring tasks;
	• functions of the DVAS;
	• functions of the MOMS;
	• functions of the ATMS;
	• trip building logic and process;
	• RSS logs, error logs and processing of exceptions;
	• System dataflow and workflow queues;
	• explanation of the Dashboard data and analysis;
	• special use and monitoring tools and
	• queries and reports.
1442	System monitoring and RSS Administration training will be conducted in one (1) session with a class size of up to five (5) people, for a minimum of eight (8) hours.
1443	Contractor shall ensure the System monitoring staff are properly trained in the Requirements of monitoring the ETTM System and its uninterrupted Operations.
1444	Contractor shall provide a minimum of one (1) weeks of classroom and on-the-job training (OJT) to all personnel in their respective area of responsibility before such personnel are assigned monitoring duties.
1445	Contractor shall provide Documentation this initial training has been successfully completed.
1446	All System monitoring personnel shall attend the training sessions. Authority's technical staff also shall attend all training sessions.
1447	Contractor shall keep accurate training records on all Maintenance and Software support services personnel. Authority shall be permitted to review and verify Maintenance and Software support services personnel qualifications and training records at any time. Evidence of completion of training by Contractor personnel shall be provided to Authority upon request.

2.6.7.3 Training Facilities

1448	Contractor shall deliver training at the Authority facilities at a location to be determined in Orange County.

2.6.7.4 Scheduling and Preparation for Training

1449	It shall be Contractor's responsibility to provide sufficient notice to Authority on the types of training it shall provide and work with Authority on the timing for each training session. Authority shall identify a list of participants that Contractor shall notify to schedule their participation in the training.
1450	Contractor shall perform all scheduling activities and shall make every attempt necessary to accommodate the maximum number of persons for each training session given scheduling conflicts. Contractor shall provide sufficient notice to allow participants a reasonable lead time.
1451	Contractor shall notify Authority of the range of dates for training sessions at the ETTM System and shall provide a minimum two (2) weeks' notice to allow participants a reasonable lead time. Authority shall Approve the training schedule.

2.6.7.5 Training Materials

1452	Draft copies of all training materials shall be submitted by Contractor to Authority for review, comment and Approval, prior to final printing of quantities required for training.
1453	Authority shall have the right to require additional interim drafts at no additional cost should draft training materials submitted not be of adequate quality or have missing or incorrect information.
1454	For each course described in the section above, Contractor shall provide the materials listed below.

2.6.7.5.1 Instructor Guides

1455	Contractor shall provide an instructor guide for each training course. The guide shall include the following elements:
	• course agenda;
	• course objective;
	• procedures for managing training session;
	• resource and facilities required, including laptops, power and communications requirements;
	• detailed lesson plans;
	• a description of training aids and items to aid in on the job performance (e.g., where applicable, pocket guides or reference sheets);
	• test to be administered to assure satisfactory completion;
	• instructions for using any audio-visual support Equipment or materials and
	• student survey to obtain feedback on the training sessions and the training materials.

2.6.7.5.2 Training Aids/Devices

1456	Contractor shall provide training aids such as mock-ups, scale models, overhead displays, video demonstrations, and simulations as are necessary to successfully complete the course agenda and meet the course objective.
1457	Contractor shall provide a way for all trained personnel to access training documents, aids and tips in an online, electronic format for ongoing reference.

2.6.7.5.3 Student Workbook

1458	For each course, Contractor shall provide a student workbook, including but not limited to:
	• course agenda;
	• course objectives;
	• schedule of sessions;
	• copies of all overheads and visuals and
	• lesson outlines and summaries.
1459	Contractor shall supplement the material provided in the student workbook with additional material (as necessary), such as operations and user manuals. If such material is used, appropriate cross-references shall be included in the student workbook to identify the complete set of training materials provided to the student.

2.6.7.6 Training Room Set-up and Software Installation

1460	Contractor shall be responsible for loading all Software required to conduct training on the classroom computers (provided by the BOS Contractor).
1461	Contractor shall ensure that the Software is operating as expected on each of the classroom computers.
1462	Contractor shall ensure appropriate communications, such a voice and data, are in place.

2.6.8 Cooperation with Other Contractors and Providers

1463	Contractor shall cooperate to the fullest extent with other Contractors (91 Express Lanes), BOS Contractor, ETTM Contractor, Authority, and Third-Party Service Providers and Business Partners to ensure the ETTM System Implementation and Maintenance and Software Support Services do not conflict with or cause any interruption in capability or service or safety issues to the traveling public, customers, Authority, or existing operations.
1464	Contractor shall cooperate with external parties, as directed by Authority, to support any activity related to the ETTM System Implementation, including but not limited to:
	• Authority;
	• other Interoperable Agencies, states, and parties, as directed by Authority;
	• law enforcement;
	• auditors and
	• all Third-Party Service Providers and Business Partners.

1465	Contractor shall cooperate with and immediately notify Authority (via Authority-provided distribution list) regarding any customer complaints and System issues identified in the Express Lanes or facilities that come to Contractor's attention during the course of Implementation, Testing or Maintenance and Software Support Services.

2.6.9 Coordination with the Design-Builder and Other Civil Contractors

Contractor shall coordinate all design, installation, testing, and maintenance activities with Authority, Design-Builder, any other civil contractors, and Caltrans to ensure all Equipment specifications are addressed in the design and installation of all new or updated roadway infrastructure. In addition, Contractor shall coordinate with any other civil contractors who may be working within or adjacent to the Project area during the Agreement Term.

2.6.9.1 Coordination with the Design-Builder – I-405 Express Lanes

Contactor's coordination with Design-Builder is critical to the success of the project. To that end, this section includes specific requirements related to the Design, review, installation, and inspection of the ETTM Infrastructure provided by the Design-Builder.

1466	Design-Builder is responsible for the design and construction of certain ETTM System Infrastructure, as identified in ***Attachment 10: I-405 EL ETTM System Responsibility Matrix – Design-Builder and TSI***, including the overhead structures/toll gantries, toll equipment pads, vaults, junction boxes, conduit, power, communications, lightning protection, and Contractor shall coordinate closely with Design-Builder.
1467	Contractor shall meet with Authority and Design-Builder to review and discuss civil and structural plans and specifications to ensure the Contractor's complete understanding of the proposed Design-Builder work.
1468	Contractor shall participate in regular meetings with Design-Builder and provide comments on the civil design, construction, and maintenance of traffic required for the Implementation Phase as required by Authority. Contractor shall participate in design reviews, tolling task force meetings, and over the shoulder reviews. Contractor shall update design documents, the Baseline Implementation Schedule, and the Installation Plan, as necessary.
1469	Contractor shall coordinate with the Design-Builder to jointly conduct informal over the shoulder reviews so that the Contractor can check for concept, level of detail, design criteria, and patent flaws during the design process.
1470	Contractor shall submit an ETTM System Infrastructure Design Requirements Document to Authority for review and Approval no later than 90 Days after NTP1. Contractor shall include, at a minimum, the following in the ETTM System Infrastructure Design Requirements Document:
	• Requirements in regard to the overhead structures/toll gantries including weights, clearance, cantilevers, brackets, vibration specifications, routing, etc. for Design-Builder to design;
	• Requirements for locations of Equipment to be mounted on the overhead structures/toll gantries;
	• details for location and sizes for all roadside cabinets;

	• specifications for the roadside cabinet pads and foundations to be designed, provided, and installed by Design-Builder;
	• Requirements for power and communication for all Roadside Systems and ITS systems to be designed, provided, and installed by Design-Builder;
	• specific requirements for Equipment lightning protection and grounding to be provided by Design-Builder;
	• Requirements and locations for lighting in vicinity of each Toll Zone to be provided by Design-Builder;
	• Requirements for UPS and generator and related infrastructure needs for the Roadside System;
	• Requirements for special pavement at toll gantry areas, if any, to be provided by Design-Builder;
	• power/communication and location requirements for Toll Rate CMS and associated roadside cabinet;
	• power/communication and location requirements for the CCTV camera system;
	• power/communication and location requirements for the TDS;
	• Requirements of the of ETTM Communications Network; and
	• any other specific requirements for operations of the ETTM System.
1471	Contractor shall be responsible for ensuring that the locations, positions, installation, connections and other elements of Contractor inputs identified on the ETTM System Infrastructure Design Requirements Document provided by Contractor, for all Contractor and Authority provided Equipment, whether in-roadway, structure/toll gantry mounted, in the Equipment vault or otherwise located are accurate and correct.
1472	The installation Requirements included in the ETTM System Infrastructure Design Requirements Document shall include acceptable tolerances for the System Equipment, including all related plans and documents. The Design-Builder shall rely on the installation Requirements provided by Contractor to Design and construct the overhead structures/toll gantries for the System Equipment to function as intended, and Contractor shall be fully responsible for the accuracy of its installation Requirements.
1473	Contractor shall revise and resubmit the ETTM System Infrastructure Design Requirements Document within 14 days of receiving Authority comments.
1474	The installation Requirements included in the ETTM System Infrastructure Design Requirements Document shall be consistent with those provided in Contractor's Proposal and shall accommodate the Design provided to support the required lane configurations.
1475	Contractor shall certify the installation Requirements included in the ETTM System Infrastructure Design Requirements Document are accurate and appropriate for its intended purpose to the satisfaction and Approval of Authority.
1476	Contractor shall participate in the Design and installation of the ETTM System Infrastructure on the roadways, including but not limited to:
	• provide an ETTM System Infrastructure Design Requirements Document;
	• provide Contractor-furnished materials for the Design-Builder to install;

	• support and supply all information requested by the Design-Builder in the form of request for information (RFI);
	• review all Design-Builder provided drawings with respect to the ETTM System;
	• Approve all aspects of such drawings related to the ETTM System; and
	• ensure the ETTM System Infrastructure provided by the Design-Builder will meet the Requirements set forth in this Scope of Work and Requirements are met with regard to such Design.
1477	Contractor shall review and provide written comments on drawings and specifications submitted by Design-Builder within 21 days of receipt. Lack of comments from Contractor after 21 days shall imply Contractor's approval of Design-Builders drawings and specifications.
1478	Before Design-Builder may submit to Authority any Release for Construction Plans that includes design elements for the ETTM System Infrastructure, Contractor shall issue certification for ETTM System Infrastructure for Release for Construction. Contractor shall certify in writing that all previously provided review comments have been adequately addressed and resolved within 5 days of receipt of Release for Construction Plans.
1479	Contractor shall ensure that the installed ETTM System Infrastructure, roadway, infrastructure, structures/toll gantries, vaults, and communications meet the Requirements provided by Contractor and shall certify in writing such installed work with regard to the Design provided.
1480	Contractor shall cooperate with Authority, Caltrans, and Design-Builder to minimize required number of Lane Closures and to maximize the use of other scheduled Lane Closures. Contractor shall transmit all Lane Closure requests to Authority for Approval.
1481	Contractor shall provide certain materials to Design-Builder to install, as identified in this Scope of Work and Requirements and ***Attachment 10: I-405 EL ETTM System Responsibility Matrix – Design-Builder and TSI***. Design-Builder will provide Contractor notice a minimum of 120 Days in advance of all scheduled Design-Builder ETTM System Infrastructure construction and installation activities requiring Contractor furnished materials and/or coordination. Design-Builder will also provide Contractor notice 60 Days in advance of actual paving of the Express lanes at the ETTM Sites.
1482	Contractor shall have Contractor-provided materials to be installed by Design-Builder available for pick-up 42 Days after receipt of notice from Design-Builder. Contractor-provided materials shall be available for pick-up at Contractor's facility located within a 25-mile radius of the Project.
1483	Contractor, in conjunction with Authority, shall inspect work completed by Design-Builder and promptly report to Authority any discrepancies or defects in such construction of which Contractor has knowledge that would render the Design-Builder work unsuitable for proper installation and execution of the ETTM System by Contractor as described in this Scope of Work and Requirements.
1484	Contractor shall create and use a Civil Site Acceptance Checklist to verify that civil infrastructure elements at Equipment locations where Contractor will install Equipment are suitable for proper execution of the Implementation Phase Services. The checklist shall include at a minimum:
	• toll gantry;

	• roadside cabinet pad;
	• roadside cabinets;
	• conduits;
	• pull boxes;
	• pull ropes;
	• CCTV and TDS poles;
	• roadway pavement;
	• transformers;
	• disconnects and electrical panels; and
	• TEB
1485	For each ETTM Site, Contractor shall submit a completed Civil Site Acceptance Checklist to Authority with a courtesy copy to Design-Builder, initialing every element inspected. Contractor shall immediately provide Notice to Authority of any deficiency found during the inspection, including identification of any items that would render Design-Builder work unsuitable for proper installation and execution of the ETTM System by Contractor as described in this Scope of Work and Requirements and prevent Contractor's scheduled work at an ETTM Site.
1486	Upon successful completion of the Civil Site Acceptance Checklist, Contractor shall provide its written certification that there are no deficiencies in the subject ETTM Site and that the Design-Builder work at such location is suitable for Contractor's performance of the Implementation Phase Services at such location, and shall submit the completed Civil Site Acceptance Checklist to Authority. Delivery of such certification shall constitute Contractor's acceptance of the condition of the relevant Design-Builder work as suitable for Contactor's performance of the Implementation Phase Services at such location.
1487	Contractor shall prepare and use a Communications Network Acceptance Checklist to verify that the ETTM Communications Network provided by Design-Builder is suitable for proper execution of the ETTM System. Contractor shall be responsible for conducting field inspections at the same time Authority conducts their field inspection.
1488	Contractor shall submit the completed Communication Network Acceptance Checklist to Authority with a courtesy copy to Design-Builder. Contractor shall immediately provide Notice to Authority of any deficiency found during the inspection, including identification of any items that would render Design-Builder work unsuitable for proper installation and execution of the ETTM System by Contractor as described in this Scope of Work and Requirements and prevent Contractor's scheduled work at an ETTM Site.
1489	Upon successful completion of the Communication Network Acceptance Checklist, Contractor shall provide written certification that there are no deficiencies in the ETTM Communication Network. Such certification shall constitute Contractor's acceptance of the Design-Builder work related to the ETTM Communication Network. Contractor shall be responsible for monitoring and maintaining the ETTM Communications Network after the turnover of the entire Project from Design-Builder until end of the Agreement Term.

2.6.9.2 Coordination with Other Civil Contractors

1490	Contractor shall interface with other civil contractors who may be directly supporting the Project or working within or adjacent to the Project area during the Agreement Term, as part of this Project or other projects, including but not limited to:
	• 91 Express Lanes;
	• 91 Express Lanes TOC;
	• I-405 Express Lanes;
	• I-405 Express Lanes TOC; and
	• I-405 Express Lanes TOC (initial build-out)
1491	Contractor shall coordinate with other civil contractors to ensure that all improvements adequately support or maintain the functions of the ETTM System and Operations.
1492	Contractor shall coordinate with civil contractors, as appropriate, to provide input, design requirements, design review, and comment on any design which may impact the ETTM System; such as power, communications, paving, TOC support infrastructure, and any other information necessary associated with ETTM System.
1493	Contractor shall coordinate the Operations and Maintenance Phase Services with an civil contractors who may be working within or adjacent to the Project and whose operations may impact the Contractor's Operations and Maintenance Phase Services.

2.6.10 ETTM System Infrastructure Turnover – I-405 Express Lanes

As part of Design-Builder's work, Design-Builder will design and construct certain civil infrastructure (ETTM System Infrastructure) required for the ETTM System per ***Attachment 10: I-405 EL ETTM System Responsibility Matrix – Design-Builder and TSI***. To facilitate this coordination, Design-Builder will complete sections of the I-405 Express Lanes for ETTM System Infrastructure Turnover to the Contractor.

Design-Builder shall turnover ETTM Sites to Contractor in four (4) Toll Site Sets. Each Toll Site Set consists of one or more ETTM Toll Collection and Enforcement Sites and certain Equipment and Infrastructure required for Contractor to install the ETTM System. The Design-Builder will determine which ETTM Sites shall comprise each Toll Site Set.

The initial set of ETTM Sites (Toll Site Set 1) will include at least one of each ETTM Site type and multiple ETTM Toll CCTV Camera / ETTM Traffic Detection System Sites as well as the completed ETTM Toll Equipment Building and the ETTM Communications Network required for communication between the sites, Caltrans, Authority and the Contractor. Toll Site Set 1 will represent a completely operational tolling segment (i.e. ETTM Toll Rate CMS Site, the corresponding ETTM Toll Collection and Enforcement Site, a downstream ETTM Transponder Read Site, and all ETTM Toll CCTV Camera / ETTM Traffic Detection System Sites within that segment).

The second set of ETTM Sites (Toll Site Set 2) will include at least two ETTM Toll Collection and Enforcement Sites; at least two ETTM Transponder Read Sites; at least four ETTM Toll Rate CMS Sites; at least one-third (≥1/3) of the remaining ETTM Toll CCTV Camera Sites; and at least one-third (≥1/3) of the remaining ETTM Traffic Detection System Sites.

The third set of ETTM Sites (Toll Site Set 3) will include at least two ETTM Toll Collection and Enforcement Sites; at least two ETTM Transponder Read Sites; at least three ETTM Toll Rate CMS Sites; at least one-half (≥1/2) of the remaining ETTM Toll CCTV Camera Sites; and at least one-half (≥1/2) of the remaining ETTM Traffic Detection System Sites.

The fourth set of ETTM Sites (Toll Site Set 4) shall include all Roadside System sites not included in Toll Site Sets 1 through 3.

1494	Contractor shall coordinate the performance of the Work with the work to be performed by the Design-Builder.
1495	Design-Builder will give Authority and Contractor at least 30 Days prior written notification of the date on which Design-Builder anticipates that it will achieve ETTM System Infrastructure Turnover for the first Toll Site Set and not less than 45 Days' prior written Notice for subsequent Toll Site Sets. Within 15 Days after receipt of notification for the first Toll Site Set and within 30 Days after receipt of notification for subsequent Toll Site Sets, Contractor shall inspect the Toll Site Set and submit a written list of outstanding items, if any, to be corrected by the Design-Builder.
1496	After Design-Builder has completed all outstanding items, Design-Builder will provide Authority and Contractor a written notification requesting re-inspection. Upon receipt of Design-Builder's request for re-inspection, Contractor shall have 15 Days to conduct such additional inspections, surveys and/or testing as they deem necessary to certify that the Design-Builder has achieved ETTM System Infrastructure Turnover. Within 15 Days after receipt of notification, Contractor shall inspect the Toll Site Set and submit a written list of outstanding items, if any, to be corrected by the Design-Builder.
1497	Contractor and Authority shall promptly meet and confer to evaluate the outstanding items list within 15 Days after receipt of Design-Builder's notification requesting re-inspection. Failure of Contractor to provide notification of any outstanding items, and to deliver the Certificate of ETTM System Infrastructure Turnover within 15 Days of Design-Builder notification requesting re-inspection, shall constitute Contractor's confirmation that ETTM System Infrastructure Turnover has occurred and that Contractor has accepted the ETTM System Infrastructure.
1498	If additional items are identified during the inspection that require correction, the process of developing a correction list, performing corrective work, and re-inspection will be repeated until Authority determines that all prerequisites to ETTM System Infrastructure Turnover have been met for the relevant Toll Site Set. Authority and Contractor shall promptly execute a written Certificate of ETTM System Infrastructure Turnover following the determination that the conditions to ETTM System Infrastructure Turnover have been met for the Toll Site Set.
1499	During the period following ETTM System Infrastructure Turnover of the first Toll Site Set, Contractor shall coordinate with Design-Builder with respect to design, installation, inspection, testing, and commissioning of the ETTM System. Contractor shall promptly notify Design-Builder and Authority of any non-conforming work identified during this period and provide access to the Design-Builder to correct such non-conforming work.
1500	Regardless of when the actual ETTM System Infrastructure Turnover Dates occur, Contractor shall complete its Implementation Phase Work in the following durations for the applicable Toll Site Sets:

	• Toll Site Set 1: 260 Days;
	• Toll Site Set 2: 200 Days;
	• Toll Site Set 3: 150 Days;
	• Toll Site Set 4: 110 Days;
1501	Commencing on the applicable ETTM System Infrastructure Turnover Date, Contractor shall have primary access and priority for Lane Closures in each Toll Site Set. Contractor shall provide Design-Builder with reasonable access to such Toll Site Set areas, and shall coordinate with Design-Builder and allow Design-Builder to complete punch list work and any other work that Design-Builder is required to undertake as part of the Design Build work.
1502	If Contractor requires access to any part of the site prior to any ETTM System Infrastructure Turnover Date, Contractor shall:
	• Provide Design-Builder and Authority with at least 72 hours prior written Notice of Contractor's need to access the site, and coordinate and cooperate with Design-Builder so as not to interfere with or adversely impact performance of the Design-Builder's work;
	• Obtain an encroachment permit rider providing Contractor with access to the site and comply with the requirements of such permit rider;
	• Comply with Contractor's safety and security procedures;
	• Comply with Design-Builder's safety and security procedures and request Design-Builder's directions as to access to and occupancy of such areas; and
	• Leave the site in the same or better condition that exists at the time of accessing such area.

2.6.11 Lane Closure and Traffic Control (Implementation Phase)

Contractor will provide all maintenance of traffic (MOT) activities associated with completing Contractor Work on the 91 Express Lanes during the Implementation Phase. All Lane Closures shall be coordinated with the Authority and BOS Contractor and Lane Closure schedules shall be submitted to Authority in advance for Approval.

MOT on the I-405 Express Lanes shall be performed by the Design-Builder during the Implementation Phase only, in coordination with Contractor.

2.6.11.1 Lane Closure and Traffic Control (Implementation Phase) – 91 Express Lanes

1503	Contractor shall provide all MOT for the Work performed during the Implementation Phase. Contractor shall develop as a part of the Installation Plan, a Transportation Management Plan (TMP) in accordance with Caltrans standards for Approval by Authority. The Installation Plan shall include all design for MOT, including all planned Lane Closures of Express Lanes, general purpose lanes, and ramps and connectors.
1504	Contractor shall submit a Lane Closure Schedule as part of the Installation Plan showing the locations and times of the proposed Lane Closures. The Lane Closure Schedule shall be submitted in the format requested by Authority, and must be made in accordance with this Scope of Work and Requirements.

