
I-4 Ultimate Express Lanes System Engineering Management Plan

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Table of Contents

I-4 Ultimate Express Lanes.....	1
System Engineering Management Plan	1
1 Executive Summary	11
2 Purpose of Document.....	11
3 Scope of Project	11
3.1 Electronic Toll Collection	12
3.2 Congestion (Dynamic Tolling) Pricing System	12
3.3 Intelligent Transportation System (ITS)	12
3.4 Overall Project Scope.....	12
4 Technical Planning and Control.....	14
4.1 Concept of Operations.....	15
4.2 Quality Management Plan Guidelines.....	16
4.3 System Development Plan Guidelines	16
4.4 Data Security and Safety Plan Guidelines.....	16
4.5 Configuration Management Plan Guidelines	16
4.6 System Integration Plan Guidelines	16
4.7 Verification (Test) Plan Guidelines.....	16
4.8 Deployment Plan Guidelines.....	17
4.9 Electronic Toll System Requirements.....	17
4.10 Communications Management Plan.....	17
4.11 Procurement Management Plan	17
5 System Engineering Process	17
5.1 System Requirements Analysis.....	18
5.1.1 Sub-System Functional Analysis	18
5.1.2 Design Synthesis	18
5.1.3 System Analysis.....	18
6 Transitioning Critical Technologies	19
7 Integration of the I-4 Ultimate Managed Lanes System.....	20
8 System Operations and Maintenance.....	20

9	Conclusions.....	20
	Appendix A: Abbreviations Used In This Document.....	21
	Appendix B:Glossary of Terminology Used In The Plan.....	26
	Appendix C: Documents Referenced.....	42
	Appendix D: System Quality Management Plan Guidelines.....	43
1	General.....	44
2	Roles and Responsibilities	44
3	System Quality Policy.....	44
4	System Quality Management Organization.....	45
4.1	Contractual Responsibility (FDOT D5)	45
4.2	Project Consultant Staff	45
4.3	Integrator Systems Engineering Staff	46
5	Quality Assurance and Control.....	46
5.1	Methodologies and Standards	46
5.2	Quality Assurance and Control	46
5.3	Quality Assurance and Control Milestones.....	46
5.4	System Integrator Controls	47
5.5	Design Control	47
5.6	Document and Data Control.....	47
5.7	Purchasing Control.....	47
5.8	Corrective Actions.....	47
5.9	Quality Audits	47
6	Typical Quality Assurance & Control Check List.....	49
	Appendix E: System Development Plan Guidelines	50
1	General.....	51
2	Roles and Responsibilities	51
3	Program Management Document	51
3.1	Referenced Project Documents	51
3.2	Program Management Approach	51
4	Program Management Implementation.....	52
4.1	FDOT D5 Program Responsibilities	52
4.2	FDOT D5 Weekly Meetings	52

4.3	Key Contacts	52
4.4	Integrator Project Schedule	52
4.5	Communications.....	53
4.6	Status Reporting	53
5	On Site Installation	53
6	I-4 Express Lanes System Testing.....	53
6.1	System Design and Development	53
6.2	Work Breakdown Structure.....	53
6.3	Management Reporting And Monitoring	54
6.4	I-4 Express Lanes Program Action Items	54
6.5	System Configuration Management.....	54
6.6	System Configuration Approval.....	55
6.7	Subcontractor Control	55
6.8	integrator project schedule	55
6.9	Software development.....	55
7	Software Specification Development	56
8	Preliminary and Detailed System Design	58
9	Software Integration and Testing.....	59
9.1	Software Validation.....	59
9.2	Software Documentation.....	60
4.1	Software Documentation Control	60
9.3	Process Versioning	60
10	Conclusions.....	60
Appendix F: Data Security and Safety Plan Guidelines		61
1	General.....	62
2	Roles and Responsibilities	62
3	Data Security Engineering	62
3.1	System Engineering Consultant	62
3.2	Integrator Project Manager.....	63
3.3	Data Security Engineering Process	63
4	Scope.....	63
5	Security Engineering Approach.....	64

5.1	Data Security Engineering Administration	65
5.1.1	Organizational Structure Overview	65
5.1.2	Security Engineering Management.....	65
5.1.3	Reviews.....	65
5.1.4	Governance	65
5.2	Data Security Engineering Process	66
5.2.1	Standard Practices	66
5.2.2	Project-Specific Processes	66
5.2.3	Threat Analysis	66
5.2.4	Identification	66
5.2.5	Assessment of Threat Potentials	67
5.2.6	Vulnerability Assessment	67
5.2.7	Identification	67
5.2.8	Impact Assessment.....	68
5.2.9	Risk Analysis	68
5.2.10	Countermeasure Design	68
5.2.11	Security Architecture	68
5.2.12	Candidate Trade Studies	69
5.2.13	Security Verification and Testing	69
5.2.14	Assurance.....	69
5.2.15	Evaluation	69
	Appendix G: Configuration Management Plan Guidelines	71
1	General.....	72
2	Roles and Responsibilities	72
2.1	FDOT D5.....	72
2.2	Consultant Staff.....	72
2.3	Integrator Systems Engineer(s)	73
3	Integration Activities	73
3.1	Configuration Identification	75
3.2	Acquiring Configuration Items	77
3.3	Configuration Item Identification.....	77
3.4	Naming Configuration Items.....	77

3.5	Configuration Management Change Control	78
3.6	Request Change.....	80
3.7	Evaluating Change	80
3.8	Approve or Disapprove Change	80
3.9	Implement Change	80
3.10	Status Tracking and Reporting.....	81
3.11	Configuration Audits.....	82
3.12	Interface Controls.....	84
3.13	Integrator Management	85
Appendix H: Risk Management Plan		88
1	Introduction.....	89
2	Risk Management Approach.....	89
2.1	Risk Identification	90
2.2	Expert Consultant Review.....	90
2.3	Risk Qualification and Prioritization.....	90
2.4	Risk Monitoring	91
2.5	Risk Mitigation and Avoidance.....	91
2.6	Risk Register	92
Appendix I: System Integration Plan Guidelines.....		93
1	General.....	94
2	Roles and Responsibilities	94
2.7	FDOT D5 Personnel.....	94
2.8	Project Consultant Staff	94
2.9	Integrator System Engineering Staff	95
3	Integration Phases	95
3.1	Field Sub-Systems Integration	96
3.2	FTE Tolls Back Office System Integration.....	97
3.3	Communications System Integration	97
3.4	End-To-End Application Integration	98
3.5	Integration Plan Components	98
3.6	Integration Activities.....	98
3.7	Steps Related To Activities	99

3.7.1	Step Accomplishment	99
3.7.2	Resource Requirements	99
3.7.3	Key Integration Staff.....	99
3.7.4	Criteria for Step Completion.....	99
3.8	Integration Support.....	100
3.9	Resources and their Allocation	100
4	Training.....	100
5	Testing.....	100
Appendix J: Verification (Test) Plan		101
1	General.....	102
2	Roles and Responsibilities	102
2.1	Florida Department of Transportation District 5 (FDOT D5) Staff.....	102
2.2	Project Consultant Staff	102
2.3	Integrator Systems Engineering Staff	102
3	Test Plan.....	103
3.1	Equipment Environmental Testing.....	104
3.2	Factory Acceptance Test (FAT)	104
3.3	On-Site Integration and Commissioning Test.....	105
3.4	Operational Performance Test (OPT)	106
3.4.1	Severity 1	107
3.4.2	Severity 2	107
3.4.3	Severity 3	107
3.4.4	Severity 4	108
Appendix K: Deployment Plan Guidelines.....		109
1	General.....	110
2.	Roles and Responsibilities	110
2.1.	FDOT D5 Staff.....	110
2.2.	Project Consultant Staff	110
2.3.	Integrator's Engineering Staff.....	110
3.	Purpose of Deployment Plan	111
4.	System Deployment Staff	112
4.1.	I-4 Ultimate Express Lanes Integrator	112