1505	Lane Closure Schedules submitted to Authority with incomplete or inaccurate information will be rejected and returned for correction and resubmittal. Contractor will be notified by Authority of disapproved closures or closures that require coordination with other parties as a condition of approval.
1506	Contractor shall adhere to the Approved Installation Plan when setting up, working under MOT and restoring lanes to traffic. All Lane Closures shall also be coordinated with Authority, Caltrans (if necessary) and the TOC.
1507	Contractor shall develop, implement, and maintain a TMP that lays out the strategies for managing the work zone impacts of the Work and submit to Authority for review and approval. The TMP must follow the guidelines in the latest version of the Caltrans' Transportation Management Plan Guidelines. The TMP is considered a living document; Contractor shall amend and submit changes to the TMP for approval by Authority and Caltrans (if necessary) as changes occur in the MOT strategies proposed by Contractor.
1508	TMP compliance and implementation is the responsibility of the Contactor. Authority and Caltrans will monitor and evaluate TMP activities during the course of the Work. Authority may suspend all or part of the Contactor's operations for failure to implement and comply with TMP elements, or failure to correct unsafe traffic conditions within 24 hours after such notification is given in writing to Contractor. If Contractor does not promptly take appropriate action to bring the errors into compliance or to correct unsafe traffic conditions, Authority may proceed with corrective action against Contractor.
1509	Roadside Equipment installation shall be scheduled to minimize traffic delay during the installation process. Contractor shall make every effort to schedule Work around peak traffic movement times unless such Work can be performed without impact to traffic.
1510	The Maintenance Manager shall be present during Lane Closures.
1511	The 91 Express Lanes are completely closed to all vehicular traffic every third Sunday, weather permitting, between 6:00am and 12:00 pm for maintenance by Caltrans. Contractor is encouraged to coordinate installation with Caltrans regularly scheduled Lane Closures. Contractor's Lane Closure responsibility is as follows:
	• If Work is scheduled with Caltrans roadway maintenance activities, Contractor will not be responsible for paying for Lane Closure MOT and enforcement costs.
	• If Work is not scheduled with Caltrans roadway maintenance activities, Contractor shall be responsible for providing and paying for all Lane Closure MOT and coordinate and pay for any enforcement costs.
1512	Closures of Express Lanes are permitted to facilitate the Work during the Implementation Phase. All Permitted Lane Closures shall be as specified in ***Table 2-4: Permitted Lane Closures of 91 Express Lanes (Implementation Phase).***
1513	Closures of general purpose lanes to facilitate the Work during the Implementation Phase must be coordinated with Authority and Caltrans. Any Lane Closure of general purpose lanes must be Approved in advance by Authority and Caltrans. Approved closures of general purpose lanes will be considered Permitted Lane Closures.
1514	Contractor shall submit to the Authority for Approval written notice of a Permitted Lane Closure of an Express Lane(s) for review and Approval no later than seven (7) Days prior to the Permitted Lane Closure of any Express Lane.

1515	Closures involving work (temporary barrier placement and paving Operations) that will reduce horizontal clearances, traveled way inclusive of shoulders, to two (2) lanes or less shall be submitted to the Authority for Approval not less than twenty-five (25) Days and not more than one hundred and twenty-five (125) Days before the anticipated start of Operations.
1516	Contractor shall submit to the Authority and Caltrans written request for a Permitted Lane Closure of a general purpose lane(s) for review and Approval no later than seven (7) Days prior to the Permitted Lane Closure of any general purpose lane.
1517	Lane Closure Schedule Amendments, including adding additional closures, shall be submitted by 12:00 p.m. to Authority, in writing, at least three (3) Business Days in advance of a planned closure. Approval of Closure Schedule Amendments will be at the discretion of Authority. Authority shall be notified of cancelled closures two (2) Business Days before the date of the closure. Closures that are cancelled due to unsuitable weather may be rescheduled at the discretion of Authority.
1518	Contractor shall notify the Authority immediately, as soon as Contractor knows that a Permitted Lane Closure will be late in reopening. In the event that a Permitted Lane Closure does not reopen on time, Authority and Caltrans shall not authorize any further Lane Closures until Contractor submits to Authority a corrective action plan to avoid recurrences.
1519	Authority shall have the right to suspend the Work and cancel any previously Approved Lane Closure requests for failure to reopen to public traffic a Permitted Lane Closure within the windows specified in ***Table 2-4: Permitted Lane Closures of 91 Express Lanes (Implementation Phase)*** or otherwise Approved by Authority.
1520	Lane closures of Express Lanes and general purpose lanes shall not be allowed:
	• on Easter weekend;
	• on Mother's Day weekend;
	• on Father's Day weekend;
	• on Memorial Day weekend;
	• on Fourth of July weekend;
	• on Labor Day weekend;
	• between the Wednesday before Thanksgiving until the Monday following Thanksgiving; and
	• on any other Holidays.
1521	Contractor shall coordinate with Authority and Caltrans and local agencies to identify any special events and restrict Lane Closures accordingly.
1522	Unpermitted Lane Closures are prohibited and shall be subject to Authority Liquidated Damages in accordance with Article 18, Liquidated Damages/Lane Rental Fees, of the Agreement. Upon discovery of any Unpermitted Lane Closure, Authority will deliver Contractor a Notice of Unpermitted Lane Closure, and shall assess against Contractor the applicable Liquidated Damages, calculated in accordance with Article 18, Liquidated Damages/Lane Rental Fees, of the Agreement. Contractor shall pay Authority such Liquidated Damages within 24 hours after all applicable lanes reopen to public traffic.

1523	Authority will assess against Contractor the applicable Liquidated Damages in accordance with Article 18, Liquidated Damages/Lane Rental Fees, of the Agreement for failure to utilize a requested Lane Closure or cancellation of a requested Lane Closure less than 72 hours before the date and time that the requested Lane Closure is scheduled to commence.
1524	Contractor, however, may request Lane Closures outside of the Permitted Lane Closure windows. Contractor shall submit such requests in writing to Authority no later than fourteen (14) Days prior to Contractor's requested date for the Lane Closure, together with a revised TMP. Such requests and revised TMPs shall be subject to review and approval by Authority and Caltrans (if necessary). Written requests for Lane Closures outside the times set forth in the Lane Requirement Charts shall, at a minimum include the following:
	• Justification for the Lane Closure;
	• Proposed time periods and hours;
	• Proposed location(s); and
	• Proposed calendar duration.
1525	Any Work involving removal/relocation of Equipment (both existing equipment and Contractor's Equipment) (loosening or removal of nuts/screws, cables, connectors etc.) shall be done with appropriate Lane Closures during time periods specified in ***Table 2-4: Permitted Lane Closures of 91 Express Lanes***, unless otherwise Approved by Authority in its sole discretion.
1526	The 91 Express Lanes shall be properly closed before any Work begins in the 91 Express Lanes. All workers and equipment must be cleared from the 91 Express Lanes before they are reopened.
1527	Contractor shall record the beginning and ending times of all Lane Closures in the ATMS.
1528	All Lane Closures during the Implementation Phase shall conform to the Caltrans Encroachment Permit, as shown in ***Attachment 13 – 91 EL Encroachment Permit***. Contractor shall obtain a rider under such encroachment permit.
1529	Permitted Lane Closure windows for the 91 Express Lanes, unless otherwise Approved by Authority in its sole discretion, shall be as specified in ***Table 2-4: Permitted Lane Closures of 91 Express Lanes***.

Table 2-4: Permitted Lane Closures of 91 Express Lanes (Implementation Phase)

Direction/Period	*Hours During Which Closures Permitted*
Eastbound weekday (Sunday from 11:00 p.m. to Friday at 5:00 a.m.)	11:00 p.m. to 5:00 a.m.
Eastbound weekend (Friday 11:00 p.m. to Sunday at 5:00 a.m.)	11:00 p.m. to 5:00 a.m.
Westbound weekday (Sunday from 9:00 p.m. to Friday at 4:00 a.m.)	9:00 p.m. to 4:00 a.m.
Westbound weekend (Friday at 10:00 p.m. to Sunday at 5:00 a.m.)	10:00 p.m. to 5:00 a.m.

2.6.11.2 Lane Closure and Traffic Control (Implementation Phase) – I-405 Express Lanes

1530	Contractor shall coordinate Lane Closures and traffic control with the Design-Builder during the Implementation Phase only.
1531	Contractor shall be permitted to work at multiple ETTM Sites concurrently as agreed upon between Contractor, Design-Builder, Authority, and Caltrans.
1532	The Design-Builder shall provide MOT and work zone for installation, testing, and commissioning from 500 feet upstream to 200 feet downstream of each ETTM Site. All closures provided will include the inside shoulder, the Express Lanes, and the left most general purpose lane.
1533	The Design-Builder shall provide access to/from the work zone at the extreme ends of the Lane Closure;
1534	The Design-Builder shall provide MOT and Contractor shall complete the ETTM installation within the Lane Closure timeframes and closure durations as follows:
	• Per each ETTM Toll Collection and Enforcement Site: three consecutive Lane Closures (i.e. nightlight closures for three consecutive nights).
	• Per each ETTM Transponder Read Site: two consecutive Lane Closures
	• ETTM Toll Rate CMS Sites (Mainline): two consecutive Lane Closures
	• ETTM Toll Rate CMS Sites (Ramp): two consecutive Lane Closures
	• If access to the roadside cabinets, generators, and equipment is not available due to the configurations of the roadway and/or abnormal traffic conditions, the Design-Builder will provide up to two consecutive Days of outside shoulder/lane closure per site.
1535	The Design-Builder shall provide MOT and Contractor shall complete the Onsite Installation Test (OIT) within the Lane Closure timeframes and closure durations as follows:
	• Per each ETTM Toll Collection and Enforcement Site: four consecutive Lane Closures
	• If access to the roadside cabinets, generators, and equipment is not available due to the configurations of the roadway and/or abnormal traffic conditions, the Design-Builder will provide concurrent outside Lane Closures to provide access and work area at the roadside cabinets, generators, and Equipment during testing.
1536	The Design-Builder shall provide MOT and Contractor shall complete the Installation and Commissioning Test within the Lane Closure timeframes and closure durations as follows:
	• Per each ETTM Toll Collection and Enforcement Site: two consecutive Lane Closures
	• Per each ETTM Transponder Read Site: two consecutive Lane Closures
	• ETTM Toll Rate CMS Sites (Mainline): two consecutive Lane Closures
	• ETTM Toll Rate CMS Sites (Ramp): one Lane Closure
	• If access to the roadside cabinets, generators, and equipment is not available due to the configurations of the roadway and/or abnormal traffic conditions, the Design-Builder will provide concurrent outside Lane Closures to provide access and work area at the roadside cabinets, generators, and Equipment during testing.

1537	Lane Closures for ETTM Toll CCTV Camera and ETTM Traffic Detection System installation will follow Caltrans standard closure process and durations for installation of CCTV cameras and roadside traffic detectors.
1538	Contractor shall provide seven (7) Days' notice to the Design-Builder for any unscheduled Lane Closure.
1539	Lane Closure windows for the I-405 Express Lanes, unless otherwise Approved by Authority and Caltrans, are reflected in ***Attachment 12: I-405 EL Lane Requirement Charts***.
1540	All Lane Closures during the Implementation Phase shall conform to the Caltrans Encroachment Permit, as shown in ***Attachment 14 – I-405 EL Encroachment Permit***. Contractor shall obtain a rider under such encroachment permit.

2.6.11.3 Contingency Plan

1541	A detailed contingency Plan shall be prepared for reopening closures to public traffic. A general contingency Plan shall be included in the Installation Plan; however, a site specific contingency Plan shall be submitted to Authority before Work at the job site begins.
1542	The contingency Plan shall contain a current emergency contact list for Authority's use at all times for handling emergencies and escalations. The emergency contact list shall name primary and secondary (multiple secondary contacts as applicable) points of contact for each anticipated emergency type. The emergency contact list shall name Contractor's preferred points of contact, in order of precedence and shall include, at a minimum, Contractor Project Manager, deputy Project manager, installation manager, technical manager, technology manager, and other support staff. The purpose of the emergency contact list is to ensure Contractor can be reached outside normal working hours to address urgent matters.

2.7 Roadside System Testing Requirements

2.7.1 Roadside System Testing Concept

Authority is planning a phased approach to deploying the ETTM System on Express Lanes with the implementation of the 91 Express Lanes occurring first and the implementation of the I-405 Express Lanes occurring later. Given the extended duration of the Project, and the potential differences in the 91 Express Lanes and I-405 Express Lanes Roadside System solutions, Contractor shall conduct the following tests when each Roadside System is implemented.

This section describes Contractor's responsibilities for carrying out and reporting the results of various functional and performance tests of the ETTM System and its major components as they are being developed, demonstrated, deployed, and operated. This includes all phases of testing including the Software, Hardware, Equipment, network connections, interfaces. The testing program shall ensure that the RSS Roadway functions according to the requirements and KPIs prescribed in the Agreement, these TPs and the FDD.

Contractor shall plan for, perform, monitor, and document all tests required to prove the design and acceptability of the ETTM System, including all elements, subsystems, and the system as a whole, furnished under this Work. Contractor shall furnish Equipment that meets the criteria specified for all tests. Testing shall not commence until all design affecting the respective equipment and relevant to the stage of the design has been Approved by Authority, and Authority has Approved all related testing procedures. The testing shall be provided for all Equipment.

Given the extended duration of the Project, and the potential differences in the various Roadside System solutions, Contractor shall prepare a detailed plan for testing all Hardware, Software and full integration of the ETTM and Roadway Support Systems. The test plan will be developed to confirm that the documented functional requirements, the System Design Documentation, and the other documents within the Agreement are met by the equipment and/or roadside system operations.

Contractor shall be responsible for developing comprehensive test plans and test scripts to ensure that the system development meets all of the RSS requirements documented during detailed design and contained in the Agreement. The test plans and scripts will be reviewed and Approved by Authority.

The test plans and scripts shall be closely adhered to during each phase of equipment and system testing. At the completion of each test phase, Contractor shall submit final test results to Authority for final Approval. Authority will review the test results.

The test plan and subsequent testing activities will be developed and executed for different phases. Each test phase will commence only upon the successful completion of the previous phase.

The test phases shall be conducted by Contractor as presented below:

1543	Various tests (outlined for reference immediately below and with detailed Requirements in subsequent sections) shall be prepared and conducted by Contractor on all Roadsides, including but not limited to:
	• Factory Acceptance Test (FAT) for RSS and Roadside Systems;

	• Onsite Installation Test (OIT)
	• 91 Express Lanes;
	o Unit Testing
	o Onsite Installation and Commissioning Test;
	o Operational and Acceptance test;
	• I-405 Express Lanes and
	o Unit Testing
	o Installation and Commissioning Test;
	o Operational and Acceptance test;
	• Additional Express Lanes Corridors during Operations and Maintenance Phase (Optional).
	o Installation and Commissioning Test;
	o Operational and Acceptance test;

2.7.2 General Testing Requirements

The Requirements described in this section detail the labor, materials, facility, and support Services necessary to test the Roadside Systems and RSS and its interface to the BOS.

Contractor shall keep the Requirements Trace Matrix updated to reflect all testing, clearly tracing requirements to test phases and test scripts. Contractor shall submit each test plan to Authority in advance for review and Approval. Contractor shall obtain Authority Approval of test plans prior to testing. Contractor's Quality Manger shall review Contractor readiness to commence each phase of testing.

Authority reserves the right to recommend ad hoc testing of any variety of vehicle types or equipment failures not included in the relevant Individual Test Plan. Ad hoc tests may be added before or during actual testing. Ad-hoc testing will be kept to a minimum and is intended to further review items that arise in scheduled testing.

Contractor shall work with Authority to schedule tests so that Authority staff, consultants and partners may observe all testing.

Contractor shall include statistically significant and mutually agreeable test data sufficient in size and variety of types to fully test all requirements of the Roadside System and RSS.

Acceptance of the RSS is dependent on tests demonstrating that the ETTM System performs in a manner meeting or surpassing all requirements and the KPIs.

Within 21 Days of the completion of each individual test, Contractor shall provide for Authority review and Approval a test report containing results of each test script, a summary of the test results, a list of failed items, planned regression test schedule and punch list items. Contractor shall maintain all test results, notes, and observations. Test reports shall be signed and certified by the TSI's Quality Manager Test reports shall pay special attention to any test cases where a

failure occurred and how it was resolved. Together with results, any re-testing, regression testing, procedure modifications, Software fixes and document changes (if required) shall be detailed.

If testing or operations identifies defects in the system after the system goes live (is in use by actual customers), Contractor shall go through code release procedures described and Approved in the Quality Assurance Plan to fix the issue. Contractor shall never change the production system without prior Approval of Authority.

Contractor shall prepare and conduct tests that validate adherence to the Requirements that guided its Design and development, compliance to Approved Design and Business Rules and demonstrate the ETTM System functionality.

1544	Contractor shall be responsible for all aspects of testing performed as part of the Agreement and to provide all necessary resources and facilities to conduct all tests including but not limited to:
	• test support personnel;
	• vehicles and drivers;
	• test facilities;
	• test Equipment, tools and safety devices;
	• test schedule and test sequence;
	• coordination with Authority and existing system integrators;
	• coordination of Lane Closures and MOT, and
	• conducting the test.
1545	Contractor shall to the extent possible, develop and use specialized automated testing Software to, including but not limited to:
	• create test scripts;
	• control the automated testing;
	• exercise all conditions, configurations and scenarios;
	• conduct performance testing;
	• conduct security testing;
	• conduct regression testing;
	• compare actual test outcomes to expected outcomes;
	• test reporting;
	• conduct load testing;
	• conduct user interface testing;
	• conduct stress testing;
	• WAN / LAN traffic testing;
	• conduct sustained operational testing and
	• conduct sustained burn-in testing.

1546	Prior to the start of testing the System shall be confirmed to be fully operational and ready for testing. Transactions that fail to meet the Requirements shall be reviewed and audited and anomalies investigated.
1547	Contractor shall provide a defect tracking system, accessible by Authority, to document and track all defects identified as part of ETTM System testing and any subsequent actions taken to correct and retest those defects.
1548	The defect tracking system shall be capable of the following, including but not limited to:
	• rating (severity) defects;
	• categorizing defects;
	• prioritizing defects;
	• logging the date/time the defect was reported;
	• subsystems and test cases impacted by the defect;
	• the user who reported the defect;
	• the erroneous behavior;
	• the details on how to reproduce the defect;
	• the developers who worked on the defect and corrective action taken;
	• date the defect was corrected and formally re-tested;
	• life-cycle tracking and
	• reporting.
1549	The sample size for each requirement shall be the greater of N = log (1 - C) / log (A); or 20,000 transactions for the Operations test; where: * N = Number in the sample * C = Confidence level * A = Accuracy A value of 95% shall be used for the confidence level. Accuracy and confidence levels are expressed as decimals.

2.7.3 Master Test Plan

1550	Contractor shall provide to Authority, for review, comment and final Approval a Master Test Plan that outlines the scope and testing concepts to be used to validate the ETTM System compliance to this Scope of Work and Requirements and integration to the existing roadway systems and the BOS.
1551	The Master Test Plan provides a system-wide framework for testing activities by integrating functional, system, and performance testing of RSS components, subsystems, interfaces, and the overall Roadway System.
1552	The Approved Master Test Plan shall be used as the basis for the detailed test procedures that shall be submitted to Authority for review and Approval.
1553	The Master Test Plan shall cover all aspects of the ETTM System Roadside and RSS testing from initial development through deployment, Roadside System Acceptance and Project Acceptance as defined in the Approved Master Test Plan document**.**

1554	Contractor shall provide a Master Test Plan describing in detail the key features of the overall testing program for review and Approval by Authority. At a minimum, the Master Test Plan shall address testing approaches and schedule, KPIs, data collection and sampling methods, test entry criteria, test exit criteria, testing conditions, equipment requirements, testing locations, reporting of results and procedures for tracking and retesting failed test steps. The Master Test Plan shall, at a minimum, include the following:
	• The schedule and high level plan for each phase of testing;
	• Description of strategies for isolating test data from production data, coordinating interface testing, using simulated data, and retesting;
	• The Requirements Traceability Matrix (RTM) indicating when and how each requirement will be tested in the Individual Test Plans;
	• The plan for test vehicles including the number and type of vehicles, Transponders required, and any special/customized or legacy license plates needed for testing; and
	• All aspects of ETTM System testing.

2.7.4 Testing Sequence and Logistics

Contractor shall provide complete Individual Test Plans for review and Approval by Authority. Contractor must receive written Approval from Authority prior to the beginning of any test.

Contractor shall update each version of any test plan to incorporate or respond to Authority comments on the previous version. Each Individual Test Plan shall undergo the following review phases:

1) Test plan outline – allow 15 Days for Authority review and comment;
2) Detailed test plan – first submission – allow 21 Days for Authority review and comment;
3) Detailed test plan – second submission – allow 21 Days for Authority review and comment;
4) Detailed test plan – final version – Contractor shall submit a final detailed test plan in accordance with the Approved Baseline Implementation Schedule for approval by Authority; and
5) Test Report - 15 Days after completion of individual test.

1555	Individual Test Plans shall describe the scope, approach, resources, and schedule of intended testing activities, including test items, the features to be tested, the testing procedures and set of execution conditions, predicted results, and any risks requiring contingency planning. Individual Test Plans shall include an updated RTM indicating which requirements are tested in that individual test and shall also include all test scripts to be used. Contractor shall obtain Approval from Authority and shall have met the entry conditions prior to start of each test, including but not limited to:
	• Approval of all predecessor tests;
	• Approved test procedures for each individual test;

	• Approved test schedule;
	• successful closeout of all outstanding pre-test issues;
	• successful dry run testing with results provided to Authority;
	• Submittal of the latest Approved version of the RTM showing test validation against the Requirements and
	• confirmation that both the site(s) and System are ready for testing.
1556	After the completion of each test, Contractor shall submit for Authority's review and Approval a test report that documents the results of the test.
1557	The test report shall address the following, including but not limited to:
	• the test summary;
	• the results of each test case;
	• any anomalies and issues identified;
	• the corrective action/resolution of each item;
	• the test data;
	• calculations and back-up data supporting compliance to Requirements;
	• comments provided by Authority and
	• the results of any re-tests necessary to successfully complete each testing phase
1558	Authority shall participate in the testing and witness of each test. Authority shall have full access to the test data and results of the test.
1559	Testing will not be considered complete by Authority until all anomalies and "punch-list" items are closed-out, and the final test report is Approved by Authority.
1560	Testing shall occur in the following order, subject to Authority's Approval of the final Master Test Plan and shall include the following tests for each facility transition at a minimum:
	• FAT;
	• OIT; (also may be referred to as Site Acceptance Test)
	• Installation and Commissioning Test and
	• Operational and Acceptance Test

2.7.5 Factory Acceptance Test (FAT)

1561	A separate and distinct FAT shall be conducted by Contractor for each solution configuration required by each of the respective Projects (91 Express Lanes and I-405 Express Lanes) and schedule.
1562	The FAT shall take place in the continental United States.
1563	The FAT shall be conducted by Contractor at Contractor's facility in actual lanes with the complete test ETTM System in accordance with the Approved MTP, detailed testing procedures and Approved Baseline Implementation Schedule.
1564	The test configuration shall be representative of Contractor's AET Facility and Express Lanes solutions for each lane configuration as required by each of the respective Projects.
1565	The FAT shall be conducted by Contractor to verify that all functional elements of the ETTM System are in conformance with this Scope of Work and Requirements.

1566	Upon the successful completion of the FAT exit criteria and Approval of the FAT by Authority, Contractor shall be given the authorization to move forward to the OIT at the selected ETTM Sites.
1567	The FAT shall validate that the Roadside System Hardware meets this Scope of Work and Requirements including but not limited to:
	• 72-hour burn-in testing for customized and assembled Hardware;
	• certification of Hardware compliance to environmental Requirements;
1568	• environmental testing of the Toll Rate CMS including dust, vibration, water, high/low temperatures, salt, fog, corrosion, and humidity;
1569	• for COTS equipment that is to be installed inside a building, cut sheets or other manufacturer provided documentation showing environmental operating limits or requirements will be provided to Authority;
1570	• for equipment being manufactured specifically for this Project that are not COTS equipment, Contractor will provide Authority with Certifications or certified test results for the equipment that is to be installed outside or in any other non-environmentally controlled location; and
1571	• manufacturers certification is a document or documents that identify the environmental and operating tolerances within which the equipment is warranted to operate.
1572	The FAT may be scheduled in phases with the final phase including tests for the complete integrated system. The FAT shall include testing of the AVI subsystem to operate in dual protocol mode, i.e. Title 21 and 6C.
1573	Contractor shall use traffic simulation Software or other mutually agreed upon traffic data sets to create necessary traffic data and use it to perform tests including:
	• Volume stress test;
	• Full exercise of all reports; and
	• Pricing algorithms.
	Contractor shall use a dual lane configuration for FAT testing. OIT (Onsite Installation Test) shall not begin until FAT tests are successfully completed and the test reports are Approved by Authority. Testing shall be directly observed by Authority.
1574	The FAT shall validate that the Roadside System meets this Scope of Work and Requirements including but not limited to:
	• accurate assignment and proper framing of each vehicle through various traffic conditions and test scenarios;
	• accurate capture of images and association of Transponders and images to the correct vehicles;
	• accurate classification of vehicles, assessment of fare and processing of the transaction;
	• compliance to accuracy Requirements;
	• all exception processing Requirements;
	• correct application of Business Rules;
	• degraded mode scenarios;

	• all device failure conditions;
	• rush-hour traffic scenarios;
	• redundancy;
	• mobile enforcement Requirements;
	• DVAS capabilities;
	• throughput and load testing using simulated data;
	• interface to the RSS, and
	• transaction and image reconciliation.
1575	The FAT shall validate that the RSS meets this Scope of Work and Requirements including but not limited to:
	• user interface and compliance to user interface standards;
	• facility Dashboard and monitoring;
	• Roadside Dashboards;
	• RSS functions;
	• Image review capabilities;
	• DVAS capabilities;
	• MOMS;
	• transaction audit;
	• correct application of Business Rules;
	• System performance;
	• reporting;
	• redundancy;
	• System loading;
	• compliance of RSS interface to Approved ICDs and
	• OCR/ALPR (if applicable).

2.7.6 Unit Testing (UT)

1576	Unit Testing: The intent of unit testing, which will be conducted at Contractor's facility, is to allow Contractor to conclusively represent that the RSS equipment, subsystems, and overall system complies with the system functional requirements.
1577	Unit testing should be successfully completed prior to commencement of on-site equipment installation, system integration, and field testing. Equipment and/or system failures that are encountered during performance of the unit tests will be resolved, retested, and acknowledged as being resolved by Contractor.
1578	Unit testing is the culmination of the design, development, fabrication, and pretest of the RSS system equipment, subsystems, and overall system. Performance of unit testing may be witnessed by Authority.
1579	Unit Testing shall be performed on the ETTM System as follows:
	• Roadside System

	• I-405 Express Lane Toll Rate CMSs
	– Equipment environmental testing or manufacturer's certification for exterior installed equipment and cabinets.
	– Unit testing to consist of inspection of all components and bench testing of completed assemblies. Burn-in may be conducted to ensure that a device or system functions properly prior to installation.
	– First article inspection and testing of a complete sign assembly.
	• CCTV System
	– Equipment environmental testing or manufacturer's certification for exterior – installed equipment and cabinets.
	– Unit testing to consist of inspection of all components and bench testing of completed assemblies.
	• ETTM Communications Network
	– Equipment environmental testing or manufacturer's certification for exterior installed equipment and cabinets.
	– Unit testing to consist of inspection of all components and bench testing of completed assemblies.

2.7.7 Onsite Installation Test (OIT)

1580	The OIT shall be conducted by Contractor for each lane configuration, including successful installation of the RSS, at the onsite locations identified by Authority in accordance with the Approved MTP, detailed testing procedures and Approved Baseline Implementation Schedule.
1581	The OIT shall verify the full functionality of the ETTM System and its compliance with this Scope of Work and Requirements and the Approved Design in a controlled, onsite environment using transactions created during both live Operations and when lanes are closed to traffic.
1582	The Express Lanes OIT shall verify the full functionality of Contractor's Approved solution for its compliance with this Scope of Work and Requirements and the Approved Design in a controlled, onsite environment using transactions created during live traffic Operations and when lanes are closed to traffic. All aspects of the Express Lanes functionality shall be testing including but not limited to: lane Operations, Toll Rate CMS control, and TOD pricing.
1583	The testing shall not interfere with the existing Authority System.
1584	Before the commencement of OIT, all Equipment and Software that are required under the Agreement shall be in place, in a production environment and configured for revenue Operations. The ETTM System interfaces to the BOS shall be connected to the respective test environments as Approved by Authority. Contactor shall install and integrate all TOC Equipment and systems, including video walls.

1585	In order to test the full functionality of the MOMS and System monitoring during OIT, all Equipment shall be entered into the System prior to the start of OIT and the MOMS shall be configured for full Operations.
1586	Contractor shall test the vehicle throughput and speed Requirements and generate sufficient transactions to prove the System can process transactions accurately and meet the Performance Requirements.
1587	The OIT shall be performed under differing light conditions including bright sun light, dawn, dusk, and nighttime.
1588	Performance Requirements shall be verified using a sample size Approved by Authority.
1589	The OIT shall validate that the ETTM System meets this Scope of Work and Requirements including but not limited to:
	• Operations of in-lane Equipment and their ability to report failures to the MOMS including the UPS;
	• normal and exception processing using multi-vehicle traffic;
	• multi-lane multi-vehicle traffic conditions such as rush-hour traffic (bumper to bumper), vehicle straddling/changing lanes/merging;
	• accurate assignment and proper framing of each vehicle;
	• accurate capture and correct association of Transponders, images and trip build to the correct vehicle;
	• accurate classification of vehicles, assessment of fare and processing of the transaction;
	• transaction processing during Equipment failures, and degraded modes of operation;
	• Performance Requirements using live traffic and controlled vehicles;
	• redundancy;
	• receive and process comprehensive and incremental TSL, enforcement notification list and toll rate schedules;
	• DVAS functionality;
	• security access;
	• TOC functionality;
	• Interoperability using Interoperable test accounts;
	• lane Business Rules;
	• interface to the RSS;
	• Collect traffic data from the Entrance Readers, and
	• interface to the BOS.
1590	An Audit of the lanes shall be conducted using live traffic to verify that the ETTM System is processing vehicles accurately and transactions can be reconciled in the System using the Approved audit tools.
1591	The OIT shall validate that the RSS meets this Scope of Work and Requirements including but not limited to:

	• functionality of the RSS and MOMS Dashboards shall be verified as it applies to transactions, alarm and failure monitoring;
	• all failure conditions;
	• user interfaces and toll collection management functions;
	• Business Rules;
	• reconciliation of transactions and revenue;
	• RSS reports;
	• Ad-hoc reporting capability;
	• accuracy of Performance Reports;
	• interface to the facility server (if applicable);
	• interface to the BOS including reconciliation;
	• interface to the Roadside systems;
	• conformance with performance, load and stress test Requirements;
	• security Requirements;
	• System backup Requirements;
	• archival and purging Requirements;
	• MOMS asset management; failure notification; work order tracking and performance reporting;
	• RSS high availability Requirements and
	• RSS DR Requirements.
1592	As part of the OIT, an end-to-end testing shall be conducted that validates the following functionality, including but not limited to:
	• System's ability to process and post transactions to the RSS and on to the BOS;
	• The successful transfer of images from the Roadside Systems to the RSS, image review and on to the BOS;
	• Various transaction posting scenarios that verifies the transaction processing, transaction posting, disposition and reconciliation per the Business Rules, and
	• the ETTM System is configured for Go-Live.

2.7.7.1 Onsite Installation Test (OIT) – 91 Express Lanes

1593	The Contractor shall compare ETTM Toll Collection and Enforcement Site transaction data to data provided by the Authority and the Existing BOS Contractor from the existing 91 Express Lanes, including but not limited to:
	• number of transactions by lane;
	• transponder to vehicle assignments;
	• vehicle classifications (if option selected);
	• all automated OCR/ALPR license plate data, and
	• all transactional data fields that will be sent to the BOS in compliance with the ICD.

1594	The Contractor shall use the associated DVAS images to resolve and report on discrepancies between the ETTM Toll Collection and Enforcement Site transactional data and the existing 91 Express Lanes transactional data.
1595	At a minimum, the Contractor shall compare and report on the ETTM Toll Collection and Enforcement Site transactional data and the data from the existing 91 Express Lanes for one (1) continuous 24-hour period per lane.
1596	Prior to Approval of OIT, the Contractor shall resolve any discrepancies between the ETTM Toll Collection and Enforcement Site transactional data and the existing 91 Express Lanes System transactional data.

2.7.8 Installation and Commissioning Test

1597	Contractor shall have conducted inspection and signed off on the ETTM System Infrastructure on the I-405 in accordance with the Agreement prior to the ETTM Site Commissioning Test. The Commissioning Test is intended to test all ETTM System and Roadside System functionality on the I-405 Express Lanes and 91 Express Lanes.
1598	The ETTM Site Commissioning Test shall include ensuring that the RSS can meet all requirements when faced with multiple Equipment sites. The ETTM Site Commissioning Test shall include using vehicles to create actual transactions in many different configurations. The test shall, at a minimum, include:
	• Correct trip building and toll rate assignment;
	• Exception processing;
	• Toll rate corrections;
	• Incident reporting;
	• Accounting and audit functionality; and
	• Failure conditions.
1599	The ETTM Site Commissioning Test shall test functionality that could not be tested in previous tests or that has changed as a result of the complete installation of the entire Roadside System. The ETTM Site Commissioning Test will include actual vehicles driving to create transactions in many combinations. It will also include transactions created in various failure modes. The ETTM Site Commissioning Test plan shall, at a minimum, include:
	• Posted trip price tested from live driver reports;
	• Live traffic data capture and transaction assembly;
	• Pricing for the entire I-405 Express Lanes;
	• Trip building for both transponder-based and image-based trips;
	• Toll rate setting and overrides;
	• Reports across multiple Zones;
	• Building of files to send to the BOS; and
	• Ad-hoc report capacity.
1600	The ETTM Site Commissioning Test, at a minimum, shall:

	• Complete full testing of all system functionality, from the Roadside System through the RSS to the BOS;
	• Demonstrate that transaction files, correction files and all other required communications can be successfully sent to the BOS and that the reconciliation files and all other required communications from the BOS can be successfully received by the ETTM System;
	• Demonstrate that these files are complete and accurate;
	• Demonstrate that the reconciliation data is properly stored in the database and reflected on all reports;
	• Test all other interfaces with the ETTM System, including the RSS and MOMS; and
	• Demonstrate that TOCs operators and CSRs can properly access the required screens and data and not access unauthorized portions of the system.
1601	The Installation and Commissioning Test shall be conducted by Contractor on each Toll Zone as a part of Contractor's Roadside System installation in accordance with the Approved MTP, detailed testing procedures and Approved Baseline Implementation Schedule.
1602	The Installation and Commissioning Test shall validate the functionality and operational status of the lanes including installation and configuration of all Equipment and Software. The lane Operations shall be verified end-to-end upon the completion of the installation checkout prior to opening the toll lanes and Equipment sites for revenue collection.
1603	During the Installation and Commissioning Test every piece of in-lane Equipment and its interface to the lane/zone controller shall be verified to be fully operational. The lane/zone controller, its interface to the RSS and the security access system shall be validated to ensure that the interfaces are in place and the ETTM System is ready for revenue collection.
1604	An Installation and Commissioning Test shall be conducted on the RSS and shall include the interfaces to the BOS. All data identified for migration shall be migrated to the RSS in accordance the data migration plan. Contractor shall support the possible Commissioning of the RSS prior to the Commissioning of the Roadside System.
1605	A Commissioning test shall be conducted on the RSS and shall include the image server(s) if applicable and the interfaces to the BOS.

2.7.8.1 Installation and Commissioning Test – 91 Express Lanes

1606	91 Express Lanes Go-Live shall not begin until the test results from the 91 Express Lanes Commissioning Test have been Approved by Authority. 91 Express Lanes Commissioning Testing shall be directly observed by Authority.

2.7.9 New BOS Testing

1607	As part of implementation of the New BOS, Contractor shall participate in the development of test plans and the testing of the New BOS as necessary to fully test the New BOS and new ICD.

1608	Any required ETTM System functionality not implemented with the Existing BOS shall be implemented and tested with the New BOS, including required changes to and testing of the ICD.

2.7.10 ETTM System Operational and Acceptance Test

1609	The ETTM System Operational and Acceptance Test shall be conducted by Contractor at each phase under this Project in accordance with the Approved MTP, detailed testing procedures and Approved Baseline Implementation Schedule after all lanes have been Commissioned in revenue collection.
1610	For ETTM System testing, Contractor shall develop Individual Test Plans for each of the major tests including:
	• ETTM Disaster Recovery and Back-Up Test;
	• ETTM Operations Test; and
	• ETTM Acceptance Test.
1611	Contractor shall conduct a complete test of the disaster recovery back-up equipment and plans. The plan for this test shall include instructions for mimicking several disaster and failure scenarios, which Contractor will outline in its Disaster Recovery Plan.
1612	Testers shall follow the procedures outlined in the Disaster Recovery Plan to determine whether both the System and the Disaster Recovery Plan allow Authority to continue operations and recover all data. The Disaster Recovery and Back-Up Test shall include both fail over to disaster recovery and back to normal operations.
1613	It is a condition of Go-Live that the test results from the disaster recovery and back-up testing have been Approved by Authority. Testing shall be directly observed by Authority.
1614	The ETTM System Operational and Acceptance Test shall be conducted for each Roadside at each ETTM Site upon authorization by Authority to commence such testing. The ETTM System shall be observed in live revenue Operations by Contractor and Authority for a minimum of two (2) monthly audit cycles.
1615	The objective of the Roadside System Operational and Acceptance Test is to ensure that the ETTM Software and Hardware functions over the test period with limited manual intervention in live Operations. It is intended to confirm that the Roadside System and the network are sized, tuned and configured correctly and data is processed without interruption or errors.
1616	The ETTM Operational and Acceptance Test shall validate the interface of the ETTM System to the BOS, and reconcile the transactions and images end-to-end.
1617	During the test period, System accuracy, performance of the System and Operations shall be validated including:
	• all System accuracy Requirements specified in the Agreement using representative sample size for each facility under test;
	• all Maintenance Performance Requirements;
	• all System Performance Requirements;
	• one 24-hour individual vehicle audits and two 2-hour peak period individual vehicle audits shall be performed for each lane at each ETTM Toll Collections and Enforcement Sites and ETTM Transponder Read Sites;

	• transaction processing in accordance with Authority Business Rules;
	• correct classification of vehicles and assignment of toll; and
	• monitoring of all interfaces for the accurate transfer and processing of all records.
1618	System reliability and auditability shall be verified manually and through tools and reports provided in the System.
1619	Dashboards and reports shall be verified daily for accuracy and reconciled to Operations and interface files. All exceptions shall be investigated. Queries and detailed reports shall be generated to validate the daily, weekly, monthly, yearly and comparative reports and compared to reports.
1620	The alarms displayed on the MOMS and all interface status notification shall be verified to be accurate.
1621	The sample size of the accuracy test shall be adjusted to make sure a representative sampling of transactions from each lane is included in the sample size. The sample size shall be statistically high to ensure that data collected from each lane is representative of all traffic conditions and vehicle types and covers all environmental and light conditions.
1622	Failure of the Roadside System to meet a Performance Requirement shall result in the restart of that particular test until such time the accuracy Requirements are met.
1623	The ETTM System Operational and Acceptance Test shall be repeated until Authority is satisfied that the ETTM System meets the terms and conditions of the Agreement as set forth in the Agreement at each Roadside.

2.7.11 Project Acceptance

1624	Upon the successful completion of ETTM System Operational and Acceptance Test for the ETTM System, the closure of all punch-list items and completion and submission of all Agreement required documents as set forth in the Agreement, Contractor shall be given the Project Acceptance as described in the Agreement.

2.8 Maintenance and Software Support Services

The Requirements described in this section detail the Hardware Maintenance and Software and Administrative Support Services Requirements for the Roadside System including any existing equipment integrated into Contractor's solution. The Hardware Maintenance and Software and Administrative Support Services ("Maintenance") include:

1. Hardware Maintenance Services for the Equipment, infrastructure and Hardware;
2. Network Maintenance Services for the Roadside Systems;
3. ETTM ITS Maintenance;
4. Toll Facility Maintenance;
5. TOD Pricing;
6. Shadow Dynamic Pricing;
7. ETTM System Server and Database Administration Services, and
8. Software Support Services for the ETTM System.

Contractor shall provide all Maintenance activities associated with the Maintenance and Software Support Services throughout the Agreement Term as further set forth in this Scope of Work and Requirements and in the Agreement.

2.8.1 Roadside Maintenance Services – General Requirements

1625	Hardware, Software and System Maintenance Services shall be for a period from Acceptance of the ETTM System through the end of Agreement Term (including extensions) as further set forth in the Agreement with full warranties as further set forth therein.
1626	Contractor shall be responsible for supporting and maintaining the ETTM System for any time period in which the System is installed, Commissioned and placed into revenue service but has not passed required testing. The Maintenance of the Roadside System provided under this Agreement prior to Acceptance is not included in the term of the Maintenance and Software Support Services. Contractor shall coordinate all Maintenance activities with Authority during this period.
1627	Contractor shall provide the latest Software License and associated Escrow as further set forth in the Agreement.
1628	In the Operations and Maintenance Phase, Maintenance shall include all Services required to maintain the System, including Hardware, Equipment, Software and components at required performance levels. Authority shall not be charged any additional amounts beyond those included in the Approved Price Proposal for all Services related to Maintenance; notwithstanding the foregoing, Force Majeure events shall be as set forth in the Agreement.
1629	Contractor is responsible for the provision and maintenance of all equipment, devices, and vehicles required to perform the maintenance of all Equipment and assigned infrastructure, including but not limited to:
	• maintenance truck;
	• bucket truck;
	• maintenance tools

1630	All Equipment mounting Hardware and brackets provided as a part of this Scope of Work and Requirements shall be included under Maintenance Services and as such shall be warrantied for the life of the Project.
1631	Contractor shall provide Roadside System Maintenance Services and Operations.
1632	Contractor shall provide one hundred (100) percent of ETTM ITS and LAN Maintenance Services
1633	Contractor shall provide one hundred (100) percent of RSS Hardware, Software, Database and System Administration Maintenance Services including operating System and Software security Updates in coordination with Authority.
1634	The Services and Work performed under the Agreement are considered PII and highly confidential and Contractor personnel and ETTM System shall at all times comply with Authority security policy and any State and Federal law or policy.
1635	User sign-on, access and access failures, both local and remote, to any element of the ETTM System shall be recorded and tracked for security audit proposes and reported to the MOMS. Security Software shall continuously and automatically monitor the System for unauthorized access; access violations shall be reported to the MOMS as Priority 1 Alert. These reports shall be provided to Authority within twelve (12) hours of discovery.
1636	A system level account shall be provided for Authority security systems to perform “credentialed” scans. Additionally, Authority can request Contractor to perform any scans and ensuing reports through the Agreement Term.
1637	Contractor shall perform scans and provide reports upon a request from Authority for the life of the Agreement.
1638	Contractor shall not circumvent the Approved System security. All access to the System and Approved changes made shall be recorded, monitored, reviewed and audited. Specific requirements for this shall be developed by Contractor during System Design.

2.8.1.1 Warranty Program

1639	Contractor shall be responsible for the development, implementation and administration of a warranty program for all Hardware, Contractor developed Software and third-party Software as further set forth in the Agreement.
1640	Contractor shall maintain warranty records and service agreements for all Hardware including existing Hardware re-used by Contractor and third-party Software, and shall review and implement Software Upgrades and available patch reports to keep the Roadside System current per the Approved QA Plan and as further set forth in the Agreement, Terms and Conditions.

2.8.1.2 Detailed Maintenance Requirements

The Maintenance Services shall include monitoring; preventive; pervasive; corrective; security related and emergency Maintenance Services and all Upgrades and Updates to be performed on all elements of the Roadside System.

1641	Detailed assignments of Levels to incident types shall be in accordance with the Requirements and shall be defined and Approved during the Implementation Phase of the Project.

1642	Contractor shall monitor MOMS work orders and initiate corrective actions to meet Requirements for response to Maintenance events and incidents that are under Contractor's responsibility.
1643	As part of the Maintenance and Software Support Services, Contractor shall develop and test Software as required, both systematically and field testing to accommodate corrective actions, changes to Business Rules or configurations. Scope shall include provision of evidence packages detailing the planned changes for Authority's review and Approval, including installation of new Software and confirmation of successful installation per the Approved QA Plan.

2.8.1.2.1 Maintenance Requirements – Level 1

The functions listed in this section are categorized as Level 1 Maintenance tasks.