4.2.	Integrator Staff Qualifications.....	112
4.3.	Integrator Management Support and Services	113
4.4.	Integrator Project Manager.....	113
4.5.	Chief Technical Officer.....	113
4.6.	Installation Manager.....	114
4.7.	Hardware Installation Engineer.....	114
4.8.	FTE Tolls Back Office Installation Engineer (Hardware and Software)	114
4.9.	Roadside Equipment Software Support Engineer.....	115
4.10.	Subcontractors	115
4.11.	Installation Equipment and Tools.....	115
5.	Electronic Toll System Documentation	116
6.	Installation Considerations.....	116
6.1.	Installation Safety.....	116
6.2.	Code and Industry Standards	117
6.3.	Installation Planning.....	117
6.4.	Weather And Productivity.....	117
6.5.	Shop Drawing Submittals	117
6.6.	Installation Daily Cleanup.....	117
7.	System Testing and Acceptance	118
7.1.	Operational Performance Test Records.....	118
7.2.	Corrective Action	118
7.3.	Observation And Operational Performance Test Records	118
7.4.	Installation Schedule	119
8.	Integrator Training.....	119
8.1.	FTE Tolls Back Office Supervisor staff:.....	119
8.2.	FTE Tolls Back Office Customer Service Representative staff:.....	119
9.	Conclusions.....	120
	Appendix L: Electronic Tolling and Pricing Requirements	121
	Appendix M: Communications Management Plan.....	188
1	Introduction.....	189
2	Communications Management Approach.....	189
3	Communications Management Constraints	190

4	Stakeholder Communication Requirements	190
5	Roles	191
5.1	Project Sponsor – FDOT D5 District Secretary of Transportation	191
5.2	Program Manager – FDOT D5	191
5.3	Key Stakeholders – FTE, FDOT Central Office, FHWA, Selected Concessionaire (Integrator)	191
5.4	Change Control Board.....	191
5.5	Customer	191
5.6	Project Manager	191
5.7	Project Team	192
5.8	Steering Committee.....	192
5.9	Technical Lead	192
6	Project Team Directory.....	193
6.1	Communication Methods and Technologies.....	193
	Communications Matrix	195
7	Communication Flowchart.....	197
8	Guidelines for Meetings.....	198
8.1	Meeting Agenda	198
8.2	Meeting Minutes	198
8.3	Action Items	198
8.4	Meeting Chair Person.....	198
8.5	Note Taker.....	198
8.6	Time Keeper	198
8.7	Parking Lot.....	198
9	Communication Standards	199
9.1	Kickoff Meeting	199
9.2	Project Team Meetings.....	199
9.3	Technical Design Meetings	199
9.4	Monthly Project Status Meetings	199
9.5	Project Status Reports	199
10	Communication Escalation Process	200
	Appendix N: Procurement Management Plan	201

1	Introduction.....	202
2	Procurement Management Approach	202
3	Procurement Definition.....	203
4	Type of Contract to be used	203
5	Procurement Risks	204
6	Procurement Risk Management.....	204
7	Cost Determination	204
8	Standardized Procurement Documentation.....	205
9	Procurement Constraints	206
9.1	Schedule:	206
9.2	Cost:	206
9.3	Scope:	206
9.4	Resources:	206
9.5	Technology:.....	206
10	Contract Approval Process	206
11	Decision Criteria	207
12	Integrator Management.....	207
13	Performance Metrics for Procurement Activities	208

1 Executive Summary

This Systems Engineering Management Plan (SEMP) is a supplement the Project Management Plan (PMP) [1], focusing on the system project management arrangements and system engineering processes to be used for the project. It provides detail on systems engineering tasks, particularly detailed information on the processes to be adopted to manage the special risk associated with large, innovative system and software development projects.

Engineering tasks related to the development of custom software, or the adaption of existing commercial systems, from requirements, through design implementation, integration, and verification are very complex, and are new to many transportation engineers. This document and associated documents have been developed as guidance for technical planning and control, systems engineering process, transitioning critical technologies, and integration of the I-4 Ultimate Managed lanes System.

2 Purpose of Document

The System Engineering Management Plan (SEMP) and associated documents have been developed as guidelines to define the various technical planning and control, systems engineering process, transitioning critical technologies, and integration of the I-4 Ultimate Managed lanes System. The document will serve the following purposes:

- A repository for project technical plans
- Identification of items that are to be developed, delivered, integrated, installed, verified, and supported
- Definition of when these tasks will be done, who will do them, and how the products will be accepted and managed
- Definition of the technical processes to be used to produce each of the project's products.

The intended readership of the document includes the following groups:

- FDOT Central Office
- FDOT D5
- FDOT Central Office
- FTE staff, consultants and integrators
- Project consultants
- The successful I-4 Ultimate Concessionaire ("Integrator")

3 Scope of Project

Detailed design and implementation of the I-4 Ultimate Managed lanes system will be the contractual responsibility of FDOT D5 and conducted by a number of different organizations under FDOT D5 direction. Detailed roles and responsibilities are defined in the I-4 Ultimate Managed Lanes System Concept of Operations (ConOps), contained in a separate document. The system consist of three primary elements

3.1 Electronic Toll Collection

This includes the roadside, telecommunications and back office facilities required to collect tolls in a non-stop manner from relevant vehicles using the SunPass electronic toll collection system. – the electronic toll collection system will be designed, implemented and operated under the auspices of a Memorandum of Understanding (MOU) between FDOT D5 and FTE. This will specify the services to be delivered by FTE and the relevant quality levels. It will also define respective roles and responsibilities for each stage of the project. Roadway sensors on both the general purpose and managed lanes are part of pricing and traffic management.

3.2 Congestion (Dynamic Tolling) Pricing System

The hardware and software required to determine the toll to be charges or each time period, each road segment and each vehicle type on the I-4 Managed Lanes facility. The congestion pricing system will support dynamic pricing to achieve demand management goals. The pricing system will calculate toll rates based on prevailing traffic conditions. FDOT D5 will operate and manage the congestion pricing system.

3.3 Intelligent Transportation System (ITS)

Consists of the regional traffic management center, field devices and telecommunications infrastructure required to support traffic management, incident management and traveler information. ITS (roadway sensors, telecommunications, dynamic message signs and CCTV that are not part of the electronic toll collection and pricing system) will be designed, and implemented under the auspices of a contract between FDOT D5 and a selected concessionaire for the I-4 Ultimate project (Integrator).

3.4 Overall Project Scope

The concessionaire will be selected through a competitive public procurement process. The RFP for the procurement will define requirements and guidance for system engineering for the Concessionaire.

As it is desirable to have a single SEMP for the entire system, this document covers both Items 1 and 2. For simplicity, FTE, the FTE system integrator and the selected concessionaire are referred to as the “Integrator” in the remainder of this document and Appendices.

The engineering process that will be implemented in support of the design, development, testing and deployment of the I-4 Ultimate Managed lanes System will be important to ensure a successful project. That engineering process is identified in this SEMP and the guidelines presented in these documents will be conveyed to the selected I-4 Ultimate Managed lanes System Integrator (Integrator) through the Request for Proposals (RFP), MOU and other contract documents. The work of the selected Integrator will be monitored closely by FDOT D5 and consultants to ensure project success.

The I-4 Ultimate Managed lanes System will include the implementation of various technologies, including Florida Statewide ETC system electronic tolling, vehicle detection, system enforcement devices, and various types of telecommunications systems. An Integrator will be selected to perform the I-4 Ultimate Managed lanes System design, development, integration, testing and deployment. Florida Department of Transportation District 5 (FDOT D5) will be responsible for ensuring that the delivered I-4 Ultimate Managed lanes System operates according to the RFP and the other contract requirements. FDOT D5 will use consultants, FTE resources and resources from the selected concessionaire to provide tolling system technical and project monitoring assistance to ensure that the I-4 Ultimate Managed lanes System operates as planned.

The scope of the I-4 Ultimate Managed lanes project was detailed in the draft Project Management Plan (PMP) and is replicated here for convenience.

“1.2.1 Project Scope

Highway Improvements include the addition of lanes as described earlier, auxiliary lanes and standard widths for the outside and inside shoulders. The project is more than a widening of the road. While extra lanes of traffic will be added to help congestion and make way for the expected growth, some benefits of the project are not so obvious, such as: geometric improvements, operational ramp improvements, shoulder improvements, drainage upgrades and bridge replacements.

The Ultimate Interstate 4 (I-4, SR 400) widening project will extend from West of Kirkman Road in Orange County to East of SR 434 in Seminole County. I-4 will be reconstructed to accommodate three (3) General Use Lanes (GUL), auxiliary lanes, and two (2) Managed Lanes in the eastbound and westbound directions. Access to and from the Managed Lanes will be provided through slip ramps located along the corridor and direct access Managed Lane-only ramps at Grand National Drive, Anderson Street South Street, Ivanhoe Boulevard, and Central Parkway interchanges.

The SR 408/I-4 interchange will be built to its ultimate configuration and will include modifications to SR 408, which is operated by Orlando Orange County Expressway Authority (OOCEA).

The widening of Interstate 4 includes reconstruction of the following interchanges:

- ***Kirkman Road***
- ***Orange Blossom Trail (OBT)***
- ***Michigan Avenue***
- ***Kaley Street***
- ***SR 408***
- ***SR 50***
- ***Ivanhoe Boulevard***
- ***Princeton Street***

- *Par Avenue*
- *Fairbanks Avenue*
- *Lee Road*
- *Maitland Boulevard*
- *SR 436*
- *SR 434*

A significant number of bridges that are part of Interstate 4 are being replaced within the limits of the project.

Preliminary design (up to 60% design) has been completed on this twenty one (21) mile corridor. These preliminary plans have established the I-4 mainline and ramp geometry based on the traffic operational needs for the roadway. The plans also provide the beginning and end transitions from the Managed Lanes to the existing General Use Lanes at the termini of the project. But there have been modifications to the preliminary design for some of the locations.

These modifications are:

- *Revised Managed Lane exit flyover-ramp for the EB Maitland Boulevard exit*
- *Revised layout for Kirkman Interchange*
- *Grand National Drive Interchange with I-4*
- *Modifications to Managed Lane exits at South Street and Anderson Street and their adjoining ramps*
- *Replacement of Shingle Creek Bridge over I-4*
- *Replacement of Westbound I-4 Bridge over Orange Blossom Trail (OBT)*
- *Central Parkway Managed Lane Interchange with I-4"*

The project also provides for the planning, design, installation and operation of a sophisticated open road tolling, dynamic pricing system and ITS system. This document addresses system engineering processes and requirements associated with the electronic toll collection, pricing and ITS systems.

4 Technical Planning and Control

FDOT D5 will be responsible for ensuring that the I-4 Ultimate Managed lanes System is properly designed, developed, integrated, tested and deployed. FDOT D5 shall use the services of consultants and resources from the selected concessionaire (Integrator) to make sure that this takes place. Even though the Integrator shall be contractually responsible to develop and closely adhere to their own engineering practices, FDOT D5 and their consultants will have the capability to review and approve the Integrator's engineering practices and closely monitor these activities to ensure full compliance of the various procedures.

It was determined that the best way to ensure successful system implementation was to develop a set of system engineering guidelines that will be submitted to and discussed with the Integrator. The Integrator will then be required to submit planning and design work consistent with the

guidelines. In order to convey to the Integrator the types of system engineering practices that should be utilized, a number of SEMP documents have been developed as follows:

Concept of Operations

- A. List of Abbreviations
- B. List of Terminology
- C. List of Referenced Documents
- D. Quality Management Plan Guidelines;
- E. System Development Plan Guidelines;
- F. Data Security and Safety Plan Guidelines;
- G. Configuration Management Plan Guidelines;
- H. Risk Management Plan
- I. System Integration Plan Guidelines;
- J. Verification (Test) Plan Guidelines;
- K. Deployment Plan Guidelines; and
- L. Electronic Toll System Requirements.
- M. Communications Management Plan
- N. Procurement Management Plan

The Concept of Operations for the project has been developed a separate document and will be submitted under separate cover.

As described above, the SEMP documents have been developed for use as guidelines defining the technical planning and control, systems engineering process, transitioning critical technologies, and integration of the I-4 Ultimate Managed lanes System. The development of detailed plans for this engineering effort will be the responsibility of the chosen I-4 Ultimate Managed lanes System Integrator.

Brief descriptions of each document are as follows:

4.1 Concept of Operations

Provides a high-level system operational overview of the I-4 Ultimate Managed lanes System Project. This Plan describes the operating parameters of the I-4 Ultimate Managed lanes System, defines which organization will be responsible for the I-4 Ultimate Managed lanes System implementation, defines which group will construct the I-4 Ultimate Managed lanes (Concessionaire), describes how the I-4 Ultimate Managed lanes System will be designed and developed, defines the external interfaces to Florida's Turnpike Enterprise (FTE), FDOT D5 Regional Traffic Management Center (RTMC) and the law enforcement agency. It also defines roles and responsibilities for operations and maintenance.

4.2 Quality Management Plan Guidelines

Defines guidelines for the Integrator to ensure that all necessary quality assurance (QA) and quality control (QC) processes are identified, maintained and adhered to by the Integrator. This is in order to ensure that the delivered I-4 Ultimate Managed lanes System operates according to the system performance requirements that are presented in the RFP and the other contract documentation.

4.3 System Development Plan Guidelines

Provides details regarding how the Integrator will conduct the actual hardware and software design, system development, shop testing, integration and factory testing of the I-4 Ultimate Managed lanes System to ensure that it is designed and developed properly. These guidelines will be used as the basis for the Integrator to develop a detailed I-4 Ultimate Managed lanes System Development Plan, including management controls such as internal reviews, schedules, requirements traceability matrix and Work Breakdown Structure (WBS).

4.4 Data Security and Safety Plan Guidelines

Defines data security measures to be incorporated into the I-4 Ultimate Managed lanes System. The data security issue is of particular importance as the existing FDOT D5 telecommunication network is shared with multiple agencies including education and health services as well as transportation. This Plan will also identify the ways in which the system design, development and deployment will be performed to ensure that the work is conducted in a safe manner.

4.5 Configuration Management Plan Guidelines

Defines guidelines on the I-4 Ultimate Managed lanes System configuration and how the Integrator should develop, maintain and adhere to internal configuration management procedures and processes. This is to ensure that system design and development enhancements and modifications are carried out in a systematic manner that avoids unanticipated consequential changes in system operation. This also ensures that all parties involved in deploying and operating the system have a common understanding of the current system configuration.

4.6 System Integration Plan Guidelines

Defines how the equipment, subsystems and overall system will be integrated and tested by the Integrator to ensure that a fully integrated and operating system is deployed. This ensures that all of the functional requirements that are defined in the RFP and the other contract documents are delivered. Both hardware and software integration and testing are addressed in this document.

4.7 Verification (Test) Plan Guidelines

Defines system testing and validation requirements that will be implemented by the Integrator. This is to verify that the delivered I-4 Ultimate Managed lanes System features all of the system requirements that are presented in the RFP and the other contract documents and that all features are operating to the required specifications.