1644	All Maintenance incidents, activities and monitoring shall include but are not limited to:
	• monitoring the Roadside System for failures and alarms, and confirm a MOMS work order has been created for each failure as defined
	• acknowledging and responding to work orders assigned to Contractor;
	• creation and assignment of a work order in MOMS if a work order has not been created;
	• performing the necessary Maintenance and closing the MOMS work order upon confirmation that the failure has been successfully corrected;
	• monitoring and Maintenance of the production, data warehouse and test environments;
	• Updates to Operating System and Software infrastructure in the production, data warehouse and test environments;
	• Performing Preventive Maintenance in accordance with Approved Maintenance Plan.
	• general Equipment and Hardware Maintenance, replacement and spare parts inventory in MOMS;
	• general inspection and Maintenance of Roadside Infrastructure;
	• Equipment and Hardware monitoring, Updates and general Maintenance and troubleshooting including diagnostic checks;
	• ongoing monitoring, Updates, Maintenance tasks related to roadside subsystems, Operations, controllers, servers and storage systems;
	• proactively addressing potential server and storage System Hardware issues;
	• Address and resolve third-party Software issues (OS, third-party, peripheral and infrastructure Software);
	• backup System monitoring (verification of successful backups), maintaining (applying Updates when needed) and managing (backup media rotation, offsite storage, etc.);
	• monitoring, Updating, Upgrading and general Maintenance and troubleshooting of LAN communications and associated devices;

	• monitoring, Updating, Upgrading and general Maintenance and troubleshooting of WAN communications and associated devices;
	• deployment of Roadside Systems Software to the production data warehouse and test environments;
	• maintaining the ongoing relationship (support and Maintenance agreements) with third-party vendors and
	• performing Software licensing renewals.
1645	Contractor shall perform all System administrative functions at regular intervals if not automated and recording and tracking such activities as Preventive Maintenance work orders through MOMS.
1646	Contractor shall perform continuous monitoring of Roadside System Operations to verify System is functional; security posture is adequate; processes are being executed as scheduled; files are transmitted as specified, and System is operating to Agreement Performance Requirements.
1647	Contractor shall perform manually retrieval of data from the zone controllers and download of TSL and License Plate File in the event of extended communications failure.
1648	Contractor shall perform re-establishing or re-installing Roadside System files, programs and parameters, as required, following a failure or damage to the System and returning lanes to fully operational condition.
1649	Contractor shall perform Disaster Recovery (DR) procedures as needed and return lanes and RSS to fully operational condition when DR is initiated.
1650	Contractor shall continuously monitoring OCR/ALPR performance and performing OCR/ALPR Updates as required to support license plate changes.
1651	Contractor shall analyze anomalies and periodic, daily and weekly trends to identify problems and initiating investigation and subsequent correction.
1652	Contractor shall actively monitor system performance and recommend changes or improvements as technology or new methods becomes available that will create measurable improvements and/or efficiencies for both technology and operations.

2.8.1.2.2 Maintenance Requirements – Level 2

Level 2 Maintenance tasks shall be performed as described below.

1653	Level 2 Maintenance shall include but not be limited to the following:
	• Work orders and Alerts assigned to Contractor as defined during the Implementation Phase.
	• development of defect fixes, security fixes, performance fixes and corrections to the Software and Applications as identified during audits;
	• Updates to all Software drivers to meet any new standard Operating System Upgrades as they become available;
	• Software changes required to accommodate changes to Business Rule, parameter changes, lane configurations and minor updates to existing ICDs;
	• source code Maintenance;
	• perform internal testing prior to releasing fixes to production;

	• perform field testing prior to releasing fixes to production;
	• ongoing Software Maintenance and warranty as set-forth in the Agreement;
	• change management and configuration management tasks prior to Software and Hardware changes and
	• any Level 1 escalated issue.

2.8.1.3 Updates and Upgrades

1654	Contractor shall provide in electronic format all patches, Updates, and Upgrades made to the System Software.
1655	Contractor shall provide all Software modifications, Updates, and Upgrades required to Maintain and support the Roadway System in conformance with the Requirements and to mitigate system security threats. The following items are examples of items that shall be included in the Maintenance Services and shall not be considered Enhancements paid for by Authority: Equipment version changes; configuration or parameter changes; minor changes to Software or code, such as changes to the existing ICDs; third-party Hardware and Software Updates and Upgrades, Software modifications required to ensure Roadway System is compliant to latest standards (for example PCI DSS) and security patches, and changes for Contractor's benefit that improve Contractor's ability and efficiency to maintain and support the Roadway System.

2.8.1.4 Enhancements

1656	Enhancements shall be proposed by Contractor or requested of Contractor in accordance with the Agreement Modification process as set forth in the Agreement. Examples of Enhancements include: accommodating major changes to standards and statutes and regulations not otherwise anticipated, but excluding Updates to PCI DSS; Interoperability Equipment changes, or the addition of new Equipment or functionality providing demonstrable benefits in performance, costs or productivity to Authority.

2.8.1.5 Software Deployment

Contractor shall provide a reliable, repeatable, and easy-to-deploy method to update the ETTM Software and RSS Software in all lanes and environments as applicable.

1657	Contractor shall employ and apply industry standards for enterprise-grade Software deployment and shall provide Software Updates via easy-to-use executable installer files or similar.
1658	Contractor shall provide a wizard-like method so all aspects of the Software update process are encapsulated in a single automated installation package, avoiding requiring separate manual processes.
1659	Contractor shall provide an automated means for the installation to be verified ensuring that the version installed includes all appropriate Software elements (such as executable files, configuration files, components, libraries and registry entries) in place.
1660	Contractor shall provide full logging of the installation process so issues can be investigated.

1661	Contractor shall provide a seamless rollback feature as part of the Software installer that will automatically reverse the installation and restore its original version in the event a fatal error is encountered during the installation process.

2.8.1.6 Maintenance Priorities, Response and Repair Times

1662	Response and repair time is defined as the combined time from when failure occurred or problem was reported to when the repair or correction of the failure occurred; the period of time beginning when the failure occurred (failure time) and ending when the fault condition is corrected and returned to normal Operations.
1663	Response and repair times for every Maintenance event shall be recorded in the MOMS and reported and such reports shall be provided to Authority in accordance with the reporting Requirements of this Scope of Work and Requirements.
1664	Contractor shall post a weekly schedule staff or a pool of staff to respond to and correct any issues. Contractor provided staff or a pool of staff provided by the Contrator shall be trained and educated in maintaining and servicing the ETTM System to meet the Performance Requirements outlined in this Scope of Work and Requirements.
1665	Response to calls and repair times shall be determined by Priority as described below. Contractor failure to meet the response and repair time criteria described below shall result in monthly fee adjustments.
1666	Regardless of coverage, onsite or on-call service, acknowledgement of receipt of notification of a Maintenance issue or human acknowledgment of a failure shall not exceed thirty (30) minutes after the failure notification was recorded or problem was reported.
1667	The Priority of failures shall be defined during the Implementation Phase. Time to respond and complete repair are determined by Priority and is defined as below.
1668	Priority 1: Defined as any malfunction or fault that results in the immediate loss of revenue; security breach; closure of lanes outside of Authority lane closure Requirements; hazard to personnel or driving public; loss of audit data; loss of redundancy in any redundant System components; loss of any high availability components; loss of functionality that impacts Interoperable Agencies or failure that negatively impacts the Roadside or RSS Operations.
	• For Roadside Maintenance, this Priority shall have a two (2) hour time to respond and complete repair.
	• For RSS Maintenance, this Priority shall have a four (4) hour time to respond and complete repair.
1669	Priority 2: Defined as any malfunction or fault that degrades the System performance but not the operational ability of the System. It includes, but is not limited to inaccurate reporting, inability to reconcile revenue or loss of System functionality that impacts access to data.
	• For Roadside Maintenance, this Priority shall have a four (4) hour time to respond and complete repair.
	• For RSS Maintenance, this Priority shall have an eight (8) hour time to respond and complete repair.

1670	Priority 3: Defined as any action or event that has the potential to result in a malfunction or degrading of the System performance but has not impacted performance and is not anticipated to immediately impact performance.
	• For Roadside Systems Maintenance, this Priority shall have a twenty-four (24) hour time to respond and complete repair.
	• For RSS Maintenance, this Priority shall have a forty-eight (48) hour time to respond and complete repair.
1671	Outages and tasks performed under the Approved Preventive Maintenance period shall be defined as Priority 4. The System shall be available and fully operational within the Approved time schedule for such activities and upon completion of the Preventive Maintenance period. Delays and problems associated with not completing scheduled Preventive Maintenance within the window specified may be included in the Performance Requirement Calculations. Any failures generated or resulting from Preventive Maintenance activities shall be accounted for as Priorities 1, 2 or 3 and be addressed in accordance with these Requirements.

2.8.1.7 Notifications

1672	The entry of a problem (either by the System or an Authorized User) into the MOMS or the presence of a failure notification shall constitute the start of the acknowledgment time for purposes of measuring Contractor's acknowledgment time and response/repair time.
1673	For purposes of measurement of performance and for the development of Maintenance policy and procedures, notification of System malfunctions, problems and discrepancies may be provided to Contractor in four (4) different methods, summarized below.
	• Verbal notification: Defined as an in-person notification or telephone call to Contractor's designated Maintenance personnel. In all cases, the first conversation with, or notification of Contractor shall signify the start of the response time for purposes of measuring Contractor's response time. All verbal notifications shall be recorded in MOMS by Contractor.
	• Written notification: Defined as a written description of a problem or condition, typically provided by Authority. Written notification could be faxed, texted, or emailed to Contractor by a customer or user. The time of receipt of fax, message or email shall signify the start of the response time for purposes of measuring Contractor's response time. All written notifications shall be recorded in MOMS by Contractor.
	• MOMS notification: Defined as an automatic notification through the MOMS identifying a problem within the Roadside System that is the Maintenance responsibility of Contractor and sending out an automatic work order message by email or text to a Contractor's Maintenance staff to respond to the failure. In addition to Contractor notification, the work order shall be posted on the MOMS and available via reports. The presence of a MOMS notification in the System shall constitute the start of the response time for purposes of measuring Contractor's response time.
	• Generation of Alert: Defined as an automatic creation of an Alert identifying a problem within the Roadside System that is the Maintenance responsibility of Contractor. The generation of the automatic Alert in the System shall constitute the start of the response time for purposes of measuring Contractor's response time.

2.8.1.8 Recording of Maintenance Activities

1674	Contractor and Authority shall utilize the MOMS for initiating the work orders. MOMS shall be utilized for recording and tracking all Maintenance and Software Support Services performed on the Roadside System. All Equipment provided under this Agreement shall be tracked through MOMS from the purchase to their disposal.
1675	In all cases Contractor is responsible for logging all reported Maintenance activities into the MOMS. Contractor shall also be responsible for documenting all information and issues related to a failure condition, including all actions taken to complete the correction into the MOMS.
1676	The work order shall contain as much information as possible in order for persons other than the technician or his supervisor to reasonably determine the fault, when it was worked on, the corrective action and any other information pertaining to the individual Maintenance event, including replacement of parts.
1677	All performance metrics shall be recorded and tracked through the MOMS and compliance to Performance Requirements shall be validated using MOMS reports.
1678	It is Contractor's responsibility to ensure that its Maintenance staff has real time access to the MOMS and that all the required connections are established and ongoing to ensure that the Maintenance staff has secure remote access Approved by Authority. Maintenance staff shall be trained in the use of the MOMS.

2.8.1.9 Audits

1679	Contractor shall completely support Authority in any audit activity relating to the ETTM System or Operations. In addition, Contractor shall conduct audits in accordance with Contractor's Quality Assurance Program. All deficiencies identified through the Audit process shall be successfully corrected by Contractor. These audits may include, but are not limited to the following:
	• internal control procedures;
	• revenue/transaction reporting;
	• financial audit and
	• ETTM System processing and performance.

2.8.1.10 Security Certification

1680	Contractor shall perform monthly penetration and vulnerability tests that are scheduled in the MOMS, as well as every time a new Software release is deployed or new network Equipment is added or replaced to evaluate the security risk to the ETTM System and identifying potential vulnerabilities.
1681	Contractor is responsible for correcting all ETTM System security deficiencies at Contractor's cost and ensuring there are no security risks.

2.8.1.11 Cooperation with Other Vendors and Providers

1682	Contractor shall cooperate to the fullest extent with other Contractors and third-party vendors in order to ensure that the ETTM System Operation and Maintenance do not conflict with or cause any deterrent in capability or service to the traveling public, customers, or Authority.

2.8.2 Maintenance Responsibilities and Services

This section details Contractor's responsibilities for providing Maintenance Services and associated communications during this time period, including but not limited to:

- Roadside Equipment and Infrastructure Maintenance;
- ETTM Hardware Maintenance (servers, storage, network switches, firewalls, routers, etc.);
- ETTM ITS Maintenance;
- Toll Facility Maintenance;
- network administration;
- System administration;
- database administration;
- Software support services;
- monitoring services;
- System security and
- Preventive maintenance.

In delivering the Maintenance Services, Contractor shall perform the following Services, including but not limited to:

- onsite support of the RSS and Roadside Systems;
- onsite support of the ETTM System
- well documented Maintenance schedules and processes;
- Authority Approval and onsite supervision for all Maintenance Work;
- coordination with Authority and other affected agencies as needed on all lane work;
- coordination with Authority and Caltrans on all Lane Closures;
- Contractor-provided Maintenance of Traffic (MOT) for all Lane Closures, utilizing regularly scheduled maintenance as much as possible;
- change and configuration management;
- complete around-the-clock Maintenance of the System;
- ongoing participation with Authority's staff and involvement in meetings and processes and
- provision of an ample spare parts inventory to meet all Performance Requirements.

2.8.2.1 ETTM Hardware Maintenance and Software Support Services

The Requirements in this section describe Hardware Maintenance and Software Support Services.

1683	Contractor shall inspect, monitor, test, troubleshoot and repair all cables; wiring; conduits; cable trays; terminations; all in-lane System electronics and controllers; all network equipment; all re-used equipment; of the Roadside System including, but not be limited to:

	• perform routine diagnostics on all in-lane peripherals.
	• perform routine diagnostics on all in-lane subsystems.
	• perform Inspection and Maintenance of environmental control devices, UPS, and generators.
	• perform Inspection and Maintenance of racks, cabinets, vaults, and general supporting infrastructure.
	• perform monitoring and Maintenance of the Roadside System Software processes, Operations, and interfaces to the RSS and to the BOS.
	• perform monitoring real-time Roadside Operations screens and Dashboards and responding to issues.
1684	Contractor shall perform analysis of real-time, daily and weekly trends to identify problems, including but not limited to:
	• high number of transactions without Transponder;
	• high number of trips with a mix of Transponder-Based and Image-Based Transactions;
	• high number of Class Mismatch transactions;
	• abnormal changes in traffic counts;
	• high number of exceptions or unusual occurrences;
	• transaction exceptions;
	• high number of invalid Transponder transactions;
	• abnormal changes in Transponder counts and status changes and
	• high number of rejected images.

2.8.2.2 Monitoring and System Administration Services

The Requirements in this section describe the Monitoring and System Administration Services.

1685	All System administrative functions, if not automated, shall be performed by Contractor at regular intervals as part of the Preventive Maintenance Services according to the Approved Maintenance Plan to ensure System performance is optimized. All such System administrative functions shall be scheduled as Preventive Maintenance work orders through MOMS and tracked.
1686	Continuous monitoring of System Operations shall be performed by Contractor in conjunction with Authority to verify System is functional; security posture is adequate; processes are being executed as scheduled; files are transmitted as specified, and System is operating to Agreement Performance Requirements.
1687	Continuous monitoring of Operations including but not be limited to:
	• confirming and verifying receipt of all the MOMS messages and Alerts;
	• verifying the MOMS is receiving and processing System events and reporting the correct status;
	• evaluating sample transactions data for exception;
	• confirming data and image transmission to the RSS;

	• verifying processes, programs and scheduled jobs are successful;
	• reviewing comparative reports to identify System degradation;
	• confirming successful transfer of Transponder status list to the lanes;
	• reviewing OCR/ALPR or manual image processing results and poor quality images;
	• monitoring the DVAS video and event data;
	• verifying security access cameras are operational;
	• reviewing sample images from each ALPR camera;
	• validating Toll Rate CMS displays are correct;
	• monitoring traffic detectors (if applicable);
	• correcting performance issues identified;
	• evaluating storage requirements;
	• verify time synchronization is occurring as configured and System clocks are not drifting beyond acceptable threshold and
	• reviewing error logs and Alerts.
1688	Provide continuous 24/7 System administration services coverage on the RSS to ensure that it is performing and will continue to perform at a satisfactory level.
1689	System administration services shall include monitoring and corrective action to ensure System performance is in accordance with this Scope of Work and Requirements. This shall include but is not limited to:
	• monitoring RSS Hardware at the primary and secondary locations including servers; storage devices and backup systems;
	• verifying processes, programs, and scheduled jobs are successful;
	• all transactions and images are successfully transmitted to the receiving Systems;
	• all messages described in the ICD are being successfully exchanged between the ETTM System, and BOS;
	• confirm applications are functional and available to Authorized Users;
	• all scheduled reports are successfully generated and available to Authorized Users;
	• all processes are functioning and data and images are moving successfully though the queues;
	• all third-party interfaces are functioning and successfully exchanging files;
	• scheduling of preventive, corrective and predictive Maintenance activities;
	• any daily, weekly, or periodic Maintenance required to maintain the System at required performance levels (for example: indexing and tuning databases; archiving and purging in accordance with Authority's retention policy);
	• maintaining and updating records of all Maintenance events and activities in the MOMS;

	• third-party Software or firmware Upgrades in conjunction with Authority, as required and to be compliant to security Requirements including but not limited to performing security Software Upgrades, database Upgrades and operating System Upgrades;
	• contact with Authority, Operations and Contractors regarding System issues, performance, security posture, Software Release and Maintenance scheduling;
	• Approved manual actions, adjustments and Updates to the System data based on predefined criteria to correct issues and as Authorized by Authority;
	• re-establishment or re-installation of System files, programs and parameters, as required, following a failure or damage to the System;
	• monitoring of error logs and System logs;
	• Maintenance of up-to-date Software backups (all System Software and data);
	• installation of new Software and confirmation of successful installation;
	• verify time synchronization is occurring as configured and System clocks are not drifting beyond acceptable threshold;
	• assisting Authority staff as requested by Authority;
	• troubleshooting Roadside System issues;
	• creation of Ad-hoc reports requested by Authority;
	• generation of queries as requested by Authority, and
	• analysis of data as requested by Authority.
1690	Maintenance and Software Support Services shall include monitoring and corrective action to ensure System performance is in accordance with this Scope of Work and Requirements, to include database management and operation. This shall include, but is not limited to:
	• investigation and analysis of errors and exceptions and taking corrective action including correcting the problem and reprocessing the data;
	• monitoring of notifications, and initiating corrective actions on application programs to meet Requirements;
	• Updates to the ETTM System and application to support Upgrades to Hardware or third-party Software;
	• Updates and Upgrades to the ETTM System and application to support all changes to Business Rules and ETTM System Configurable parameters, and deploy changes in production;
	• participate in Interoperability meetings as requested by Authority.
	• Updates and Upgrades to the ETTM System and application to support minor changes to Authority Interoperable Agency and National Interoperability ICD;
	• Updates to the ETTM System and application to support the addition of new Interoperable Agencies;
	• Updates to the ETTM System and application to support changes to continue its compliance to updated security Requirements;
	• Updates to the ETTM System and application to correct security deficiencies, and

	• Updates to the ETTM System and application to support legislative and statutory changes.
1691	Contractor shall perform OCR/ALPR Updates as required to support license plate changes for California plates and the license plates from the States of California, Nevada, Arizona, Illinois, Texas, Washington, and Utah.
1692	Contractor shall monitor all network Alerts and alarms, as well as detect intrusion attempts and prevent intrusions.
1693	Contractor shall Upgrade and Update the network security and provide the required Software and monitoring tools to ensure the ETTM System is always in compliance with the most recent penetration and vulnerability test Requirements.
1694	For the 91 Express Lanes, with each change to the toll rate schedule, Contractor shall provide an updated electronic file (Excel or simple file format) for uploading to the 91 Express Lane Toll Rate CMSs. The file type and format shall be determined during the Implementation Phase and shall be synchronized with the ETTM System toll rates.

2.8.2.3 Express Lanes – Post-Deployment Evaluation

1695	Following deployment of the DPS, the ETTM System shall support extensive reporting, testing and evaluation of the Express Lanes performance to provide Authority with critical information to enable adjustment of configurable parameters (if necessary) to achieve operational and revenue goals. To support this, the ETTM System should be designed to generate the following reports on demand, drawing on data extending back for up to 13 months:
	• Comparative performance reports summarized by 15-minute intervals, differentiating between the general purpose lanes and the Express Lanes, by Corridor, by Segment and including, average speeds, average density, full Corridor-length travel time;
	• Toll rate graphs for any given day, showing the rates by interval for each Segment, in each direction.
1696	Assessment of operational standards for 91 Express Lanes. In order to inform Authority of the extent to which these goals are achieved on a day-to-day basis, the ETTM System shall generate the following reports broken down by direction:
	• the percentage of time during peak periods in which the average speed in the Express Lanes was greater than or equal to the configurable operational goal (for example, 55 mph);
	• the percentage of time during peak periods in which density in the Express Lanes was less than or equal to the configurable operational goal (for example, 35 vehicles per mile per lane); and
	• the percentage of time during peak periods in which the full-length travel time in the Express Lanes was less than the full-length travel time in the general purpose lanes.
1697	Assessment of operational standards for I-405 Express Lanes. In order to inform Authority of the extent to which these goals are achieved on a day-to-day basis, the ETTM System shall generate the following reports broken down by Corridor, by Segment, and by direction:

	• the percentage of time during peak periods in which the average speed in the Express Lanes was greater than or equal to the configurable operational goal (for example, 55 mph);
	• the percentage of time during peak periods in which density in the Express Lanes was less than or equal to the configurable operational goal (for example, 35 vehicles per mile per lane) and
	• The occurrence of HOV ONLY mode with details on time of occurrence, duration, speed and travel time in Express Lanes and general purpose lanes, and if incidents affect the HOV ONLY time.
	• the percentage of time during peak periods in which the full-length travel time in the Express Lanes was less than the full-length travel time in the general purpose lanes.

2.8.2.4 Interoperability Requirements

1698	Contractor shall support the following Authority Interoperable Agencies and National Interoperability activities as required by Authority. Activities include but are not limited to:
	• support CTOC and National Interoperability Agency testing as requested;
	• support substantial changes to the System to meet major modifications to Authority Interoperable Agencies and National Interoperability specifications, and
	• be compliant with the latest published Authority Interoperable Agencies and National Interoperable specifications for the duration of the Agreement.

2.8.2.5 Updates to Maintenance Plan and Other Maintenance Related Documentation

1699	Contractor shall periodically update the Maintenance Plan and other Maintenance Documentation to reflect any changes to the policies or procedures developed by Contractor and Approved by Authority for the ETTM Maintenance Services. The Maintenance Plan shall be updated and submitted for review and Approval on an annual basis. However, sections of the Maintenance Plan or its appendices shall be submitted for review and Approval as the changes are identified. A version update sheet shall be included with the Maintenance Plan, and the Maintenance Plan on file shall have the most recent version from the configuration management database. A final Submittal of the Maintenance Plan and other Maintenance Documentation shall be provided at the end of the Agreement Term.
1700	Contractor shall provide in electronic format all patches and Updates made to the System Software (third-party and Contractor) after Acceptance.

2.8.2.6 Types of Maintenance

2.8.2.6.1 Preventive Maintenance

1701	Contractor shall provide and perform onsite Preventive Maintenance on the Roadside System Hardware, RSS Hardware, Contractor LAN /WAN communications Equipment and Software in accordance with the Approved Maintenance Plan.

1702	Contractor shall inspect all Contractor installed Equipment, both major components and support components (fans, cables, connectors, cabinets, Equipment racks, storage units) that constitute the Roadside System and shall make such repairs; cleaning; adjustments, and replacements of components as necessary to maintain the Equipment in normal operating condition in accordance with the Approved Maintenance Plan.
1703	In addition to required ongoing Contractor monitoring, the servers and data processing units shall be periodically checked by Contractor to verify that storage space is not reaching limits, disks are not fragmented or damaged, Software being used is of latest version per the configuration management and data is being processed and transferred in an appropriate manner.
1704	Transaction and image processing volumes and times shall be monitored by Contractor and Systems optimized for performance with Authority Approval.
1705	Report generation times, System access times, and System response time shall be monitored by Contractor to ensure performance meets the Contractual Requirements.
1706	Contractor shall include all Equipment and Systems as part of the Preventive Maintenance in accordance with the original Equipment manufacturer's guidelines. Any variations or exceptions shall be noted by Contractor and Approved in advance by Authority.
1707	Preventive Maintenance shall be performed by Contractor during the normal working hours when Maintenance technicians are scheduled to be onsite. Authority Approved diagnostic aids, tools and Equipment to perform Preventive Maintenance Equipment analysis shall be provided by Contractor, as necessary.
1708	Preventive Maintenance requiring lane closure shall be scheduled by Contractor for off-peak travel periods; evenings; Saturdays, and Sundays and coordinated with Authority and Caltrans, if necessary, so that the Work shall not interfere with normal traffic flow, unless otherwise Approved by Authority.
1709	Contractor shall provide a Preventive Maintenance schedule, to be Approved by Authority, as part of the Maintenance Plan. The schedule shall detail the Preventive Maintenance to be performed on each Equipment item and System. The schedule shall provide a description of the Work to be performed, expected duration and the frequency.
1710	The Preventive Maintenance schedule shall be entered by Contractor into the MOMS and work orders shall be automatically created to Alert Contractor staff of required Preventive Maintenance. Failure of Contractor to perform required Preventive Maintenance in accordance with the Approved schedule shall result in monthly fee adjustments, as specified below in the Maintenance Performance Requirements.

2.8.2.6.2 Corrective Maintenance

1711	All Work performed by Contractor to correct problems to meet this Scope of Work and Requirements or Software defects shall be considered as corrective Maintenance. Such problems include but are not limited to:
	• failure of subsystem functions;
	• problems identified by the users, including the Caltrans, and customers;
	• interface issues;
	• failure of processes and programs;
	• data reconciliation issues;

	• report issues;
	• application failures;
	• ETTM System network issues;
	• inadequate security posture;
	• degraded System or component performance, and
	• non-conforming availability or Mean Time Between Failures (MTBF).
1712	Authority shall be notified before any corrective Maintenance is performed.
1713	Notwithstanding the foregoing, for repeated failure of Equipment, components, or Systems, Contractor shall undertake an investigation. If the problem is determined by Authority to be a Pervasive Defect, Contractor shall be responsible for resolution as set forth in the Agreement.

2.8.2.7 Maintenance Coverage

1714	Contractor shall provide continuous (24/7) coverage for all monitoring and Maintenance-related activities sufficient to meet this Scope of Work and Requirements.

2.8.2.8 Spare Parts

2.8.2.8.1 91 Express Lanes Spare Parts

Contractor shall access to storage area at the 91 Express Lanes Anaheim Administration building for Contractor's use.

1715	Contractor shall be responsible for the inventory of all spare parts at the storage facility and shall be insured in this regard as set forth in the Agreement. Contractor shall account for all spare parts and shall provide safeguards against theft, damage, or loss of the spare parts.
1716	Contractor shall ensure that the spare parts have been tested and deployment ready. Spare should be labeled with the test date.
1717	Contractor shall ensure that only spare parts and Equipment required to service the ETTM System are stored at this facility and shall only be used for Authority.

2.8.2.8.2 I-405 Express Lanes Spare Parts

Contractor shall provide a storage location for Contractor's use for the storage of the Roadside System spare parts unless provided by Authority.

1718	Contractor shall be responsible for the inventory of all spare parts at the storage facility and shall be insured in this regard as set forth in the Agreement. Contractor shall account for all spare parts and shall provide safeguards against theft, damage, or loss of the spare parts.
1719	Contractor shall ensure that the spare parts have been tested and deployment ready. Spare should be labeled with the test date.
1720	The spares facility and storage area shall be secured and connected to an up-to-date security network System with alarm notification monitored by Contractor. Further, it is

	required that Authority shall have full and unrestricted access to the Maintenance and or storage facility.
1721	Contractor shall ensure that only spare parts and Equipment required to service the ETTM System are stored at this facility and shall only be used for Authority.

2.8.2.8.3 Spare Parts Inventory Management

1722	Contractor shall be responsible for the Maintenance of an adequate spare parts inventory during the Agreement Term. Contractor is responsible for monitoring and identifying the existing spare parts inventory, ordering spare parts as required, and proposing the quantity needed to maintain the required performance.
1723	Contractor shall, on a quarterly basis, update and recommend a spare part quantity to be maintained in order to support the ETTM System functionality and operational readiness.
1724	Contractor shall notify Authority if a spare part is to reach the Manufacturers/Suppliers end of life cycle or support prior to the end of the Agreement.
1725	Contractor shall be responsible for purchasing and replenishing spare parts inventories to the levels required to meet the Performance Requirements. Contractor's failure to purchase or replenish the spare parts or consumables to levels necessary to meet the Performance Requirements is not an excusable failure and will not relieve Contractor from Performance Requirements or any associated liquidated or actual damages resulting from the non-performance.
1726	During the Agreement Term, Contractor shall be responsible for purchasing all spare parts and miscellaneous repair items and consumable materials necessary to maintain the ETTM System at the performance levels specified in the Agreement.

2.8.2.8.4 Spare Part Inventory and Tracking

1727	Contractor shall be responsible for recording the inventory into the MOMS, monitoring the inventory quantity and ensuring that the inventory is maintained to the levels required.
1728	Contractor shall keep accurate records of all parts entering and leaving inventory including but not limited to: time and date part was dispensed, and the location within the ETTM System where the part was dispatched and used.
1729	Contractor shall also be responsible for tracking of all warranty replacement for Contractor provided Equipment through returned material authorization (RMA) process. If the replaced part is under warranty, the part shall be immediately replaced with a new part. If the replaced part is out of warranty, Contractor shall make every effort to repair the replaced item to a usable status and place the part back into spares inventory.
1730	If Contractor is unable to repair the part, a new part shall be purchased and placed into spares inventory. The details of the repair efforts, including problem; status; inventory, and repair disposition shall be included in the MOMS inventory and repair database.

2.8.2.8.5 Procurement and Control of Spare Parts

1731	Thirty (30) Days prior to installing the first Toll Zone, Contractor shall have purchased and have available the agreed upon inventory of spare parts.

1732	The spare parts shall be purchased on behalf of Authority and shall be owned by Authority and located onsite in a manner to ensure that Authority receives the maximum benefit from any warranties associated with the spare parts.
1733	Contractor shall ensure that all spare parts, Equipment and other Authority owned property located on Contractor's property or in Contractor controlled space shall not be subject to any risk of being confiscated, claimed, attached, withheld by a landlord, creditor, or similar risk.
1734	Contractor shall label/tag all Equipment identifying it as the property of the Express Lanes with the Authority phone number, an Authority specific control number, barcode, and link to Contractor provided database for tracking. All spare parts and consumables shall be maintained by Contractor free and clear of any liens and encumbrances of any kind. Authority shall have the right to inspect the spares and consumables inventory upon request.
1735	Provide the capability to enter new inventory items to MOMS via several methods, including but not limited to:
	• manually;
	• file upload and
	• barcode (scanner).
1736	Any spare parts that are lost or damaged due to the negligence, intentional act, or omission of Contractor or its employees, Subcontractors, agents, or invitees shall be replaced by Contractor at its sole cost.
1737	Authority may elect to assume responsibility at any time for storage of spare parts, and Contractor shall deliver all spare parts to Authority for storage after receipt of reasonable Notice from Authority.

2.8.2.8.6 Spare Parts Availability

1738	Contractor shall maintain the required physical inventory of agreed to spare parts in accordance with the Agreement.

2.8.2.9 Repair Depot

1739	Contractor shall be responsible for providing and staffing a repair depot for the return and repair of ETTM System components.
1740	Contractor shall be responsible for repairing failed ETTM System components and returning them to the spare parts inventory.
1741	Failed components shall be tracked by Contractor utilizing MOMS, including final resolution. Component tracking shall include but not limited to the following: receipt, repair date/information, replace reason, date of return.
1742	Contractor shall indicate the details of the repairs performed on any components. This shall include but not be limited to boards and connectors replaced.

1743	If the replaced part is under warranty, the part shall be immediately replaced with a new or manufacturer refurbished part by Contractor. If the replaced part is out of warranty, Contractor shall make every effort to repair the replaced item to a usable status and place the part back into spares inventory. Except for Pervasive Defects, for out of warranty components, Contractor shall document why the component could not be repaired and advise Authority that a new spare must be ordered.

2.8.2.10 Annual System Certification

At the end of Year 1 Maintenance, and annually thereafter, Contractor shall conduct a System wide Certification that shall include tuning of the lanes, Maintenance of the servers and database, and general System check-out. Upon the completion of the System-wide Certification, Contractor shall conduct a Certification test similar to the ETTM System Operational and Acceptance Test for a duration sufficient to collect the requisite sample size to validate System Performance Requirements. Discrepancies under the control of Contractor shall be corrected by Contractor at no additional charge to Authority.

1744	For measuring Contractor's performance against the key performance indicators that are measured during the Annual Certification, test results available no later than 30 Days after the end of Year 1 Maintenance and every subsequent year on the same date shall be used to determine compliance. Any performance measures where Contractor cannot demonstrate compliance shall be subject to the designated amount of the adjustment to the Monthly Fee.
1745	The Annual Certification test shall be similar in approach to the System Acceptance Test and shall be conducted for a duration sufficient to collect the requisite sample size to validate that System Requirements are being met.
1746	Contractor shall include the Annual System Certification Plan in the Maintenance Plan and it shall include a checklist of all the certifications and updates to be performed, including but not limited to:
	• Disaster Recovery testing;
	• updates to Project Documentation;
	• updates to Project contact information, and
	• updates to emergency contact list.
1747	A sample size of 10,000 shall be used to validate each accuracy requirement. Data shall be collected from all lanes at each Toll Zone and lane.
1748	DVAS recordings shall be performed for a two-hour period in each lane at each Toll Zone and compared to the transactions to validate vehicle detection accuracy.
1749	A hundred percent (100%) end-to-end audit of the System shall be performed for a seven (7) Day period to validate transaction and reconciliation Requirements.
1750	A Certification report shall be submitted to Authority for Approval documenting the results of the annual Certification.

2.8.2.11 Emergency Response Management

Contractor shall have an Emergency Response Management Plan Approved by Authority and Contractor shall follow the procedures set forth in this Plan when an emergency situation is invoked.

1751	Contractor shall develop and follow an Emergency Response Management Plan Approved by Authority.
1752	Contractor shall immediately respond to any emergency situation and repair the System, as notified by Authority or otherwise, that may arise that has already or could potentially damage the Roadside System. Contractor shall be prepared to put forth all necessary resources to divert or correct an emergency condition.
1753	The Emergency Response Management Plan shall address how Contractor will handle emergencies in accordance with the policies and procedures established by Authority, including but not limited to the following emergency conditions:
	• weather related;
	• vehicle accident;
	• conditions that invoke the DRP;
	• third-party (power outage or communication failure);
	• vandalism that causes parts of the Roadside System to be inoperable and
	• detection of security breaches, discovered vulnerabilities and activities that pose a security threat to the ETTM System;

2.8.2.12 Roadway Support Systems (RSS) Disaster Recovery

1754	Contractor shall perform DR procedures in accordance with the Approved DRP in the event of a disaster and return the RSS to a fully operational condition.
1755	Contractor shall test the DR procedures on a yearly basis during the Agreement Term to validate that they are functioning per the Design. Authority shall witness the test and Contractor shall provide a report outlining the test, test results and any anomalies encountered for Authority's review and Approval.
1756	Contractor shall address any issues encountered from the yearly DR testing.

2.8.2.13 Incident and Revenue Loss Reporting

1757	Contractor shall immediately notify Authority of any incident or event whereby the potential or actual loss of revenue occurred or could potentially occur. Contractor shall take immediate action to rectify the condition and return the Roadside System to normal functioning.
1758	A Monthly Incident Report shall be provided by Contractor that includes a breakdown of lost transaction data and revenue by Roadside for each incident. If the condition is determined to be due to the fault of Contractor, damages shall be assessed in accordance with the Agreement.

2.8.2.14 Maintenance Staffing, Materials and Training

2.8.2.14.1 Maintenance Staffing Requirements

1759	Contractor shall be responsible for maintaining an adequate level of technical staff to perform Maintenance and Software Support Services on the Roadside System. Contractor shall ensure that sufficient staffing is available to cover all Maintenance activities identified in this Scope of Work and Requirements at all times including but not limited to during the following periods:
	• weekends;
	• holidays;
	• personnel on vacation/sick time;
	• after regular scheduled Work hours (on call), and
	• unexpected emergency or crisis.
1760	Contractor shall provide personnel to perform the following functions. It shall be Contractor's responsibility to staff at appropriate levels to meet the Requirements, using the Maintenance Plan as the guideline for staffing levels and full job descriptions:
	• **Management:** Contractor's Maintenance Management responsibilities include all Maintenance Management business dealings with Contractor Project Manager. Responsibilities include single point of contact for all Work related issues, including System problems, material issues, or Contractor personnel issues. Maintenance Management responsibilities also include ensuring that Systems are properly functioning and that the Maintenance and repair Work are properly performed and documented.
	• **Monitoring Staff*:*** The monitoring functions shall include the support for the monitoring of the System Operations, ensuring that systems are properly functioning, operating the Authority TOC, and conducting image review. Additionally, the monitoring staff shall coordinate with Authority in confirming the Maintenance and repair Work are properly performed.
	• **Field Supervision:** The Field Supervisory functions include being responsible for the day-to-day Operations of the technicians, ensuring that all required Work is accomplished properly and efficiently.
	• **Maintenance Technical Staff:** Responsibilities include responding to Maintenance activities, Alerts and work orders and for field level Preventive Maintenance. Maintenance technicians shall be qualified to troubleshoot Maintenance problems and identify the source of the problem.
	• **Network Engineering:** Network Administration shall include the configuration and Maintenance of the network systems and communications network.
	• **Database Administration:** Database administration shall include management of the servers and databases. The database administration shall cover all aspects of the System database and ensuring the database is optimized for peak performance. The responsibilities include the configuration and operation of the System database and generation of database queries as requested by Authority and other support personnel.

	• **Systems Engineering:** Responsibilities include the configuration and monitoring of all System processing and verification that all Operations and processes are occurring as scheduled. All MOMS alarms relating to process failures shall be investigated and resolved by the System engineering staff. Systems engineering responsibilities also include ensuring the proper configuration of all servers and coordinating all server Maintenance. System engineering responsibilities also include identifying issues, communicating with the System Software personnel and coordinating resolution of the problem. All user-related problems (application Software) shall also be handled by the System engineering personnel.
	• **Software Technical Staff:** Responsibilities include responding to Maintenance activities, Alerts and work orders and resolution of Software problems. Software technical staff shall be qualified to troubleshoot Maintenance problems, identify the source of the problem and correct the problem.
	• **Administrative Staff:** Responsibilities include support of Contractor's Maintenance organization for the performance of Maintenance functions and provision of adequate phone and administrative support at the Maintenance management facility.

2.8.2.14.2 Tools and Materials

1761	Contractor shall provide all test Equipment and tools and support; including but not limited to monitoring tools; smart phones; laptops, and any other items required for the Maintenance and Software Support staff to perform their Maintenance activities. All such devices shall have adequate and up-to-date security Software and be Approved by Authority before they are used on the ETTM Communications Network. All required test Equipment, tools and Software tools shall be on site (as required) and in adequate supply, with all required personnel trained on their use.

2.8.2.14.3 Training Program

1762	Contractor shall ensure that Maintenance and Software services staff is properly trained for Requirements of maintaining the System. Contractor shall provide a minimum of two (2) weeks of classroom and On the Job Training (OJT) to all personnel in their respective area of responsibility before such personnel are assigned Maintenance duties.
1763	Contractor shall provide personally identifiable information (PII) training to all personnel Approved to work on the Project who have access to secure and personal information.
1764	Contractor shall provide trained qualified technical staff to support the Maintenance and Software Support Services described in this Scope of Work and Requirements. It is Contractor's sole responsibility to develop training necessary to successfully perform all of the Maintenance actions required to keep the System operational.
1765	Contractor shall complete all required training and Certifications prior to performing actual Maintenance and Software Support Services within a revenue collection environment. In the event changes or modifications are made to the System Equipment or configuration, supplemental training shall be accomplished prior to the actual service date for the changes or modifications.

1766	Training shall include Contractor's safety standards and guidelines and applicable Authority policies and procedures.
1767	Contractor shall provide Documentation to the Authority that this initial training has been successfully completed.
1768	Various training programs Contractor shall institute shall include, but not be limited to, the following:
	• a thorough understanding and operating knowledge of the MOMS is required of all Maintenance personnel;
	• an in depth understanding of the Roadside System and Operations, including all Equipment, Software, interfaces, file transfers and interconnections;
	• use of Maintenance Documentation such as Maintenance manuals; drawings; vendor manuals, and parts list;
	• functions of the System monitoring tools used to manage the System monitoring tasks;
	• Preventive Maintenance of all Systems and sub-systems;
	• troubleshooting; diagnostics; repair, testing, and Maintenance follow up;
	• System logs, errors logs, and processing of exceptions;
	• System dataflow and workflow queues;
	• review of the Dashboard data and analysis;
	• discussion on the areas of responsibility;
	• special use Maintenance and monitoring tools and
	• queries and reports.
1769	All System Maintenance and Software Support personnel shall attend the appropriate training sessions. Authority staff shall be notified of and invited to attend any or all training sessions two (2) weeks in advance of the training.
1770	All System Maintenance and Software Support personnel shall be trained on scheduling, work assignments, escalation process, transportation requirements and communications;
1771	Contractor shall provide training offered by vendors and original Equipment manufacturer (OEM) for Roadside System components where available and required to properly operate, maintain, test and repair such Equipment and Software.

2.8.2.14.4 Training Materials and Ongoing Education

1772	Training material shall consist of Maintenance manuals, vendor manuals and any other Documentation that provides for the efficient and effective Maintenance of the System and its components.
1773	Contractor shall hold regular meetings with Authority technical personnel to update Maintenance procedures, bring proposed System changes to the attention of the technical staff and discuss Maintenance issues identified in the field. Contractor shall provide Authority with the meeting schedule so that the appropriate Authority staff can attend these meetings.

1774	Authority shall have the right to make recordings and copies of all training program materials. Contractor shall provide releases from all employees/Contractors to allow unlimited, royalty free use and copies of recordings.

2.8.2.14.5 System Documentation

1775	Contractor shall have appropriate System Documentation available to all Maintenance and Software Support personnel as required to perform their respective duties.
1776	Contractor shall update the System Documentation to reflect any changes to the System Approved by Authority. A version update sheet shall be included with the System Documentation, and the Documentation on file shall have the most recent version from the configuration management database. A complete submission of the System Documentation shall be made every two (2) years that reflects all Approved changes to-date.

2.8.2.14.6 Training Records

1777	Contractor shall keep accurate training records on all Contractor and Authority Maintenance personnel. Authority shall be permitted to audit Maintenance personnel qualifications and training records at any time. Evidence of completion of training by Contractor and Authority Maintenance personnel shall be provided to Authority upon request.

2.8.2.15 Safety

1778	Contractor is solely and completely responsible for safety conditions on the Site. Safety practices will not be limited to normal business hours or other time constraints. All Contractor employees and Subcontractors at all tiers must comply with the Health and Safety Plan and Governmental Rules as required in accordance with California Occupational Health and Safety Act of 1973.
1779	Contractor shall take all reasonable precautions and be solely responsible for the safety of, and shall provide protection to prevent damage, injury, or loss to, all persons throughout the Agreement Term and shall comply with all health and safety requirements under applicable Governmental Rules.
1780	The ETTM System and operational and maintenance processes must be designed and implemented in a manner that promotes the safety and security of persons and property. Contractor shall perform safety and health work in accordance with all applicable Governmental Rules and Project Standards listed in this Scope of Work and Requirements, including the Caltrans Safety Manual, 2009 and otherwise in accordance with the Agreement.
1781	Contractor shall adhere to all applicable safety standards and guidelines for working on or around energized Equipment and in a Maintenance environment, including but not limited to the following:
	• Authority safety procedures and guidelines;
	• Caltrans safety procedures and guidelines;
	• OSHA (Occupational Safety and Health Administration);

	• NEMA (National Electrical Manufacturers Association);
	• NEC (National Electrical Code);
	• FHWA (Federal Highway Administration), and
	• any other local, State, or Federal ordinance, procedure, or guideline that provides for a safe operation and working environment.