4.8 Deployment Plan Guidelines

Defines how the I-4 Ultimate Managed lanes System will be prepared for installation, how it will be installed, tested and opened to traffic. The detailed equipment and software development, integration testing and installation plans shall be provided by the Integrator as part of their required documentation submittals.

4.9 Electronic Toll System Requirements

Defines the I-4 Ultimate Managed lanes System functional requirements, business operating rules, and interfaces to other external systems. The I-4 Ultimate Managed lanes System requirements shall be used by the Integrator as the basis for developing their proposal and to effectively design develop and implement the new I-4 Ultimate Managed lanes System I-4 Ultimate Managed lanes System. Requirements have been coordinated with FTE Florida Statewide ETC system requirements.

4.10 Communications Management Plan

Defines the communication requirements for the project and how information will be distributed. This plan also identifies and defines the roles of people involved in project. It also includes a communications matrix which maps the communication requirements of the project.

4.11 Procurement Management Plan

Defines the procurement requirements for the project and how it will be managed from developing procurement documentation through contract closure.

The Integrator will also be responsible for the development of a comprehensive training plan. The training plan will include all training activities as necessary, for the FTE Florida Statewide ETC system™ customer service representatives and back office staff, FDOT D5 operations staff and Regional Traffic Management Center staff, I-4 Ultimate Managed lanes System maintenance technicians, and other operation staff. The training plan will be submitted for review and approval by FDOT D5. This plan is discussed in more detail in the Deployment Plan.

5 System Engineering Process

FDOT D5 will utilize a system engineering process that ensures that the Integrator develops and closely adheres to a design process that is acceptable to FDOT D5. The design process approach to be used on this Project is the federal approved V Model, which is described in this document, Appendices and the Concept of Operations. The V Model System Engineering process addresses systems planning, engineering, software development, integration testing, documentation development, installation and deployment of the I-4 Ultimate Managed lanes System. FDOT D5 will utilize the services of consultants to ensure that this process is followed. Presented below are the four areas of engineering analysis that will be implemented by FDOT D5:

5.1 System Requirements Analysis

The Concept of Operations document was used during the development of the various I-4 Ultimate Managed lanes functional requirements. FDOT D5 developed the system requirements document in coordination with experienced tolling systems operation staff at FTE to obtain important feedback and make certain that the requirements are closely coordinated with Florida Statewide ETC system™ current and developing capabilities. The system requirements will be provided to prospective Integrators as part of the I-4 Ultimate Managed lanes System RFP package.

5.1.1 Sub-System Functional Analysis

As part of the system requirements development process, FDOT D5 consultants and the Integrator will expand on the system requirements to the sub-system level. The consultants will ensure there are no conflicts between the system and the sub-system related requirements. It is expected that the various external interfaces, including to the FTE tolls back office, FDOT D5 RTMC, and the enforcement system equipment, will be identified at this point in the requirements development process.

5.1.2 Design Synthesis

The Integrator will then use the various system and sub-system related functional requirements as the basis for designing the I-4 Ultimate Managed lanes System. FDOT D5 and their consultants shall closely oversee the Integrator's design process and will conduct several rounds of testing to ensure that all identified requirements are being met. It is envisioned that FDOT D5's consultants will utilize the comprehensive requirements trace matrix, which will be developed by the Integrator, as the guide to ensure that the Integrator is designing the I-4 Ultimate Managed lanes System correctly.

5.1.3 System Analysis

During the Integrator's I-4 Ultimate Managed lanes System design process, FDOT D5's consultants will monitor this activity to quickly identify possible technical problems with proposed equipment, existing Florida Statewide ETC system™ hardware or software, and Integrator application software. If technical trade-offs need to be implemented, the Integrator shall follow these procedures, which will be clearly identified in the I-4 Ultimate Managed lanes System RFP. FDOT D5 will be required to approve the requested technical trade-off as proposed by the Integrator and recommended by the consultants.

FDOT D5 will develop and implement an internal document and drawing review and approval process that will be applied to the systems engineering process of the I-4 Ultimate Managed lanes System Project through system acceptance. FDOT D5's District Secretary will have the contractual and legal authority to sign off on all system engineering related aspects of the Project. The typical approval process will be as described below:

1. The Integrator shall be required to provide a particular document and/or drawing within a certain timeframe as will be stated in the I-4 Ultimate Managed lanes System RFP.
2. The District Secretary, or her designee, and FDOT D5's consultants will carefully review and provide comments and/or suggested modifications on the document or drawing. The consultants will then compile all of the comments into a matrix/database.
3. The consultants will provide a recommendation to the District Secretary, which might be to approve the document/drawing or ask the Integrator to make changes and re-submit the document for a second round of review.
4. The District Secretary will then make the decision whether or not to officially approve the document/drawing and will inform, in writing, the Integrator Project Manager/s of that decision.

To enhance the ability for FDOT D5 to track the Integrator's system engineering process, the Integrator will be required to provide a document management tool. This tool will support storage and retrieval of project documents, including correspondence and e-mail messages. The program will also have the capability to segregate FDOT D5 documents from general project documentation to be accessed exclusively by FDOT D5 and consultant staff. It is envisioned that this system will be Cloud-based to allow the users to access the documents and files remotely to facilitate the Integrator contract oversight task.

6 Transitioning Critical Technologies

FDOT D5 and I-4 Ultimate Managed lanes System consultants are aware of the risks associated with the potential technology transitioning process. Much time has been spent during the project documentation development process to consider this important factor. Based on the specific technology considerations for the I-4 Ultimate Managed lanes System Project, most of the technologies to be incorporated into the I-4 Ultimate Managed lanes System are all very mature and have been in successful operation for many years as part of the existing FTE Florida Statewide ETC system™ program. These I-4 Ultimate Managed lanes System technologies include the use of a Florida Statewide ETC system™ transponder detection process, vehicle detection equipment, devices to determine vehicle travel times, tolling zone beacons, Closed Circuit Television (CCTV) equipment, and DMS.

One of the I-4 Ultimate Managed lanes System technologies that will require detailed analysis is the system enforcement equipment, which includes mobile enforcement readers (MERs) and hand-held enforcement devices. Both of these pieces of equipment, and their associated software, are currently in the early stages of use at other facilities. A procedure to deal with possible technology swapping will be clearly identified in the I-4 Ultimate Managed Lanes System RFP. FDOT D5 shall have approval rights for the technology transfer process and for the technology that is ultimately chosen by the Integrator. FDOT D5's consultants will be involved in this process and will provide technology recommendations to FDOT D5.

Another challenge with respect to technology transitioning is the incorporation of emerging and future technologies. The I-4 Ultimate project is a massive project involving the re-construction of 22 miles of limited access highway, including widening of the highway at approximately 130

bridge structures. Construction is expected to begin in 2014 with completion planned for 2020. The system will therefore be launched in about 8 years' time, allowing significant scope for technology development between current planning efforts and system utilization. Foreseeable technology changes and a process for incorporating disruptive technology developments will be defined in the MOU between FDOT D5 and FTE and in the RFP.

7 Integration of the I-4 Ultimate Managed Lanes System

The I-4 Ultimate Managed lanes System RFP and other contract documents will define system integration requirements. The Integrator shall explain in the Integration Plan the methods that will be used to ensure successful integration of the system components into a fully functioning I-4 Ultimate Managed lanes System, fully addressing the requirements from the RFP and the other Contract documents. The V-Model system engineering process steps shall be detailed and adhered to by the Integrator during the design, integration, verification/testing, deployment and training phases required to support the operation and maintenance of the new I-4 Ultimate Managed lanes System I-4 Ultimate Managed lanes System. The Integrator shall provide written confirmation that they will adhere to each of these engineering steps. FDOT D5 and their consultants shall closely monitor the integration process to ensure that it is being performed correctly.

8 System Operations and Maintenance

System operations and maintenance requirements will be defined in the I-4 Ultimate Managed lanes System RFP. The Integrator will be required to prepare and submit an Operations and Maintenance Plan, which will be reviewed and approved by FDOT D5. The Integrator shall explain in the Operations and Maintenance Plan the methods that will be used to operate and maintain the I-4 Ultimate Managed lanes System consistent with the RFP and other contract document requirements. This Plan will be adhered to by the Integrator who will be responsible for I-4 Ultimate Managed lanes System operations and maintenance during the life of the concession. FDOT D5 and consultants will closely monitor the operations and maintenance effort to ensure that it is being performed correctly.

9 Conclusions

The system engineering process that will be used during the I-4 Ultimate Managed lanes System design, development, integration, testing and deployment phases of this project is critical to ensure success. The processes identified herein will be described fully in the I-4 Ultimate RFP. FDOT D5 and their consultants will ensure that the chosen Integrator adheres to the guidelines and requirements that are presented in this SEMP and appendices.

Appendix A: Abbreviations Used In This Document

The following table contains a list of all the abbreviations used in the various plan documents and Appendices, along with an explanation of the abbreviation.

Abbreviation	Explanation
24/7	24 hours per day, 7 days per week
CCTV	Closed Circuit Television Camera
CERT	United States Computer Emergency Readiness Team
CI	Configurable Item
CM	Configuration Management
CMP	Configuration Management Plan
ConOps	Concept of Operations
COTS	Commercial Off The Shelf
CSR	Customer Service Representative
CTO	Chief Technology Officer
DDD	Detailed Design Document
DDR	Detailed Design Review
DMS	Dynamic Message Sign
DoS	Denial of Service
EB	East Bound
ETC	Electronic Toll Collection
FAT	Factory Acceptance Test
FDOT	Florida Department of Transportation
FDOT Central Office	Florida Department of Transportation Central Office

Abbreviation	Explanation
FDOT D5	Florida Department of Transportation District 5
FHWA	Federal Highway Administration
FTE	Florida's Turnpike Enterprise
GUL	General Use Lane
I-4	Interstate 4
ISO	International Standards Organization
IT	Information Technology
ITS	Intelligent Transportation Systems
MER	Mobile Enforcement Reader
MOMS	Maintenance Online Management System
MOU	Memorandum of Understanding
MS	Microsoft
OBT	Orange Blossom Trail
OICT	On-site Integration and Commissioning Test
OOCEA	Orlando-Orange County Expressway Authority
OPT	Operational Performance Test
OS	Operating System
PCI	Payment Card Industry (standard)
PDD	Preliminary Design Document
PDF	Portable Document Format (Adobe Acrobat)
PDR	Preliminary Design Review

Abbreviation	Explanation
PERT	Project Evaluation and Review Technique
PIP	Project Installation Plan
PM	Project Manager
PMD	Program Management Document
PMO	Project Management Office
PMP	Project Management Plan
PQM	Project Quality Manager
QA	Quality Assurance
QC	Quality Control
QM	Quality Management
QMP	Quality Management Plan
RCSC	Regional Customer Service Center
RFP	Request for Proposals
RTMC	Regional Traffic Management Center
SANS	SysAdmin, Audit, Network, and Security
SDP	System Development Plan
SEMP	System Engineering Management Plan
SSD	Software Specification Document
SVP	System Verification (Test) Plan
VDS	Vehicle Detection System
WBS	Work Breakdown Structure

Appendix B: Glossary of Terminology Used In The Plan

The following table contains a list of all the terms used in the various plan documents and Appendices, along with an explanation of the term.

Term	Explanation
All Electronic Toll Collection (AETC)	The operation of a highway facility where there is no cash option to pay for the use of the facility and tolls are collected by transponder based electronic toll collection or by video tolling
Business Process	The definition of the activities and work products required to accomplish a task or run a business operation
Channelized Toll Plaza	A toll facility where traffic is channeled past a number of toll booths or payment points requiring that vehicle slow down Some facilities also have barriers across the lanes that are raised after payment
Chief Technology Officer	An executive-level position in a company or other entity whose occupant is focused on scientific and technological issues within an organization
Closed Circuit Television Camera	Camera that is connected to copper or fiber optic telecommunications network that is dedicated to the specific purpose. The term closed circuit the first to the fact that the images from the camera are relayed along a closed circuit and not broadcast like commercial television
Commercial off The Shelf	A Federal Acquisition Regulation (FAR) term defining a non-developmental item (NDI) of supply that is both commercial and sold in substantial quantities in the commercial marketplace, and that can be procured or utilized under government contract in the same precise form as available to the general public
Communications Management Plan	Defines the communication requirements for the project and how information will be distributed

Term	Explanation
Communications Management Plan	Portion of the overall Project Management Plan which details how project communications will be conducted, who will participate in communications, frequency of communications, and methods of communications
Concept of Operations	Is a document describing the characteristics of a proposed system from the viewpoint of an individual who will use that system. It is used to communicate the quantitative and qualitative system characteristics to all stakeholders
Configurable Item	The fundamental structural unit of a configuration management system
Configuration Management	Arrangements for establishing and maintaining the integrity and control of software/hardware products and documents supplied by the Integrator during the life cycle of the I-4 Ultimate Express Lanes Toll Collection, Pricing and Intelligent Transportation Systems
Configuration Management Plan Guidelines	Defines arrangements for establishing and maintaining the integrity and control of software/hardware products and documents supplied by the Integrator during the life cycle of the I-4 Ultimate Express Lanes Toll Collection, Pricing and Intelligent Transportation Systems. This document provides guidelines for the creation of the Configuration Management Plan by the Integrator
Congestion Pricing	Dynamic tolling implemented to achieve a level of service objectives by taking advantage of the relationship between trip cost and traffic volume
Customer Service Representative	Customer facing staff in the SunPass Customer Service Center

Term	Explanation
Data Security and Safety Plan Guidelines	Describes the tools, processes, and methods required to design, implement, and test the electronic toll collection, pricing and ITS to ensure that it remains dependable once deployed. In the context of the I-4 Ultimate Express Lanes Project, it is also to ensure that the management and monitoring of the related transportation infrastructure continues unimpeded. This document provides guidelines for the creation of the Data Security and Safety Plan by the Integrator
Dedicated Short Range Communications (DSRC)	Relatively short range communications in the 914 mhz or 5.8 ghz band range used to communicate between the vehicle and roadside equipment for Electronic Toll Collection
Denial of Service	An attempt to make a machine or network resource unavailable to its intended users. Although the means to carry out, motives for, and targets of a dos attack may vary, it generally consists of the efforts of one or more people to temporarily or indefinitely interrupt or suspend services of a host connected to the internet
Deployment Plan Guidelines	Provides the details of the planned installation of the I-4 Ultimate Express Lanes I-4 roadside, FTE, Regional Traffic Management Center, and system enforcement equipment and subsystems. This document provides guidelines for the creation of the Deployment Plan by the Integrator
Detailed Design Document	A detailed written description of a system, that a system designer writes in order to give a development team an overall guidance of the architecture of the software project. Usually accompanies an architecture diagram with pointers to detailed feature specifications of smaller pieces of the design. Practically, a design document is required to coordinate a large team under a single vision