2.8.2.16 Security

1782	All Contractor personnel shall be subject to appropriate security and background checks to the satisfaction of Authority. Contractor shall obtain written Approval from Authority for all service personnel and each Contractor personnel shall be required to sign an acceptable use agreement.
1783	Contractor's personnel shall be issued Authority identification badges and shall wear such identification badges at all times when on Authority property. Use of such identification badges for purposes other than Work associated with the Agreement will result in termination of the employee from the Agreement and possible other legal or disciplinary action.
1784	Visitors to the Contractor's facilities on Authority property shall register with Authority and be issued a temporary visitor badge. Contractor shall ensure all visitors complete a sign in sheet which will identify date/time/purpose/visitor/escort.
1785	The Services and Work performed under the Agreement are considered PII and confidential and Contractor personnel and the ETTM System shall at all times comply with applicable current computer and data industry standards with regard to data and information security.
1786	Authority will identify and designate a primary point of contact for Contractor. Under most circumstances, Contractor will limit communication with Authority authorized staff and to Authority's designated point of contact unless otherwise directed by Authority.
1787	Discussion by Contractor of any Services or Work performed under the Agreement with the media, in oral presentations, in written publications, or in any other form, not related to this Agreement shall be Approved in advance by Authority.

2.8.2.17 Lane Closures and Traffic Control (O&M Phase)

Contractor will provide all maintenance of traffic (MOT) associated with completing the Work on the 91 Express Lanes and I-405 Express Lanes during the Operations and Maintenance Phase. All Lane Closures shall be coordinated with the Authority and BOS Contractor and Lane Closure schedules shall be submitted to Authority in advance for Approval.

1788	Contractor shall provide all MOT for the Work performed during the Operations and Maintenance Phase. Contractor shall include in the Maintenance Plan a Transportation Management Plan (TMP) in accordance with Caltrans standards for Approval by Authority. The TMP shall include all maintenance schedules and MOT design for all planned Lane Closures of Express Lanes, general purpose lanes, and ramps and connectors.

1789	Contractor shall adhere to the Approved TMP when setting up, working under MOT and restoring lanes to traffic. All Lane Closures shall also be coordinated with Authority, Caltrans (if necessary) and the TOC.
1790	Contractor shall develop, implement, and maintain a TMP that lays out the strategies for managing the work zone impacts of the Work and submit to Authority for review and approval. The TMP must follow the guidelines in the latest version of the Caltran's Transportation Management Plan Guidelines. The TMP is considered a living document; Contractor shall amend and submit changes to the TMP for approval by Authority and Caltrans as changes occur in the MOT strategies proposed by Contractor.
1791	TMP compliance and implementation is the responsibility of Contactor. Authority and Caltrans will monitor and evaluate TMP activities during the course of the Work. Authority may suspend all or part of Contactor's operations for failure to implement and comply with TMP elements, or failure to correct unsafe traffic conditions within 24 hours after such notification is given in writing to Contractor. If Contractor does not promptly take appropriate action to bring the errors into compliance or to correct unsafe traffic conditions, Authority may proceed with corrective action against Contractor.
1792	Closures of Express Lanes are permitted to facilitate the Work during the Operations and Maintenance Phases. All Permitted Lane Closures shall be as specified in ***Table 2-5: Permitted Lane Closures of 91 Express Lanes (O&M Phase)*** and ***Table 2-6: Permitted Lane Closures of I-405 Express Lanes (O&M Phase)***.
1793	Closures of general purpose lanes to facilitate the Work during the Operations and Maintenance Phase must be coordinated with Authority and Caltrans. Any Lane Closure of general purpose lanes must be Approved in advance by Authority and Caltrans. Approved closures of general purpose lanes will be considered Permitted Lane Closures.
1794	Contractor shall submit to Authority for Approval written notice of a Permitted Lane Closure of an Express Lane(s) for review and Approval no later than seven (7) Days prior to the Permitted Lane Closure of any Express Lane.
1795	Contractor shall submit to Authority and Caltrans written request for a Permitted Lane Closure of a general purpose lane(s) for review and Approval no later than seven (7) Days prior to the Permitted Lane Closure of any general purpose lane.
1796	Lane Closure Schedule Amendments, including adding additional closures, shall be submitted by 12:00 p.m. to Authority, in writing, at least three (3) Business Days in advance of a planned closure. Approval of Closure Schedule Amendments will be at the discretion of Authority. Authority shall be notified of cancelled closures two (2) Business Days before the date of the closure. Closures that are cancelled due to unsuitable weather may be rescheduled at the discretion of Authority.
1797	Contractor shall notify the Authority immediately, as soon as Contractor knows that a Permitted Lane Closure will be late in reopening. In the event that a Permitted Lane Closure does not reopen on time, Authority and Caltrans shall not authorize any further Lane Closures until Contractor submits to Authority a corrective action plan to avoid recurrences.
1798	Authority shall have the right to suspend the Work and cancel any previously Approved Lane Closure requests for failure to reopen to public traffic a Permitted Lane Closure within the windows specified in ***Table 2-5: Permitted Lane Closures of 91 Express Lanes (O&M Phase)*** and ***Table 2-6: Permitted Lane Closures of I-405 Express Lanes (O&M Phase)*** or otherwise Approved by Authority.

1799	Lane Closures of Express Lanes and general purpose lanes shall not be allowed:
	• on Easter weekend;
	• on Mother's Day weekend;
	• on Father's Day weekend;
	• on Memorial Day weekend;
	• on Fourth of July weekend;
	• on Labor Day weekend;
	• between the Wednesday before Thanksgiving until the Monday following Thanksgiving; and
	• on any other Holidays.
1800	Contractor shall coordinate with Authority and Caltrans and local agencies to identify any special events and restrict Lane Closures accordingly.
1801	Unpermitted Lane Closures are prohibited and shall be subject to Authority Liquidated Damages in accordance with Article 18, Liquidated Damages/Lane Rental Fees, of the Agreement. The Contractor shall give written notice to the Authority of any Unpermitted Lane Closures. Upon receipt of such written notice or otherwise upon discovery of any Unpermitted Lane Closure, Authority will deliver Contractor a Notice of Unpermitted Lane Closure, and shall assess against Contractor the applicable Liquidated Damages, calculated in accordance with Article 18, Liquidated Damages/Lane Rental Fees, of the Agreement. Contractor shall pay Authority such Liquidated Damages within 24 hours after all applicable lanes reopen to public traffic.
1802	Authority will assess against Contractor the applicable Liquidated Damages in accordance with Article 18, Liquidated Damages/Lane Rental Fees, of the Agreement for failure to utilize a requested Lane Closure or cancellation of a requested Lane Closure less than 72 hours before the date and time that the requested Lane Closure is scheduled to commence.
1803	Contractor, however, may request Lane Closures outside of the Permitted Lane Closure windows. Contractor shall submit such requests in writing to Authority no later than fourteen (14) Days prior to Contractor's requested date for the Lane Closure, together with a revised TMP. Such requests and revised TMPs shall be subject to review and Approval by Authority and Caltrans in their sole discretion. Written requests for Lane Closures outside the times set forth in the Lane Requirement Charts shall, at a minimum include the following:
	• Justification for the Lane Closure;
	• Proposed time periods and hours;
	• Proposed location(s); and
	• Proposed calendar duration.
1804	Any Work involving removal/relocation of Equipment (both existing equipment and Contractor's Equipment) (loosening or removal of nuts/screws, cables, connectors etc.) shall be done with appropriate Lane Closures during nighttime period or off peak hours as listed within this section, unless otherwise Approved by Authority in its sole discretion.
1805	The Maintenance Manager shall be present during Lane Closures.

1806	The Express Lanes shall be properly closed before any Work begins in the Express Lanes. All workers and equipment must be cleared from the Express Lanes before they are reopened.
1807	Contractor shall record the beginning and ending times of all Lane Closures in the ATMS.

2.8.2.17.1 Lane Closures and Traffic Control (O&M Phase) – 91 Express Lanes

1808	All Lane Closures during the Operations and Maintenance shall conform to the Caltrans Encroachment Permit, as shown in ***Attachment 13 – 91 EL Encroachment Permit.***
1809	The 91 Express Lanes are completely closed to all vehicular traffic every third Sunday, weather permitting, between 6:00am and 12:00 pm for maintenance by Caltrans. Contractor is encouraged to coordinate ETTM maintenance with Caltran's regularly scheduled Lane Closures. Contractor's Lane Closure responsibility is as follows:
	• If Work is scheduled with Caltrans roadway maintenance activities, Contractor will not be responsible for paying for Lane Closure MOT and enforcement costs.
	• If Work is not scheduled with Caltrans roadway maintenance activities, Contractor shall be responsible for providing and paying for all Lane Closure MOT and coordinate and pay for any enforcement costs.
1810	Permitted Lane Closure windows for the 91 Express Lanes, unless otherwise Approved by Authority in its sole discretion, shall be as specified in ***Table 2-5: Permitted Lane Closures of 91 Express Lanes (O&M Phase).***

Table 2-5: Permitted Lane Closures of 91 Express Lanes (O&M Phase)

Direction/Period	*Hours During Which Closures Permitted*
Eastbound weekday (Sunday from 11:00 p.m. to Friday at 5:00 a.m.)	11:00 p.m. to 5:00 a.m.
Eastbound weekend (Friday 11:00 p.m. to Sunday at 5:00 a.m.)	11:00 p.m. to 5:00 a.m.
Westbound weekday (Sunday from 9:00 p.m. to Friday at 4:00 a.m.)	9:00 p.m. to 4:00 a.m.
Westbound weekend (Friday at 10:00 p.m. to Sunday at 5:00 a.m.)	10:00 p.m. to 5:00 a.m.

2.8.2.17.2 Lane Closures and Traffic Control (O&M Phase) – I-405 Express Lanes

Contractor shall be responsible for providing all Lane Closures and associated MOT and enforcement during the Operations and Maintenance Phase. Caltrans does not currently utilize regularly scheduled Lane Closures to perform I-405 roadway maintenance; however, Caltrans does utilize infrequent Lane Closures to perform periodic roadway maintenance. During these irregular maintenance closures, and only if Approved in writing by Authority and Caltrans, Contactor may perform Services utilizing Caltrans' Lane Closures.

1811	All Lane Closures during the Operations and Maintenance Phase shall conform to the Caltrans Encroachment Permit to be secured by Authority prior to Go-Live for the I-405 Express Lanes.
1812	Contractor is encouraged to coordinate ETTM System maintenance with scheduled Caltrans' Lane Closures. Contractor shall obtain Authority and Caltrans Approval to utilize Caltrans' scheduled Lane Closures to perform ETTM System maintenance.

1813	Contractor's Lane Closure responsibility is as follows:
	• If Work is not scheduled with Caltrans roadway maintenance activities, Contractor shall be responsible for providing and paying for all Lane Closure MOT and coordinate and pay for any enforcement costs.
	• If Work is scheduled with Caltrans roadway maintenance activities, Contractor will not be responsible for paying for Lane Closure MOT and enforcement costs.
1814	Permitted Lane Closure windows for the I-405 Express Lanes, unless otherwise Approved by Authority in its sole discretion, shall be as specified in ***Table 2-6: Permitted Lane Closures of I-405 Express Lanes (O&M Phase).***

Table 2-6: Permitted Lane Closures of I-405 Express Lanes (O&M Phase)

Direction/Period	*Hours During Which Closures Permitted*
Eastbound weekday (Sunday from 11:00 p.m. to Friday at 4:00 a.m.)	11:00 p.m. to 4:00 a.m.
Eastbound weekend (Friday 11:00 p.m. to Sunday at 4:00 a.m.)	11:00 p.m. to 4:00 a.m.
Westbound weekday (Sunday from 11:00 p.m. to Friday at 4:00 a.m.)	11:00 p.m. to 4:00 a.m.
Westbound weekend (Friday at 11:00 p.m. to Sunday at 4:00 a.m.)	11:00 p.m. to 4:00 a.m.

2.8.2.18 Maintenance and Software Support Records

1815	Authority shall have access to all Maintenance and Software Service records at any time for review and audit, upon reasonable Notice. Contractor shall provide monthly reports generated in the System that permits Authority to evaluate Contractor's Maintenance performance.
1816	Contractor's Maintenance manager shall maintain current, complete and accurate records for all Maintenance and Software Support Services activities. Contractor's Maintenance manager shall institute procedures that make sure Maintenance staff enters complete information into the MOMS before closing a work order or trouble ticket.
1817	All preventive, pervasive and predictive Maintenance activities shall be reported in the same manner as corrective or emergency Maintenance activities by Contractor. The information shall be contained on the MOMS and shall be made available through various MOMS reports.

2.8.2.19 Maintenance Summary Reports

1818	Contractor shall provide the Maintenance summary reports to Authority on a monthly basis in advance of the Monthly Meeting. The format of the Monthly reports shall be Approved by Authority and included in the Maintenance Plan.
1819	Contractor shall provide an annual executive summary report to Authority that summarizes Contractor's performance for the maintenance year. The format of the Executive Summary reports shall be Approved by Authority and included in the Maintenance Plan.

1820	Maintenance summary reports shall also be readily available on-demand through the System in detail or summary format to Authority authorized personnel via the network on a daily, weekly, or other time period basis determined by Authority. The Maintenance summary report shall include but not be limited to:
	• a summary of Contractor's performance for the month under review noting all accomplishments and deficiencies;
	• all Maintenance and System Performance Reports that show Contractor's compliance to Maintenance Performance Requirements;
	• detailed listing of failures and the impacted subsystems where Contractor's and System performance for the month were not in compliance with the Performance Requirements;
	• any exceptions Contractor believes are Non-Chargeable Failures that Contractor is not responsible for;
	• detailed list of parts replaced as a result of Maintenance actions, with an identification of warranty versus non-warranty replacement;
	• status of removed parts and Equipment with an aging status for parts under repair or replacement (serial numbers, being repaired in Maintenance shop, purchase replacement part);
	• trend analysis for repetitive failure;
	• status of spare parts inventory;
	• staffing report detailing positions and staff hours worked;
	• staff performance trends;
	• Software and firmware releases implemented;
	• major Maintenance activities that occurred and are scheduled to occur;
	• incidents that invoked emergency response or resulted in loss of toll revenue and
	• summary of work order, Software defects and trouble tickets by Priority and category.

2.8.2.20 Roadway Support Systems (RSS) Servers and Database Administration, Maintenance and Software Support Services

The Requirements in this section describe the Services to be provided by Contractor under the Maintenance and Software Support Service for the ETTM System.

1821	Contractor shall provide Maintenance and Software Support Service for all elements of the RSS in all environments required in the Agreement including but not limited to:
	• RSS Hardware;
	• operating systems;
	• databases;
	• application Software;
	• third-party Software;
	• security Updates;

	• Software configuration and
	• Software version control.
1822	Contractor shall provide continuous 24/7 System administration services coverage on the RSS to ensure that it is performing and will continue to perform at a satisfactory level.
1823	Contractor support staff shall be available on-call 24/7 to investigate and perform Maintenance for those failures escalated to Contractor.
1824	Maintenance and Software Support Services shall include monitoring and corrective action to ensure System performance is in accordance with this Scope of Work and Requirements, to include database management and operation. This shall include, but is not limited to:
	• investigation and analysis of potential errors and exceptions and taking preventative/corrective action including correcting the problem and reprocessing the data;
	• monitoring of notifications, and initiating corrective actions on application programs to meet Requirements;
	• Updates to the ETTM System and application to support Upgrades to Hardware or third-party Software;
	• Updates to the ETTM System and application to support all changes to Business Rules and ETTM System Configurable parameters, and deploy changes in production;
	• Updates to the ETTM System and application to support changes to Authority Interoperable Agencies ICD including the addition of new Interoperable Agencies;
	• Updates to the ETTM System and application to support the addition of new Interoperable Agencies;
	• Updates to the ETTM System and application to support changes to continue its compliance to updated security Requirements, and
	• Updates to the ETTM System and application to support legislative and statutory changes.
1825	As part of the Maintenance and Software Support Services, Contractor shall develop and test Software as required in accordance with Agreement Amendment process to accommodate corrective action and changes to Business Rules. Scope shall include provision of evidence packages detailing changes for Authority's review and Approval, installation of new Software and confirmation of successful installation.

2.9 Performance Requirements – Maintenance and Operations

Contractor shall provide an ETTM System that is designed to meet the Requirements set forth in this Scope of Work and Requirements during Maintenance and Operations.

Authority requires Contractor to continuously maintain and operate the ETTM System in accordance with the standards of performance identified in these Performance Requirements and further, that Contractor fully meet these Performance Requirements, beginning with the first month of Maintenance and Operations. In addition, as part of the Operational and Acceptance Test Contractor shall validate that the ETTM System meets the standards of performance identified in these Performance Requirements.

Authority intends to focus on the outcomes from the ETTM System by minimizing the number of Performance Requirements to be tracked, monitored and reported while still maintaining a high confidence in the ETTM System performance. This is done by closely aligning performance measurement to the timely transmission of accurate and complete transactions to the BOS and availability of the ETTM System instead of focusing on the intermediate steps in the process.

Contractor's performance will be monitored by Authority and shall be rated based on Contractor's ability to meet these Performance Requirements. Contractor shall use the Approved measurement and reporting methods developed collaboratively with Authority during the Implementation Phase, to report on Contractor's performance against these Performance Requirements.

These Performance Requirements reflect the minimum tolerable performance expected of Contractor to avoid unnecessary impact to Authority, customers or the general public.

Authority will utilize a fee adjustment-based performance method to track Contractor's compliance with the Performance Requirements. If Contractor fails to meet these Performance Requirements, Authority will assess fees for each failure. Fees will be summed, the total of which will determine any performance adjustments to be made to Contractor's monthly invoice as further detailed below. Contractor is also subject to direct damages for actual revenue loss.

Contractor shall use best efforts to minimize the impacts that result from failure to meet the Performance Requirements, regardless of whether invoice adjustments are made. Furthermore, Contractor shall take corrective action to immediately remedy any failures and provide a Corrective Action Plan (CAP) to Authority for Approval that documents the corrective action taken to prevent future reoccurrence of the problem associated with the non-performance.

A summary of the ETTM System Performance Requirements is provided in ***Table 2-7: ETTM Performance Measures***, including measurement frequency and fees for each Performance Requirement. Additional detailed information about the Performance Requirements is provided in the subsequent sections.

2.9.1 General Performance Requirements

Contractor shall be required to meet all Operational Performance Requirements detailed herein and as part of the Monthly Invoice provide reports that show compliance to the defined Performance Requirements, including details of failures that resulted in the non-performance.

1826	Contractor shall design, implement, maintain and operate the ETTM System to meet the Performance Requirements specified herein.
1827	Contractor shall facilitate performance monitoring by reporting performance in clearly measurable and easy to understand terms and reports.
1828	Contractor shall validate System compliance to the accuracy requirements by collecting data to the required sample size in live traffic Operations as described below for each requirement.
1829	Data collection shall include the use of live traffic and controlled vehicles intermingled with live traffic emulating normal Operations as specified below for each requirement.
1830	Authority will conduct a review of Contractor's performance on a monthly basis, utilizing a combination of reports generated by the System, including MOMS, and other Approved reports provided by Contractor, as determined by Authority to be necessary.
1831	Contractor shall immediately notify Authority of any failure observed by Contractor whereby actual loss of revenue occurred or the potential for losses exist.
1832	If resolution of any failure is under Contractor's control and/or responsibility as described in the Agreement, as a Chargeable Failure, Contractor shall take action to correct the failure condition and return the ETTM System to normal functioning in accordance with the Agreement. If the failure condition is determined to be due to Contractor's fault and it results in failure to meet the Performance Requirements, Authority will assess fees for each failure as described in this Performance Section and may be subject to other remedies in accordance with the Agreement.
1833	Contractor shall identify and include in the Performance Requirements reporting any failures and incidents that are outside Contractor's control and/or responsibility and are described in the Contact as Non-Chargeable Failures.

2.9.1.1 Performance Measurement

Performance will be measured in categories that align with the primary functions of the ETTM System. These categories are:

- Availability
- Completeness
- Operations

Each of these categories represents a group of functions within the ETTM System and each function includes individual Key Performance Indicators (KPI), which will be used to measure Contractor's performance in meeting the Performance Requirements.

The specific method of measuring Contractor's performance will vary depending on the KPI being measured, but will generally be measured against the Performance Requirement on a monthly basis. Regardless of how a KPI is measured, Contractor shall provide reporting for all performance measures monthly.

The amount by which the KPI is missed matters in determining how well the ETTM System is performing so the Monthly Fees deductions for a particular failure are increased as the deviation from the KPI increases.

Table 2-7: Performance Measures provides a summary of the KPIs for Contractor and master table that shall be referenced in the event of discrepancies. A detailed description of each KPI and its associated Performance Requirement is provided in the subsequent sections.

Table 2-7: ETTM Performance Measures

#	Category	KPI	Performance Requirement	Measurement Frequency	Fee Adjustment (deduction from monthly invoice)
1	Availability	a. Express Lanes Lane	Each lane (travel lanes and shoulders) 99.90% of the time	Monthly	0.5% Monthly Fee adjustment for a .1% drop to 99% 5% Monthly Fee adjustment for availability below 99%
		b. I-405 Toll Rate Changeable Message Sign (CMS)	Each Toll Rate CMS 99.95% of the time	Monthly	0.5% Monthly Fee adjustment for a .1% drop to 99% 5% Monthly Fee adjustment for availability below 99%
		c. Core Roadway Support Systems (RSS)	99.95% of the time	Monthly	0.5% Monthly Fee adjustment for a .1% drop to 99% 5% Monthly Fee adjustment for availability below 99%
2	Completeness	a. ETTM Preventive Maintenance Complete	Perform Preventive Maintenance on the ETTM System according to Approved Preventive Maintenance Schedule.	Monthly	$1000 per subsystem per month per scheduled Maintenance activity not completed per schedule
3	Operations – Vehicle Detection and Transaction Framing	a. Transponder Capture Rate	99.97%	Annual System Certification	$250 per Calendar Day delay until KPI is met
		b. Transponder Reporting Accuracy	99.99%		$250 per Calendar Day delay until KPI is met
		c. Vehicle Detection Accuracy	99.99%		$250 per Calendar Day delay until KPI is met

#	Category	KPI	Performance Requirement	Measurement Frequency	Fee Adjustment (deduction from monthly invoice)
		d. Transponder Association Accuracy	99.95%		$250 per Calendar Day delay until KPI is met
		e. Image Capture and Reporting Accuracy	99.95%		$250 per Calendar Day delay until KPI is met
		f. Image Association Accuracy	99.95% on all 100% of all captured images		$250 per Calendar Day delay until KPI is met
4	Operations – Image Extraction and Accuracy	a. License Plate Extraction (OCR/LPR) Accuracy	99.95% on 70% of all captured images	Annual System Certification	$250 per Calendar Day delay until KPI is met
		b. Overall Image Transaction Accuracy (automated and manual)	99.95%	Monthly	$10 for each license plate in error for error rates above the 0.05 percent rate
		c. Accuracy of Rejection and Categorization of Rejected Image	99.75%	Monthly	$10 for each incorrectly categorized rejected image in error for error rates above the 0.25 percent rate
5	Operations –Transaction and Image Processing	a. Transaction Processing and Transmission	100.00%	Monthly	$50 per twenty-four (24) hours delay per 1,000 transactions
		b. False Read Processing	less than 0.001%	Annual System Certification	$10 for every false read processed and included in a trip.
		c. Image Processing and Transmission	100.00%	Monthly	$50 per twenty-four (24) hours delay per 1,000 images

#	Category	KPI	Performance Requirement	Measurement Frequency	Fee Adjustment (deduction from monthly invoice)
6	Operations –I-405 EL Toll Rate CMS Accuracy	a. I-405 Post/Maintain the correct toll rate to the Toll Rate CMS	100% when fully functional	Monthly	$500 for every 0.1 percent drop in the accuracy
		b. I-405 Report Toll Rate CMS errors or communications to MOMS within five (5) minutes	99.90%	Monthly	$50 for every five (5) minutes of delay
		c. 91 Accuracy of toll rate file generated for import to the 91 EL toll rate signs	100%	Per Pricing Update	$2,500 per incident
7	Operations - I-405 Traffic Detection	a. Traffic Detection System (TDS) Accuracy (vehicle volume on EL and GP Lanes in a direction of travel)	97.00%	Annual System Certification	$100 per Calendar Day delay until KPI is met
		b. Traffic Detection System (TDS) Accuracy (average speed of any individual EL and GP lane)	Within 5 mph		$100 per Calendar Day delay until KPI is met
8	Operations – Trip Management	a. Transaction/trip Assembly	99.995%	Monthly	$25 per reported incident
		b. Transaction/Images/trip Transmission	100.00%		$50 per Calendar Day delay per 1,000 Trip Transactions

#	Category	KPI	Performance Requirement	Measurement Frequency	Fee Adjustment (deduction from monthly invoice)
		c. Trip Transaction Correction Transmission	100.00%		$5 per Calendar Day delay per Trip Transaction Correction
9	Operations – Audit and Reconciliation	a. Audit and Reconciliation	100.00%	Annual System Certification	$250 per Calendar Day delay until KPI is met
10	Operations – Security Breach	a. Security Breaches	0 breaches	Monthly	$10,000 per occurrence of a breach
11	Operations – Respond and Repair	a. Priority 1 – Roadside	Respond and complete repair within two (2) hours of failure/event notification. If code change is required, respond within two (2) hours, notify Authority within one (1) hour, and repair time to be reasonably determined by Authority and Contractor based on amount of testing required.	Monthly	$100 per occurrence for every additional delay of one (1) hour
		b. Priority 1 - RSS	Respond and complete repair within four (4) hours of failure/event notification. If code change is required, respond within two (2) hours, notify Authority by next Day, and repair time to be reasonably determined by Authority and Contractor based on amount of testing required.	Monthly	$100 per occurrence for every additional delay of one (1) hour

#	Category	KPI	Performance Requirement	Measurement Frequency	Fee Adjustment (deduction from monthly invoice)
		c. Priority 2 - Roadside	Respond and complete repair within four (4) hours of failure/event notification. If code change is required, respond within four (4) hours, notify Authority by next Day, and repair time to be reasonably determined by Authority and Contractor based on amount of testing required.	Monthly	$100 per occurrence for every additional delay of two (2) hours
		d. Priority 2 - RSS	Respond and complete repair within eight (8) hours of failure/event notification. If code change is required, respond within four (4) hours, notify Authority by next Day, and repair time to be reasonably determined by Authority and Contractor based on amount of testing required.	Monthly	$100 per occurrence for every additional delay of two (2) hours
		e. Priority 3 - Roadside	Respond and complete repair within twenty-four (24) hours of failure/event notification. If code change is required, respond within twenty-four (24) hours, notify Authority by next Day, and repair time to be reasonably determined by Authority and Contractor based on amount of testing required.	Monthly	$100 per occurrence for every additional delay of twenty-four (24) hours

#	Category	KPI	Performance Requirement	Measurement Frequency	Fee Adjustment (deduction from monthly invoice)
		f. Priority 3 - RSS	Respond and complete repair within forty eight (48) hours of failure/event notification. If code change is required, respond within twenty-four (24) hours, notify Authority by next Day, and repair time to be reasonably determined by Authority and Contractor based on amount of testing required.	Monthly	$100 per occurrence for every additional delay of twenty-four (24) hours
12	Operations – Data Transmission and Processing	a. Transmission of TSL to the Roadside System	Transmit the Comprehensive and Incremental Home and CTOC/Interoperable TSL to each of the lane/zone controllers within thirty (30) minutes of the Roadway Support Systems receipt of the TSL.	Monthly	$100 per occurrence per one (1) hour delay to each of the lane/zone controllers.
		b. Transmission of Files to the BOS	Transmit Toll Rate CMS Images and Traffic Summaries to BOS.	Monthly	$1000 per Calendar Day delay
13	Operations – Annual System Certification	a. Performance of the Annual System Certification	Conduct Annual System Certification of ETTM System Performance Requirements	Annual	$5,000 per month for delay in performing the certification
14	Operations – Occupancy Detection System (ODS) Accuracy (If Optional Service awarded)	a. Overall ODS Reporting Accuracy	90.00%	Monthly	$500 for every 0.1 percent drop in the accuracy
		b. False Negative Accuracy	less than 0.005%	Monthly	$10 for every false negative processed and included in a trip.

2.9.2 ETTM System Performance Requirement Details

These KPIs are based on performance that is measured in calendar hours, days and minutes as applicable. Any issues considered Non-Chargeable Failures, that affect Contractor's ability to meet a KPI should be noted, documented appropriately and with sufficient detail and discussed as part of Monthly ETTM System Performance Reviews.

Authority places a great deal of importance on the controls Contractor has in place for the System and the effectiveness of those controls. Authority will monitor Contractor's performance for compliance with the Performance Requirements. Contractor shall be required to meet all System and Maintenance Performance requirements.

2.9.2.1 Availability – 1.a: Express Lanes Lane Availability

Tolls are collected 24 hours a day, 7 days a week and as such the Express Lanes must achieve a high degree of availability. The Express Lanes is viewed as a function; a combination of Hardware and Software that builds accurate and complete trip transactions. This Requirement will measure the function; thus, if a high availability subcomponent is not working, yet the component still performs the function as Approved in Design, it would not be counted against availability.

1834	The KPI is measured for each Express Lane with all of its subsystems properly functioning and available to, create transactions and send required transactions and images to the RSS. Availability shall be calculated based on the following calculation: Availability = 1- (Chargeable Failure min / (minutes in period-exception min in period))
1835	• System reporting detailing the Express Lanes availability along with MOMS and help desk tickets, work orders and feedback from customers, Authority staff and consultants will be utilized to identify availability failures.
	• For any month in which any Express Lane does not meet the availability requirement, Contractor shall be assessed a fee adjustment of the monthly maintenance fee as described in ***Table 2-7: ETTM Performance Measures***, for each lane not meeting the requirement.

2.9.2.2 Availability – 1.b: I-405 Toll Rate Changeable Message Sign (CMS)

The Toll Rate CMS is a direct communication link to the traveling public. Errors or inaction within this subsystem can cause extreme consequences in terms of cost and reputation, thus availability of this subsystem is vital. The Toll Rate CMS cameras are key to properly monitoring the Toll Rate CMS and shall be used to verify the Toll Rate CMS availability.

1836	The KPI is measured for each Toll Rate CMS with all of it subcomponents and Software operating and displaying the toll amount accurately. Availability shall be calculated based on the following calculation: Availability = 1- (Chargeable Failure min / (minutes in period-exception min in period))

	• System reporting detailing the Toll Rate CMS availability along with MOMS and help desk tickets, work orders and feedback from customers, Toll Rate CMS camera images, Back Office staff, Authority staff and consultants will be utilized to identify availability failures.
	• For any month in which any Toll Rate CMS does not meet the availability requirement, Contractor shall be assessed a fee adjustment of the monthly maintenance fee as described in ***Table 2-7: ETTM Performance Measures***, for each Toll Rate CMS not meeting the requirement.

2.9.2.3 Availability –1.c: Roadway Support Systems (RSS)

Tolls are collected 24 hours a day, 7 days a week and as such the RSS must achieve a high degree of availability.

1837	The KPI is measured for the RSS as described in Section 2.3.12.8, Availability, with all of its devices, Software, applications and processes properly functioning and available. Availability shall be calculated based on the following calculation: Availability = 1- (Chargeable Failure min / (minutes in period-exception min in period))
	• System reporting detailing the RSS availability along with MOMS and help desk tickets, work orders and feedback from customers, Back Office staff, Authority staff and consultants will be utilized to identify availability failures.
	• For any month in which the RSS does not meet the availability requirement, Contractor shall be assessed a fee adjustment of the monthly maintenance fee as described in ***Table 2-7: ETTM Performance Measures***, for RSS not meeting the requirement.

2.9.2.4 Completeness – 2.a: ETTM System Preventive Maintenance Complete

Tolls are collected 24 hours a day, 7 days a week and as such Preventive Maintenance plays a crucial role in making sure all equipment, components, servers, systems, communications, infrastructure, power, and environmental controls are functioning at a high availability level. Preventive maintenance shall be performed by Contractor in accordance with Authority Approved schedule.

1838	Contractor shall perform all required Maintenance activities and provide the complete and accurate Preventive Maintenance log to Authority as part of the Monthly Performance package.
	• The Maintenance log and MOMS work orders generated for Preventive Maintenance will be reviewed along with spot checks to verify the required Maintenance activities have been completed as specified.
	• For any month in which any scheduled Preventive Maintenance activity is not performed, Contractor shall be assessed a fee adjustment of the monthly maintenance fee as described in ***Table 2-7: ETTM Performance Measures***, per subsystem per month scheduled Maintenance activity not completed per schedule.

2.9.2.5 Operations - Vehicle Detection and Transaction Framing – 3.a: Transponder Capture Rate

1839	The Transponder mounted in accordance with the manufacturer mounting instructions shall be captured by the AVI System under all conditions within the Design specification described in this Scope of Work and Requirements. Accuracy = (Total Sample Size – Errors – Exceptions)/(Total Sample Size – Exceptions)
1840	The KPI is measured for all Corridors, Toll Zones and lanes based upon the Transponder mix collected during the Annual Certification period in accordance with Section 2.8.2.10, Annual System Certification. Testing shall require the use of controlled vehicles with known "good" Transponders intermixing with live traffic to create the required sample size. Scope of Work
1841	Contractor shall conduct the test and provide the test results to Authority as part of the Monthly Performance package.
	• The System reports and reader logs will be reviewed to verify the KPI.
	• For Contractor failure to meet the KPI during the Annual Certification period, Contractor shall be assessed a fee adjustment of the monthly maintenance fee as described in ***Table 2-7: ETTM Performance Measures***, per Calendar Day delay until KPI is met.

2.9.2.6 Operations – Vehicle Detection and Transaction Framing – 3.b: Transponder Reporting Accuracy

1842	A Transponder that is detected and read by the AVI reader shall be reported to the zone controller under all conditions within the Design specification described in this Scope of Work and Requirements. Accuracy = (Total Sample Size – Errors – Exceptions)/(Total Sample Size – Exceptions)
1843	The KPI is measured for all Corridors, Toll Zones and lanes based upon the Transponder mix collected during the Annual Certification period in accordance with Section 2.8.2.10, Annual System Certification. Testing shall require the use of controlled vehicles with known "good" Transponders intermixing with live traffic to create the required sample size.
1844	Contractor shall conduct the test and provide the test results to Authority as part of the Monthly Performance package.
	• The System reports and reader logs will be reviewed to verify the KPI.
	• For Contractor failure to meet the KPI during the Annual Certification period, Contractor shall be assessed a fee adjustment of the monthly maintenance fee as described in ***Table 2-7: ETTM Performance Measures***, per Calendar Day delay until KPI is met.

2.9.2.7 Operations – Vehicle Detection and Transaction Framing – 3.c: Vehicle Detection Accuracy

1845	The zone controller shall detect and report all vehicles traveling through the ETTM Toll Collection and Enforcement Sites and ETTM Transponder Read Sites under all conditions within the Design specification described in this Scope of Work and Requirements. Accuracy = (Total Sample Size – Errors – Exceptions)/(Total Sample Size – Exceptions)

1846	The KPI is measured for all Corridors, Toll Zones and lanes based upon the two-hour data collected during the Annual Certification period in accordance with Section 2.8.2.10, Annual System Certification. The transactions generated in the System shall be verified against the two-hour DVAS video.
1847	Contractor shall conduct the test and provide the test results to Authority as part of the Monthly Performance package.
	• DVAS video, transaction reports and test results will be reviewed to verify the KPI.
	• For Contractor failure to meet the KPI during the Annual Certification period, Contractor shall be assessed a fee adjustment of the monthly maintenance fee as described in ***Table 2-7: ETTM Performance Measures***, per Calendar Day delay until KPI is met.

2.9.2.8 Operations – Vehicle Detection and Transaction Framing – 3.d: Transponder Association Accuracy

1848	Every Transponder that is reported to the zone controller shall be assigned to the correct vehicle under all conditions within the Design specification described in this Scope of Work and Requirements. Accuracy = (Total Sample Size – Errors – Exceptions)/(Total Sample Size – Exceptions)
1849	The KPI is measured for all Corridors, Toll Zones and lanes based upon the Transponder mix collected during the Annual Certification period in accordance with Section 2.8.2.10, Annual System Certification. Testing shall require the use of controlled vehicles with known “good” Transponders intermixing with live traffic to create the required sample size.
1850	Contractor shall conduct the test and provide the test results to Authority as part of the Monthly Performance package.
	• The System reports, test vehicle logs and back-up ICPS images will be reviewed to verify the KPI.
	• For Contractor failure to meet the KPI during the Annual Certification period, Contractor shall be assessed a fee adjustment of the monthly maintenance fee as described in ***Table 2-7: ETTM Performance Measures***, per Calendar Day delay until KPI is met.

2.9.2.9 Operations – Vehicle Detection and Transaction Framing – 3.e: Image Capture and Reporting Accuracy

1851	The ICPS shall capture and report all vehicle images to the zone controller as defined in Authority Business Rules under all conditions within the Design specification described in this Scope of Work and Requirements. Scope of Work Accuracy = (Total Sample Size – Errors – Exceptions)/(Total Sample Size – Exceptions)
1852	The KPI is measured for all Corridors, Toll Zones and lanes based upon the two-hour data collected during the Annual Certification period in accordance with Section 2.8.2.10, Annual System Certification. The transactions and their associated images generated in the System shall be verified against the two hour DVAS video.
1853	Contractor shall conduct the test and provide the test results to Authority as part of the Monthly Performance package.

	• DVAS video, transaction reports with ICPS images and test results will be reviewed to verify the KPI.
	• For Contractor failure to meet the KPI during the Annual Certification period, Contractor shall be assessed a fee adjustment of the monthly maintenance fee as described in ***Table 2-7: ETTM Performance Measures***, per Calendar Day delay until KPI is met.

2.9.2.10 Operations – Vehicle Detection and Transaction Framing – 3.f: Image Association Accuracy

1854	The System shall correctly associate all captured image to the correct vehicle as defined in Authority Business Rules under all conditions within the Design specification described in this Scope of Work and Requirements. Accuracy = (Total Sample Size – Errors – Exceptions)/(Total Sample Size – Exceptions)
1855	The KPI is measured for all Corridors, Toll Zones and lanes based upon the two-hour data collected during the Annual Certification period in accordance with Section 2.8.2.10, Annual System Certification. The transactions and their associated images generated in the System shall be verified against the two hour DVAS video.
1856	Contractor shall conduct the test and provide the test results to Authority as part of the Monthly Performance package.
	• DVAS video, transaction reports with ICPS images and test results will be reviewed to verify the KPI.
	• For Contractor failure to meet the KPI during the Annual Certification period, Contractor shall be assessed a fee adjustment of the monthly maintenance fee as described in ***Table 2-7: ETTM Performance Measures***, per Calendar Day delay until KPI is met.

2.9.2.11 Operations – Image Extraction and Accuracy – 4.a: License Plate Extraction (OCR/LPR) Accuracy

1857	The System shall correctly extract the license plate, plate type, and Jurisdiction under all conditions within the Design specification described in this Scope of Work and Requirements. This is a two-step process where the sample size against which the accuracy is calculated is first determined based on confidence level and Jurisdiction. All exceptions are also removed giving the adjusted sample size. License Plate Extraction Accuracy will be calculated for the following states: California, Nevada, Arizona, Illinois, Texas, Washington, and Utah. This provides the automation performance. Using this adjusted sample size, the accuracy is determined. Accuracy = (Adjusted Sample Size – Errors)/(Adjusted Sample Size)
1858	The KPI is measured for all Corridors, Toll Zones and lanes based upon the two-hour data collected during the Annual Certification period in accordance with Section 2.8.2.10, Annual System Certification. The accuracy will be determined on the two hour sample of vehicle transaction/images collected. Contractor shall perform the validation (review images manually using the QA functionality) and create the supporting documentation.

1859	Contractor shall conduct the test and provide the test results to Authority as part of the Monthly Performance package.
	• transaction reports with ICPS images, OCR/VSR results and test results will be reviewed to verify the KPI.
	• For Contractor failure to meet the KPI during the Annual Certification period, Contractor shall be assessed a fee adjustment of the monthly maintenance fee as described in ***Table 2-7: ETTM Performance Measures***, per Calendar Day delay until KPI is met.

2.9.2.12 Operations – Image Extraction and Accuracy – 4.b: Overall Image Transaction Accuracy

1860	The ETTM System shall provide images of sufficient image quality to achieve the overall accuracy requirements and this includes automated and manual processes used by Contractor to obtain the license plate, plate type, and Jurisdiction. The incorrect determination of the license plate is considered an error. Accuracy = (Total Sample Size – Errors – Exceptions)/(Total Sample Size – Exceptions)
1861	Reject reasons that are considered exceptions and not under Contractor's control are:
	• the vehicle has no plate;
	• plate is not in the normal camera field of view because it is not mounted in accordance with State laws;
	• the plate is covered by dirt, a trailer hitch, tailgate, or some other material such that the numbers/letters are not human readable, and
	• the plate is damaged so that numbers/letters are not human readable.
1862	The KPI is measured for all Corridors, Toll Zones and lanes based upon normal operations and is part of Contractor's Maintenance Requirements. Contractor shall perform the validation (review images manually using the QA functionality) and create the supporting documentation in accordance with sampling 1% of the image review results daily each month. In addition, the BOS Contractor's staff will perform QA on a daily basis and these results will be used for verification of the accuracy.
1863	Contractor shall provide the operational results to Authority as part of the Monthly Performance package.
	• Performance reports, transaction reports with ICPS images, OCR/VSR results and QA results will be reviewed to verify the KPI.
	• For Contractor failure to meet the KPI during the Maintenance period, Contractor shall be assessed a fee adjustment of the monthly maintenance fee as described in ***Table 2-7: ETTM Performance Measures***.

2.9.2.13 Operations – Image Extraction and Accuracy – 4.c: Accuracy of Rejection and Categorization of Rejected Image

1864	Contractor shall correctly determine that the plate meets the criteria for rejection and select the correct reject reason for all images which do not meet the criteria for identification. Accuracy = (Total Sample Size – Errors)/(Total Sample Size)
1865	The KPI is measured for all Corridors, Toll Zones and lanes based upon normal operations and is part of Contractor's Maintenance Requirements and can be combined with the verification of Overall Image Transaction Accuracy. The rejected images and reject reasons will also be audited by the BOS Contractor's staff on a daily basis as part of QA process.
1866	Contractor shall provide the operational results to Authority as part of the Monthly Performance package.
	• Performance reports and QA results will be reviewed to verify the KPI.
	• For Contractor failure to meet the KPI during the Maintenance period, Contractor shall be assessed a fee adjustment of the monthly maintenance fee as described in ***Table 2-7: ETTM Performance Measures***.

2.9.2.14 Operations –Transaction and Image Processing – 5.a: Transaction Processing and Transmission

1867	All transactions generated by the zone controllers in accordance with the accuracy Requirements shall be reported and transmitted to the RSS under all conditions within the Design specification described in this Scope of Work and Requirements. The performance will be measured daily as part of normal operations.
1868	Contractor shall provide the operational results to Authority as part of the Monthly Performance package.
	• Performance reports will be reviewed to verify the KPI.
	• For Contractor failure to meet the KPI during the Maintenance period, Contractor shall be assessed a fee adjustment of the monthly maintenance fee as described in ***Table 2-7: ETTM Performance Measures***.

2.9.2.15 Operations – Image Transaction Processing – 5.b: False Read Processing

1869	The false read processing (for example, cross lane reads and duplicate reads that result in incorrect or duplicate transactions) should eliminate Transponder read error under all conditions within the Design specification described in this Scope of Work and Requirements. Accuracy = (Total Sample Size – Errors – Exceptions)/(Total Sample Size – Exceptions)
1870	The KPI is measured for all Corridors, Toll Zones and lanes based upon the two-hour data collected during the Annual Certification period in accordance with Section 2.8.2.10, Annual System Certification. Testing shall require the use of vehicle data collected during live traffic Operations and test results will be verified by Authority or contractor on behalf of Authority.

1871	Contractor shall conduct the test and provide the test results to Authority as part of the Monthly Performance package.
	• transaction reports and test results will be reviewed to verify the KPI.
	• monitoring the BOS reported issues for accurate Account posting will also be used.
	• For Contractor failure to meet the KPI during the Annual Certification period, Contractor shall be assessed a fee adjustment of the monthly maintenance fee as described in ***Table 2-7: ETTM Performance Measures***.

2.9.2.16 Operations – Image Transaction Processing – 5.c: Image Processing and Transmission

1872	All images generated by the ICPS in accordance with the accuracy Requirements shall be reported and transmitted to the RSS under all conditions within the Design specification described in this Scope of Work and Requirements. The performance will be measured daily as part of normal operations.
1873	Contractor shall provide the operational results to Authority as part of the Monthly Performance package.
	• Performance reports will be reviewed to verify the KPI.
	• For Contractor failure to meet the KPI during the Maintenance period, Contractor shall be assessed a fee adjustment of the monthly maintenance fee as described in ***Table 2-7: ETTM Performance Measures***.