Term	Explanation
Detailed Design Review	Provides an in-depth assessment, by an independent team of discipline experts and managers, that the design (or concept) is realistic and attainable from a programmatic and technical sense
Digital Video Recorder (DVR)	A device that stores video images in digital form on either a hard disk or solid-state memory. It also has an operating system that allows the storage of the images to be managed and selected images retrieved as required. For dynamic tolling applications this device would be integrated into a larger system
Dynamic Message Sign (DMS)	Often referred to as variable message signs or changeable message signs. These are roadside devices that display configurable messages to drivers. They are typically connected to a fiber-optic telecommunications network to a traffic management center. An operator at the traffic management center can input the message and have it displayed on one or more roadside dynamic message signs. For dynamic tolling purposes this technology is used to communicate the prevailing toll for each segment of road to the drivers. They are typically placed sufficiently far in advance of the decision point in the network that the driver can see the message and then take a decision on the basis of the tolling information
Dynamic Pricing	A pricing structure in which charges are regularly adjusted according to traffic conditions to maintain a free-flowing level of traffic, increasing when the lanes are relatively full and decreasing when the lanes have extra capacity. Traffic sensors on the road facility being managed and sometime on parallel routes are used to continually monitor the traffic conditions
Dynamic Tolling	Use of traffic sensors and electronic toll collection technology (open road) to vary the price for using a road facility at regular intervals

Term	Explanation
Elasticity of demand	The change in demand divided by the change in price for a commodity
electronic payment system	A system that has been designed and implemented to enable cash free payment for goods and services using payment device, reader, telecommunications and back office technologies
Electronic Toll Collection (ETC)	Electronic systems that collect tolls, eliminating the need for tollbooths and for vehicles to stop to make payment.
Electronic Toll System Requirements	The needs or conditions to be met for Electronic Toll Collection on the I-4 Ultimate Project, taking account of the possibly conflicting requirements of the various stakeholders
Escalation	The process which details how conflicts and issues will be passed up the management chain for resolution as well as the timeframe to achieve resolution
Express Lane	A limited access road facility where users pay a fee for the use of the facility or qualify for free use due to the number of occupants in the vehicle
Factory Acceptance Test	Before delivery or final installation checks are made to be certain that equipment or plant has been completed to the required quality and is fully operational. A factory acceptance test determines whether equipment or plant operates as intended and meets all contractual specifications
Federal Highway Administration	Is a division of the United States Department of Transportation that specializes in highway transportation

Term	Explanation
Fiber Optic Communications	The transmission of voice video and data as pulses of light along very thin glass strands. Equipment of the ends of each fiber cable converts electronic pulses to light pulses. This telecommunications technique is capable of transmitting very high volumes of data over large distances. The fiber-optic cables can be installed in conduits and buried underground, or can be attached to poles as an aerial installation
General Use Lanes	Limited access lanes on which no toll or fee is charged, These are usually operated in parallel with express, High Occupancy Toll or managed lanes
Headway	This is the distance from the back of one vehicle to the front of the next. Typically measured in feet
High Occupancy Toll Lane	A high occupancy vehicle lane in which vehicles that do not meet the occupancy requirements are permitted to use the facility in return for the payment of a toll. This enables the use of excess capacity on high occupancy vehicle facilities.
Information Technology	Provides an initial assessment, by an independent team of discipline experts and managers, that the design (or concept) is realistic and attainable from a programmatic and technical sense.
Intelligent Transportation Systems	The application of information and communication technology to transportation to save time, lives and money
International Standards Organization	The International Organization for Standardization develops and publishes International Standards.
Level of Service	This is a measure of traffic conditions specified in the Highway capacity manual and in the AASHTO green book

Term	Explanation
Limited Access Highway	A limited-access road known by various terms worldwide, including limited-access highway, dual-carriageway and expressway, is a highway or arterial road for high-speed traffic which has many or most characteristics of a controlled-access highway (freeway or motorway), including limited or no access to adjacent property, some degree of separation of opposing traffic flow, use of grade separated interchanges to some extent, prohibition of some modes of transport such as bicycles or horses and very few or no intersecting cross-streets
Managed Lane(s)	A lane or lanes that are used to increase roadway efficiency through management of operations and access
Maximum toll	This is a maximum amount in dollars or cents that will be charged for a trip along the dynamic tolling facility. It is often specified in terms of a Per mile charge. For example One dollar per mile
Memorandum of Understanding	A document describing a bilateral or multilateral agreement between two or more than two parties. It expresses a convergence of will between the parties, indicating an intended common line of action
Minimum toll	This is a minimum amount in dollars or cents that will be charged for a trip along the dynamic tolling facility. It is often specified in terms of a Per mile charge. For example \$.25 per mile
Mobile Enforcement Reader	Includes an antenna, a reader coupled to receive signals from the antenna and a control/display unit (CDU) coupled to the reader. The CDU selects a receive direction and processes signals provided thereto from the reader. When the MER and a transponder are in proximity, the MER interrogates the transponder and receives information related to toll payment

Term	Explanation
Non-cash transactions	Payment for goods or services by means other than cash. Such as credit cards, debit cards, PayPal or special purpose payment systems for transportation
Non-stop tolling	The collection of tolls or fees at normal road operating speeds
Onsite Integration and Commissioning Test	Equipment, subsystem and system-wide testing of the Managed Lanes System. The purpose is to provide both the Integrator and FDOT D5 a mechanism for verifying and documenting successful system performance throughout the installation process up to the point of approval to commission the lanes
Open Road Tolling (Open Road Tolling)	Electronic toll collection using overhead gantries and no traffic channelization
Operational Performance Test	The final phase of testing of the I-4 Ultimate Express Lanes System. This test shall serve to closely monitor the performance of the managed lanes under live traffic operating conditions once the managed lanes are open to toll-paying vehicles
Orlando-Orange County Expressway Authority	A toll road operating agency in Central Florida that implements and operates an expressway system that improves the mobility and quality of life in Central Florida and provides access to major economic centers consistent with growth management and environmental objectives, accomplishing this in a manner which is financially sound and cooperative with other modes of transportation and governmental jurisdictions
Payment Cards Industry Standard (PCI)	A data security standard for payment systems data developed by the credit card industry
Portable Document Format (Adobe Acrobat)	A file format used to represent documents in a manner independent of application software, hardware, and

Term	Explanation
	operating systems
Preliminary Design Document	A preliminary version of a written description of a system, that a system designer writes in order to give a development team an overall guidance of the architecture of the software project. Usually accompanies an architecture diagram with pointers to detailed feature specifications of smaller pieces of the design
Preliminary Design Review	Provides an in-depth assessment, by an independent team of discipline experts and managers, that the design (or concept) is realistic and attainable from a programmatic and technical sense
Prepaid Toll Account	A special purpose account that contains funds that are deducted to paying tolls. Funds are paid in by cash at a service center or transferred from the drivers credit card
Pre-published toll schedule	A schedule of toll rates that specifies the toll for a specific day, time of day, segment of Highway and class of vehicle
Procurement Management Plan	Defines the procurement requirements for the I-4 Managed Lanes Project and how it will be managed from developing procurement documentation through contract closure
Program Management Document	Defines and describes the arrangements and activities to be supported in order to effectively manage work, schedule and budget for the project
Project Evaluation and Review Technique	A statistical tool, used in project management that is designed to analyze and represent the tasks involved in completing a given project
Project Management Office	A group or department within a project that defines and maintains standards for project management within the project

Term	Explanation
Project Management Plan	A project management plan is the planning document, capturing the entire project end-to-end, covering all project phases, from initiation through planning, execution and closure
Project Manager	A professional in the field of project management. Project managers can have the responsibility for the planning, execution and closing of any project
Project Quality Manager	A professional in the field of quality management. Project quality managers can have the responsibility for planning and executing project quality activities
Quality Assurance	A program for the systematic monitoring and evaluation of the various aspects of a project, service, or facility to ensure that standards of quality are being met
Quality Control	An aggregate of activities (as design analysis and inspection for defects) designed to ensure adequate quality especially in manufactured products
Quality Management	Activities (as design analysis and inspection for defects) designed to ensure adequate quality especially in manufactured products
Regional Traffic Management Center	The FDOT D5 traffic management facility that has responsibility for Central Florida Region traffic management.
Request for Proposals	Procurement document that defines what the client requires and how proposals should be structured and formatted
Revenue generation	A dynamic tolling of pricing technique while the specific objective is to maximize the amount of revenue being collected by the tolling system. This money is reinvested into transportation network

Term	Explanation
Risk Management Plan	Explains why risks exist and highlights the purpose and importance of risk management. It provides a general description of why risk management is essential to effectively managing the I-4 Ultimate Toll Collection and ITS system and describes what is needed before risk management can begin
Software Specification Document	A requirements specification for a software system is a complete description of the behavior of a system to be developed and may include a set of use cases that describe interactions the users will have with the software. In addition it also contains non-functional requirements. Non-functional requirements impose constraints on the design or implementation (such as performance engineering requirements, quality standards, or design constraints)
Speed	This is the average velocity of a sample of vehicles passing a specified point in the highway. It would be more accurately described as time mean speed
Stakeholder	Individuals or groups involved in the project or whose interests may be affected by the project's execution or outcome
Sticker Tag	An ISO 18000 6C standard paper tag used for vehicle identification in Electronic Toll Collection
SunPass Customer Service Center	Call center that is equipped to handle large amounts of customer telephone requests regarding sunpass in addition to handling other customer communications
SysAdmin, Audit, Network, and Security	SANS is the most trusted and by far the largest source for information security training and security certification in the world. It also develops, maintains, and makes available at no cost, the largest collection of research documents about various aspects of information security,

Term	Explanation
	and it operates the Internet's early warning system
System Development Plan Guidelines	Describes the methodology required to ensure that the I-4 Express Lanes system development work is conducted efficiently and effectively. The System Development Plan, to be based on these guidelines will also include the Integrator's approach to managing the project and planned software development and integration processes. This document provides guidelines for the creation of the System Development Plan by the Integrator
System Engineering Management Plan	A supplement the Project Management Plan (PMP), focusing on the technical project management arrangements and system engineering processes to be used for the project. It provides detail on systems engineering tasks, particularly detailed information on the processes to be adopted to manage the special risk associated with large, innovative system and software development projects
System Integration Plan Guidelines	Define the activities necessary to integrate the I-4 Ultimate Managed Lanes functional software components into the I-4 Ultimate Managed Lanes software application system. The Integration Plan, to be developed by the Integrator on the basis of these guidelines shall contain an overview of the system, a description of the major tasks involved in the integration, including the overall Integrator resources that are needed to fully support the integration effort. This document provides guidelines for the creation of the System Integration Plan by the Integrator. This document provides guidelines for the creation of the Quality Management Plan by the Integrator

Term	Explanation
System Quality Management Plan	Defines the activities involved in the systematic monitoring and evaluation of the various aspects of a project, service, or facility to ensure that standards of quality are being met
System Quality Management Plan Guidelines –	Defines in outline the activities involved in the systematic monitoring and evaluation of the various aspects of a project, service, or facility to ensure that standards of quality are being met. Forms the basis for the concessionaire to develop the Quality Management Plan
Time-of-Day Pricing	Facility charges that vary by time of day, with charges generally higher during peak periods and lower other times
Toll adjustment interval	In dynamic tolling and you toll rate is calculated at regular intervals based on traffic conditions. The toll adjustment interval is the time in minutes between each toll calculation
Toll by Plate or Video Tolling	The use of CCTV cameras and advanced image processing to read vehicle license plates, match the license number to a driver and vehicle licensing database and deduct a toll from a pre-paid account or automatically send a bill
Toll Operating Mode	Dynamic tolling systems May required to work in more than one toll operating mode. For example there may be three possible operating modes for a dynamic tolling system. The first mode would be normal routine operation. The second mode would be for evacuation management in which case the tolls on the whole facility would be reduced to zero for a specified period of time. The third mode would be for incident management where the toll is removed because the express lanes facility is blocked or partially blocked because of a traffic incident

Term	Explanation
Traffic flow density	The number of vehicles present at any given time within a specific period of road. This could be measured as vehicles per kilometer or vehicles per lane per kilometer
Traffic volume or flow	The number of vehicles passing a given point in the highway over a specified period of time. Often measured in vehicles per hour
Transaction	The process through which goods and services are paid for by an exchange of funds from buyer to seller
Transponder	An electronic tag mounted on a license plate, built into a vehicle, or placed on the windshield or dashboard by which drivers can be charged a fee (or toll) without stopping
United States Computer Emergency Readiness Team	The 24-hour operational arm of the United States' Department of Homeland Security's National Cybersecurity and Communications Integration Center (NCCIC). The United States Computer Emergency Readiness Team (US-CERT) leads efforts to improve the nation's cybersecurity posture, coordinate cyber information sharing, and proactively manage cyber risks to the Nation while protecting the constitutional rights of Americans
V Model	System engineering methodology specified by FHWA
Value Pricing	Adoption of market principles routinely used in the private sector to bring transportation supply and demand into balance. An example is a system of fees or tolls paid by drivers to gain access to certain roadway facilities providing consistent, free-flowing service compared to the alternative toll-free facilities

Term	Explanation
Dynamic tolling algorithm	This is a process that is conducted to calculate toll amounts related to varying traffic conditions. It is often used to describe the software program used to do the toll calculations, but more accurately it refers to the defined process which the software executes
Vehicle Detection System	A roadside device that is capable of measuring one or more parameters associated with the traffic passing the device location. These parameters could include vehicle speed, headway, and vehicle classification. There are several alternative technologies that can be used for these sensors. These include microwave, inductive loop and video image processing
Verification (Test) Plan Guidelines	Presents the I-4 Ultimate Express Lanes equipment and system verification testing process. It outlines the different types of tests that shall be conducted and identifies the roles and responsibilities of each group that will be working on this project. This document provides guidelines for the creation of the Verification (Test) Plan by the Integrator
Work Breakdown Structure	Serves as a guide for defining work as it relates to a specific project's objectives

Appendix C: Documents Referenced

[1] I-4 Ultimate Draft Project Management Plan (PMP)

[2] http://en.wikipedia.org/wiki/ISO_9000 - Retrieved February 21, 2013

[3] Payment Card Industry Standard. PCI Standard Definition Retrieved From: http://en.wikipedia.org/wiki/Payment_Card_Industry_Data_Security_Standard - On January 31, 2013. Note that PCI Official Web Site is: <https://www.pcisecuritystandards.org/>

Appendix D: System Quality Management Plan Guidelines

1 General

These System Quality Management Plan (SQMP) guidelines will identify the I-4 Ultimate Managed Lanes electronic toll, pricing and ITS system quality related objectives, including plans to achieve and measure these objectives. It will define the roles and responsibilities of each group that will work on this project and define the types of quality-related processes to be implemented and adhered to by the electronic tolling, pricing and ITS Integrator (Integrator). Note that these guidelines address quality arrangements associated with system engineering and software development.

The overall project management plan for the larger project addresses quality arrangements for other activities. All roles and responsibilities defined in these guidelines relate to positions in the client and concessionaire organizations that relate to system design, development, implementation and operations. Therefore, this SQMP describes the quality procedures to be followed by FDOT D5 management and the selected Integrator in carrying out and successfully completing the electronic tolling, pricing and ITS integration work on the I-4 Ultimate Managed Lanes Project. It is intended that these guidelines will fit within the overall umbrella of the larger quality management arrangements for the I4 ultimate project.

2 Roles and Responsibilities

The I-4 Ultimate Managed Lanes Project Systems Quality Management (SQM) responsibility shall be distributed among all participants of the systems elements of the program including the system engineering consultants and the Integrator. However, the Integrator shall be fully responsible to develop the SQM procedures and guidelines and strictly adhere to these documents throughout the course of the system design, development, implementation and testing phases of the I-4 Ultimate Managed Lanes Project. FDOT D5's primary responsibility shall be to ensure that the various SQM procedures are followed by the Integrator. This will ensure that the delivered electronic tolling, pricing and Intelligent Transportation Systems operates according to the RFP and other contractual requirements.