2.9.2.17 Operations – I-405 EL Toll Rate CMS Accuracy – 6.a: Post/Maintain the correct toll rate to the Toll Rate CMS

1874	The KPI is measured for each Toll Rate CMS. The System shall post and maintain the correct toll rate to the Toll Rate CMS under all conditions within the Design specification described in the Requirements. Accuracy = (Total Number – Failures)/(Total Number)
1875	As part of the Daily Monitoring activity, maintenance personnel shall verify the accurate posting of the toll rates on the Toll Rate CMS each time there is a change but not less frequent than every three (3) minutes.
1876	Contractor shall provide the operational results to Authority as part of the Monthly Performance package.
	• Maintenance log showing the daily verification will be reviewed to verify KPI.
	• System reports showing that the toll rate displayed on the Toll Rate CMS matched what was determined by the System based on frequent polling.
	• For Contractor failure to meet the KPI during the Maintenance period, Contractor shall be assessed a fee adjustment of the monthly maintenance fee as described in ***Table 2-7: ETTM Performance Measures***.

2.9.2.18 Operations – I-405 EL Toll Rate CMS Accuracy – 6.b: Report Toll Rate CMS errors or communications to MOMS within 5 minutes

1877	The System shall report errors from the Toll Rate CMSs to the MOMS within 5 minutes of the error detection. This includes errors in the message(s) displayed on the Toll Rate CMS, which includes but is not limited to displayed toll rates not being synchronized with TOD pricing toll rates.
1878	Contractor shall provide the operational results to Authority as part of the Monthly Performance package.
	• Maintenance log listing failures identified during daily verification will be reviewed to verify KPI.
	• System reports showing discrepancies between what the System reported and what is displayed on the Toll Rate CMS as determined by System polling.
	• errors logs showing communication failures and Toll Rate CMS failures.
	• MOMS reports showing the creation of the work orders.
	• For Contractor failure to meet the KPI during the Maintenance period, Contractor shall be assessed a fee adjustment of the monthly maintenance fee as described in ***Table 2-7: ETTM Performance Measures***.

2.9.2.19 Operations – 91 Accuracy of Toll Rate File Generated for Import to the 91Toll Rate Signs

1879	The Contractor shall provide an accurate electronic file of the 91 toll rates for import into the 91 toll rate signs.
	• For Contractor failure to meet the KPI during the Maintenance period, Contractor shall be assessed a fee adjustment of the monthly maintenance fee as described in ***Table 2-7: ETTM Performance Measures***.

2.9.2.20 Operations – I-405 Traffic Detection – 7.a: Traffic Detection System (TDS) Accuracy (vehicle volume on EL and GP Lanes in a direction of travel)

1880	The TDS shall report vehicle volume at each Segment on the Express Lanes and the general purpose lanes. If a Segment has more than one sensor, the measurement shall be by sensor by lane. The traffic counts by lane will be compared to manual counts determined using the CCTV camera and DVAS for a period of time. Accuracy = TDS volume/Total Manual Count
1881	The KPI is measured for all Corridors, Toll Zones and lanes by Segment based upon 15 minute intervals during peak and off peak traffic data, collected during the Annual Certification period. The TDS volumes will be compared to manual counts.
1882	Contractor shall conduct the test and provide the test results to Authority as part of the Monthly Performance package.
	• CCTV and DVAS video, traffic reports and test results will be reviewed to verify the KPI.

	• For Contractor failure to meet the KPI during the Annual Certification period, Contractor shall be assessed a fee adjustment of the monthly maintenance fee as described in ***Table 2-7: ETTM Performance Measures***, per Calendar Day delay until KPI is met.

2.9.2.21 Operations – I-405 Traffic Detection – 7.b: Traffic Detection System (TDS) Accuracy (average speed of any individual EL and GP lane)

1883	The average speed on any individual lane reported by the TDS at each Segment on the Express Lanes and the general purpose lanes shall be accurate to within 5 mph. The average speed shall be compared to manual measurements for 30 second intervals for a period of 30 minutes during peak and off peak traffic. Accuracy = Average variation between the TDS and manual measurements for each lane.
1884	The KPI is measured for all lanes (both Express Lanes and general purpose lanes) measured by each TDS device during the Annual Certification period.
1885	Contractor shall conduct the test and provide the test results to Authority as part of the Monthly Performance package.
	• traffic reports and test results will be reviewed to verify the KPI.
	• For Contractor failure to meet the KPI during the Annual Certification period, Contractor shall be assessed a fee adjustment of the monthly maintenance fee as described in ***Table 2-7: ETTM Performance Measures***, per Calendar Day delay until KPI is met.

2.9.2.22 Operations – Trip Management – 8.a: Transaction/trip Assembly

1886	All Transponder-Based Transactions and Image-Based Transactions generated with the above accuracy requirements shall be assembled into Trip Transactions under all conditions within the Design specification described in this Scope of Work and Requirements and Authority Business Rules. The performance will be measured daily as part of normal operations.
1887	Contractor shall provide the operational results to Authority as part of the Monthly Performance package.
	• Errors identified during the QA review of Trip Transactions and those reported by the customers will be reviewed to verify the KPI.
	• System Reports will be used to identify unmatched transactions.
	• For Contractor failure to meet the KPI during the Maintenance period, Contractor shall be assessed a fee adjustment of the monthly maintenance fee as described in ***Table 2-7: ETTM Performance Measures***.

2.9.2.23 Operations – Trip Management – 8.b: Transaction/Images/trip Transmission

1888	All Transponder-Based Transactions, Image-Based Transactions, associated images and Trip Transactions created at the RSS shall be transmitted to the BOS. The performance will be measured daily as part of normal operations.

1889	Contractor shall provide the operational results to Authority as part of the Monthly Performance package.
	• Performance Reports will be reviewed to verify the KPI.
	• For Contractor failure to meet the KPI during the Maintenance period, Contractor shall be assessed a fee adjustment of the monthly maintenance fee as described in ***Table 2-7: ETTM Performance Measures***.

2.9.2.24 Operations – Trip Management – 8.c: Trip Transaction Correction Transmission

1890	All Trip Transaction corrections generated at the RSS and their associated images shall be transmitted to the BOS. The performance will be measured daily as part of normal operations.
1891	Contractor shall provide the operational results to Authority as part of the Monthly Performance package.
	• Performance Reports will be reviewed to verify the KPI.
	• For Contractor failure to meet the KPI during the Maintenance period, Contractor shall be assessed a fee adjustment of the monthly maintenance fee as described in ***Table 2-7: ETTM Performance Measures***.

2.9.2.25 Operations – Audit and Reconciliation – 9.a: Audit and Reconciliation

1892	Transactions, images generated in the lanes and trips created at the RSS shall be auditable and reconcilable through System Reports and the final assembly of a transaction to a trip, and the final transmission status and disposition of the transaction to the BOS shall be tracked and reported.
1893	Contractor shall provide the operational results to Authority as part of the Monthly Performance package.
	• Performance Reports will be reviewed to verify the KPI.
	• For Contractor failure to meet the KPI during the Maintenance period, Contractor shall be assessed a fee adjustment of the monthly maintenance fee as described in ***Table 2-7: ETTM Performance Measures***.

2.9.2.26 Operations – Security Breach – 10.a: Security Breach

1894	The ETTM System shall be designed and implemented to prevent security breaches and have monitoring and detection tools to detect any attempts to breach the security of the Express Lanes System.
1895	Contractor shall provide the operational results to Authority as part of the Monthly Performance package.
	• Maintenance Logs, security breaches identified by Authority and the Operations Contractor, and MOMS Reports will be used to verify KPI.
	• For Contractor failure to meet the KPI during the Maintenance period, Contractor shall be assessed a fee adjustment of the monthly maintenance fee as described in ***Table 2-7: ETTM Performance Measures***.

2.9.2.27 Operations – 11: Respond and Repair

1896	Contractor shall respond to and complete repair of **Priority 1** failures/events as follows:
	• ETTM System: respond and complete repair within two (2) hours of failure/event notification; if code change is required, respond within two (2) hours, notify Authority within 1 (one) hour, and repair time to be reasonably determined by Authority and Contractor based on amount of testing required.
	• RSS: respond and complete repair within four (4) hours of failure/event notification; if code change is required, respond within two (2) hours, notify Authority by next Day, and repair time to be reasonably determined by Authority and Contractor based on amount of testing required.
1897	Contractor shall respond to and complete repair of **Priority 2** failure/events as follows:
	• ETTM System: respond and complete repair within four (4) hours of failure/event notification; if code change is required, respond within four (4) hours, notify Authority by next Day, and repair time to be reasonably determined by Authority and Contractor based on amount of testing required.
	• RSS: respond and complete repair within eight (8) hours of failure/event notification; if code change is required, respond within four (4) hours, notify Authority by next Day, and repair time to be reasonably determined by Authority and Contractor based on amount of testing required.
1898	Contractor shall respond to and complete repair of **Priority 3** failures/events as follows:
	• ETTM System: respond and complete repair within twenty-hour (24) hours of failure/event notification; if code change is required, respond within twenty-four (24) hours, notify Authority by next Day, and repair time to be reasonably determined by Authority and Contractor based on amount of testing required.
	• RSS: respond and complete repair within forty-eight (48) hours of failure/event notification; if code change is required, respond within twenty-four (24) hours, notify Authority by next Day, and repair time to be reasonably determined by Authority and Contractor based on amount of testing required.
1899	Contractor shall provide the operational results to Authority as part of the Monthly Performance package.
	• Maintenance Logs and MOMS Reports will be used to verify KPI. Priority levels for each failure will be Approved by Authority.
	• For Contractor failure to meet the KPI during the Maintenance period, Contractor shall be assessed a fee adjustment of the monthly maintenance fee as described in ***Table 2-7: ETTM Performance Measures***.

2.9.2.28 Operations – Data Transmission and Processing – 12.a: Transmission of TSL to the Roadside System

1900	The BOS will transmit the TSL to the RSS, both comprehensive and incremental for the Home and CTOC/Interoperable Agencies. The RSS shall transmit the TSL to each of the lane/zone controllers within thirty (30) minutes of the RSS receipt of the TSL.
1901	Contractor shall provide the operational results to Authority as part of the Monthly Performance package.

	• Maintenance Logs and MOMS Reports will be used to verify KPI in addition to reports obtained from the BOS.
	• For Contractor failure to meet the KPI during the Maintenance period, Contractor shall be assessed a fee adjustment of the monthly maintenance fee as described in ***Table 2-7: ETTM Performance Measures***.

2.9.2.29 Operations – Data Transmission and Processing – 12.b: Transmission of Files to the BOS

1902	Toll Rate CMS images/frames will be captured by the ETTM System and transmitted to the BOS to support customer disputes. Traffic Summaries will also be generated at the ETTM System and transmitted to BOS.
1903	Contractor shall provide the operational results to Authority as part of the Monthly Performance package.
	• MOMS Reports will be used to verify KPI in addition to reports obtained from the BOS.
	• For Contractor failure to meet the KPI during the Maintenance period, Contractor shall be assessed a fee adjustment of the monthly maintenance fee as described in ***Table 2-7: ETTM Performance Measures***.

2.9.2.30 Operations – Annual System Certification – 13.a: Performance of the Annual System Certification

1904	Start dates for the Annual System Certification will be Approved by Authority and scheduled in MOMS. Contractor is responsible for execution of the tests, collection of data, evaluation of the data and submission of the reports and results to Authority showing compliance to KPI.
1905	Contractor shall provide the Annual System Certification status to Authority as part of the Monthly Performance package for that specific month when certification process is schedule to commence.
	• Annual System Certification results will be reviewed to verify KPI.
	• For Contractor failure to meet the KPI during the Maintenance period, Contractor shall be assessed a fee adjustment of the monthly maintenance fee as described in ***Table 2-7: ETTM Performance Measures***.

2.9.2.31 Operations – Occupancy Detection System Accuracy – 14.a: Overall ODS Reporting Accuracy

1906	The number of vehicle occupants that is detected by the ODS shall be reported to the zone controller under all conditions within the Design specification described in this Scope of Work and Requirements. Accuracy = (Total Sample Size – Errors – Exceptions)/(Total Sample Size – Exceptions)

1907	The KPI is measured for all Corridors, Toll Zones and lanes based upon normal operations and is part of Contractor's Maintenance Requirements. Contractor shall perform the validation (review ODS images manually using the QA functionality) and create the supporting documentation in accordance with sampling 1% of the ODS image review results daily each month. In addition, the BOS Contractor's staff will perform QA on a daily basis and these results will be used for verification of the accuracy.
1908	Contractor shall conduct the test and provide the test results to Authority as part of the Monthly Performance package.
	• Performance reports and QA results will be reviewed to verify the KPI.
	• For Contractor failure to meet the KPI during the Maintenance period, Contractor shall be assessed a fee adjustment of the monthly maintenance fee as described in ***Table 2-7: ETTM Performance Measures***.

2.9.2.32 Operations – Occupancy Detection System Accuracy – 14.b: False Negative Accuracy

1909	The number of vehicle occupants that is detected by the ODS shall be reported to the zone controller under all conditions within the Design specification described in this Scope of Work and Requirements. The KPI measures the accuracy of the ODS and the percentage of vehicles with a false negative designations (vehicle with fewer occupants detected than the actual number of declared occupants) Accuracy = (Total Sample Size – False Negatives – Exceptions)/(Total Sample Size – Exceptions)
1910	The KPI is measured for all Corridors, Toll Zones and lanes based upon normal operations and is part of Contractor's Maintenance Requirements. Contractor shall perform the validation (review ODS images manually using the QA functionality) and create the supporting documentation in accordance with sampling 1% of the ODS image review results daily each month. In addition, the BOS Contractor's staff will perform QA on a daily basis and these results will be used for verification of the accuracy.
1911	Contractor shall conduct the test and provide the test results to Authority as part of the Monthly Performance package.
	• Performance reports and QA results will be reviewed to verify the KPI.
	• For Contractor failure to meet the KPI during the Maintenance period, Contractor shall be assessed a fee adjustment of the monthly maintenance fee as described in ***Table 2-7: ETTM Performance Measures***.

2.9.2.33 Authority Identified Anomalies and Research Requests

In addition to Contractor's monitoring of the ETTM System performance, Authority will also review System and performance data and perform tests as deemed necessary. Authority may identify data which may indicate a failure to meet one (1) or more of the Performance Requirements. As a result of Authority's activities, Authority may request that Contractor research and/or provide additional data, identify the extent of the problem or explanation related to anomalies or trends identified by Authority.

1912	Contractor shall respond and fulfill Authority's requests for research, analysis and/or explanation and provide feedback/report within one (1) week or one (1) month as agreed to by Authority.

2.9.2.34 Corrective Actions

Failure to meet a Performance Requirement does not relieve Contractor of the requirement to complete the activity associated with the Performance Requirement. Contractor shall identify the failure condition, take immediate action to remedy the condition and ensure that corrective action is taken to prevent repeated failures in the future. Contractor's compliance with this requirement shall be documented in a Corrective Action Plan (CAP). For example, if Contractor fails to completely and accurately transmit the transactions to the existing Back Office within the time required by the Performance Requirement, the transactions must still be completely and accurately transmitted and Contractor must identify the root cause of the failure, identify the extent of the problem and provide a plan to prevent future occurrences.

1913	Any failure to meet a Performance Requirement that requires the completion of a specific action(s), which is not completed in accordance with the requirement, does not relieve Contractor of the responsibility to perform in accordance with the System requirements. The required specific action(s) must be completed within 24 hours. For example, if Contractor fails to transmit all transaction files to the Agency within two (2) hours, the files must still be sent to the Agency.
1914	Contractor shall develop a CAP for each failure to meet a Performance Requirement identifying the root cause(s) and providing a plan to rectify the current situation, if applicable, and prevent future occurrences.
1915	The CAP provided by Contractor shall be in a format Approved by Authority.
1916	Contractor shall submit a CAP for each failure to meet a Performance Standard for Authority's review and Approval. Until Authority Approves the CAP the failure cannot be considered resolved.
1917	The CAP shall identify the subsystem(s), component(s), processes and activities associated with the failure to meet a Performance Requirement in sufficient detail to allow Authority to understand the issue and why the proposed solution will prevent future occurrences. The system elements include but are not limited to the elements below:
	• Availability;
	• Transponder Capture Rate;
	• Transponder Reporting Accuracy;
	• Transponder Write Performance Accuracy Rate;
	• Vehicle Detection Accuracy;
	• Transponder Association Accuracy;
	• Image Capture and Reporting Accuracy;
	• Image Association Accuracy;
	• License Plate Extraction (OCR/ALPR) Accuracy;
	• Overall Image Transaction Accuracy (automated and manual);
	• Accuracy of Rejection and Categorization of Rejected Image;

	• Transaction Processing and Transmission Requirements;
	• False Read Processing;
	• Image Processing and Transmission Requirements;
	• AVI Transaction Transmission Requirement;
	• Toll Rate CMS Performance;
	• TDS Accuracy;
	• Trip Management;
	• Audit and Reconciliation;
	• Mean Time Between Failure;
	• Security Breach;
	• Data Transmission and Processing, and
	• Contractor Maintenance Processes (Time to Respond and Repair, and Annual Certification);

2.9.2.35 Monthly Performance Review Meetings and Reporting

Contractor shall conduct Monthly ETTM System Performance Review Meetings with Authority. These meetings shall provide Authority with a detailed understanding and review of Contractor's and the ETTM System's performance for purposes of receiving guidance from Authority, Authority oversight, work planning and invoicing. Contractor shall also provide Authority a Monthly Performance Reports including calculated fee adjustments separately for the 91 Express Lanes and I-405 Express Lanes. Contractor's Performance Report will include a series of reports detailing Contractor's performance against each Performance Requirement and details related to the failure events that resulted in the non-performance. Contractor's Performance Report shall contain all information necessary for Authority to verify Contractor performance as reported by Contractor.

1918	Contractor shall manage, facilitate and conduct Monthly ETTM System Performance Review Meetings with Authority beginning at Go-Live and continuing over the life of the Agreement. At a minimum, Contractor Project Manager, Deputy Project Manager, Operations and Maintenance Manager shall attend these meetings.
1919	Contractor shall schedule and conduct the Monthly ETTM System Performance Review Meeting with Authority to occur no more than one (1) week after the submission of a Monthly Performance Report by Contractor.
1920	Performance reviews, including the provision of all required performance reporting, shall be provided by Contractor to Authority beginning one (1) month after Go-Live for the previous month. Any Monthly Maintenance Fee adjustments associated with non-performance shall not be assessed until the fourth month following Go-Live, for the previous (third) month's performance; however, this does not relieve Contractor of required performance prior to the third month and shall not constitute a waiver of any Authority rights or remedies under the Agreement in this regard.
1921	Contractor shall ensure all issues are addressed and resolved or are placed on the action item list and scheduled for resolution.

1922	Contractor shall describe in detail how the performance against a requirement will be tracked, tested and reported, identifying specific reports and data elements. In the case of a KPI which cannot be tracked by the ETTM System, the form of manual tracking or testing must be described and included in the Maintenance Plan.
1923	Contractor shall prepare and submit to Authority the Performance Report on an agreed-upon day each month as defined in these Requirements.
1924	The Performance Report shall include a calculation of the deductions from the Monthly Fees assessed that month separately for the 91 Express Lanes and I-405 Express Lanes, if applicable, and a series of reports, one (1) per Performance Requirement detailing Contractor's performance against the requirement for each KPI and a historical report detailing Contractor's performance against each requirement for the most recent 12 months.
1925	Contractor shall provide the required Performance Report package to Authority before an invoice will be considered for payment. Upon approval by Authority of the Performance Report package, Contractor may submit the request for payment as part of the monthly progress report.
1926	Performance reporting by Contractor and any associated adjustments related to Performance Requirements shall begin for the period beginning on the first day of the Operations and Maintenance Phase and shall continue for the duration of the Agreement.

3 CONTRACT DELIVERABLES REQUIREMENTS LIST

The following table identifies the Deliverables/Submittals which shall be required for this Project. This table is provided for convenience only; it is Contractor's responsibility to meet all requirements.

Table 3-1: Contract Deliverables Requirements List

CDRL ID	CDRL Name	SOW Section
1.	Project Management Plan	2.6.1.1
2.	Approved Baseline Implementation Schedule	2.6.1.6
3.	Document Control Work Plan	2.6.1.7.4
4.	Requirements Traceability Matrix (RTM)	2.6.4.1
5.	Business Rules Document	2.6.4.2
6.	System Detailed Design Documents (SDDD)	2.6.4.3
7.	ETTM System Infrastructure Design Requirements Document	2.5.13.2.1
8.	I-405 TOC Design Requirements Document	2.5.5.2
9.	ETTM System Installation Design Package	2.6.4.4
10.	RSS Installation Design Documentation	2.6.4.5
11.	Quality Assurance Plan	2.6.4.6
12.	Software Development Plan	2.6.4.7
13.	Disaster Recovery Plan	2.6.4.8
14.	Master Test Plan and Test Procedures	2.6.4.9
15.	Health and Safety Plan • Office Safety Plan • Roadside Safety Plan	2.6.4.10
16.	Individual Test Plans • Factory Acceptance Test • Unit Testing • Onsite Installation Test • Installation and Commissioning Test • New BOS Testing • Operational and Acceptance Test	 2.7.5 2.7.6 2.7.7 2.7.8 2.7.9 2.7.10

CDRL ID	CDRL Name	SOW Section
17.	Transition Plan	2.4.4
18.	Installation Plan	2.5.9
19.	Installation Checklist	2.5.10
20.	AVI Certification Report (Third-Party)	2.2.7.1
21.	Maintenance Plan • System Maintenance Plan • Software Maintenance and Warranty Plan • Annual System Certification Plan • Transportation Management Plan	 2.6.4.11.1 2.6.4.11.2 2.8.2.10 2.8.2.17
22.	Operations Plan • Incident Management Plan • KPI Reporting and Management Plan	2.6.4.12
23.	Emergency Response Management Plan	2.8.2.11
24.	Training Plan and Training Materials	2.6.4.13
25.	Third-Party Documentation • Third-Party Software Documentation • Third-Party Hardware Documentation	 2.6.4.14.1 2.6.4.14.2
26.	Manuals • ETTM System Maintenance Manual • Reconciliation and Audit Manual • RSS Administrators Manual • ETTM System User Manual	 2.6.5.2.1 2.6.5.2.2 2.6.5.2.3 2.6.5.2.4
27.	As-Built Documentation and Drawings	2.6.5.3
28.	Monthly Performance Reports	2.9.2.33
29.	End of Contract Transition Plan	2.6.2