3 System Quality Policy

The selected Integrator's internal system QM program must be compliant with International Standards Organization (ISO) 9000 or an equivalent standard. The SQM Plan developed by the Integrator, and reviewed and approved by FDOT D5, shall be compliant with the Integrator's SQM program.

4 System Quality Management Organization

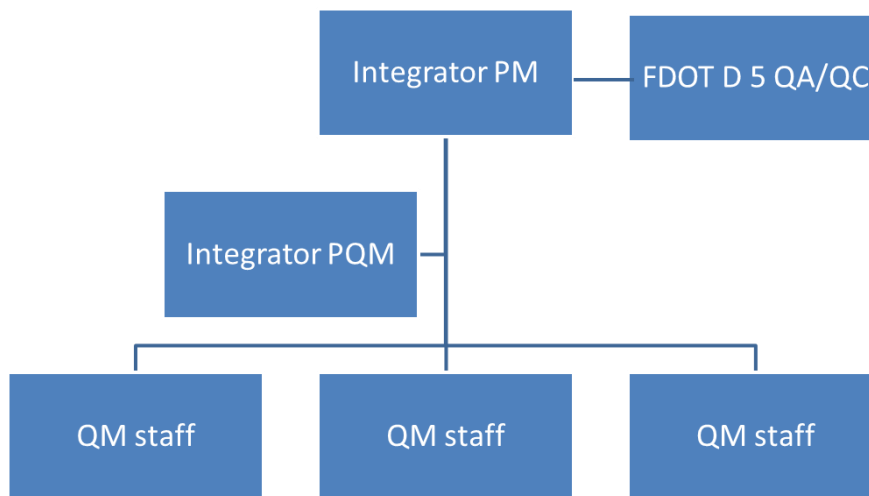


Figure 1: System Quality Management Organization Chart

All members of the I-4 Ultimate Managed Lanes Project system team are responsible for producing work of the highest quality. The Integrator Project Manager (PM) has the overall responsibility for guaranteeing that the SQM procedures are adhered to. The PM will have the assistance of the Integrator's Project Quality Manager (PQM), who will have responsibility for implementing and monitoring the SQM process. This is illustrated by the organization chart on the preceding page.

The PM and the PQM shall also have a direct interface on all quality-related matters with FDOT D5 Quality Assurance/Quality Control (QA/QC) project staff. Listed below are suggested starting points for defining the SQM's organizational responsibilities required for the program's success.

4.1 Contractual Responsibility (FDOT D5)

FDOT D5 shall have contractual responsibility for all I-4 Ultimate Managed Lanes SQM activities and will work closely with consultant staff and Integrator staff to ensure that full quality control is adhered to during the system design, development, integration, testing, installation and deployment phases of the I-4 Ultimate Managed Lanes Project.

4.2 Project Consultant Staff

FDOT D5's I-4 Ultimate Managed Lanes program management, tolling, pricing and ITS consultant staff shall have, at a minimum, the following roles and responsibilities:

1. Ensure system quality objectives are met on this project.

2. Identify each of the applicable policies and procedures as part of the ISO 9001: 1994 Standards or an equivalent standard.
3. Participate in all facets of system QA/QC activities and provide recommendations to FDOT D5 Secretary of Transportation for verification of SQM features of the project.
4. Provide SQM guidance to the Integrator and FDOT D5 staff during the system design, development, integration, testing, installation and maintenance process.
5. Provide regulatory guidance for SQM related requirements in conjunction with FDOT D5 staff.
6. Maintain a liaison with the FDOT D5 Secretary of Transportation and Integrator staff to incorporate additional QA/QC procedures throughout the I-4 Ultimate Managed Lanes system design, development, integration, testing, installation, maintenance and possibly operations phases of the Project.

4.3 Integrator Systems Engineering Staff

The electronic tolling, pricing and ITS System Integrator engineering staff for the I-4 Ultimate Managed Lanes Project shall have the following roles and responsibilities:

1. Develop a detailed SQM manual based on these guidelines and ISO 9001 1994 [2] standards for review and approval by FDOT D5.
2. Identify and document the relevant specific system QA/QC procedures and guidelines that are necessary to satisfy all of the project-specific operating requirements.
3. Identify the control documents for management of quality with regard to system development and implementation.
4. Carry out project-specific SQM procedures enabling quality audits.

5 Quality Assurance and Control

5.1 Methodologies and Standards

In addition to the policy and people, the SQMP will define the project's SQM procedures. The SQM procedures will be developed by the Integrator, and subject to FDOT D5 review and written approval. They shall provide the specific approach to ensure that quality objectives are met on the project in accordance with each of the applicable ISO 9001 1994 Standards (or an equivalent standard) policies and procedures. The Integrator shall apply these SQM procedures to the I-4 Ultimate Managed Lanes Project.

5.2 Quality Assurance and Control

The SQMP shall be developed and a QA/QC program implemented during all phases of the I-4 Ultimate Managed Lanes Project. This QA/QC program shall indicate how the Integrator will address changes to the scope of services on the project requested by either FDOT D5 or the Integrator.

5.3 Quality Assurance and Control Milestones

The Integrator RFP will include the system design, development, testing and implementation milestones for the I-4 Ultimate Managed Lanes Project. Reaching each of the specified milestones will trigger a pre-determined payment from FDOT D5 to the Integrator. The SQM

and QA/QC procedures and guidelines will be clearly described in the proposal and in the Contract to make sure a process is in place that will allow FDOT D5 to clearly determine whether each milestone has been reached.

5.4 System Integrator Controls

The Integrator PM shall direct the implementation of the approved SQMP, which will execute the following SQM and QA/QC procedures to maintain a proper level of quality throughout the project.

5.5 Design Control

The quality process as defined in the SQMP shall govern the control of the system design, development, integration, testing, implementation and maintenance of the work to be completed on this project.

5.6 Document and Data Control

The Integrator shall implement various document and data control procedures as part of the SQM and QA/QC process. The Integrator shall track electronic communications, physical documents, and communication records generated by their staff on the project. Procedures will be developed by the Integrator to guarantee that this takes place. The Integrator shall also provide FDOT D5 with a hard copy of all project correspondence that they develop, including system design documents, drawings, letters, e-mails, etc.

5.7 Purchasing Control

Any direct purchasing for the project shall follow the SQMP direction which applies. All approvals and processing of purchases charged to the project shall adhere to the existing FDOT D5 policy. In the event that sub Integrators are used on the project, the procedure to procure and control these services and/or equipment or software shall be established according to the SQMP. Most project-related purchases for materials used by the Integrator shall be managed by the Integrator and will comply with the various SQM and QA/QC procedures established by the Integrator and approved, in writing, by FDOT D5.

5.8 Corrective Actions

The SQMP shall clearly identify the various processes and products that will be used by the Integrator to identify any defects, and methods of corrective action to resolve such defects.

The SQMP will determine the ISO standards that should be followed in the Integrator's SQM and QA/QC procedures and guidelines. The SQMP shall also identify specific products to be used to track, monitor, and document corrective actions in a structured manner.

5.9 Quality Audits

Internal quality audits are required to prove that the QA/QC procedures are working effectively. Audits will be performed by the Integrator PM, the PQM, or another designated

person. Audits on areas that are within the scope of influence of the Integrator PM and specific SQM team members shall be conducted by staff that have not conducted actual work on the system design, development, etc. This will ensure that the staff that has performed the actual work is not checking the work in question.

Quality audit documentation shall be made available by the Integrator to FDOT D5. The following illustrates the internal quality audit framework that shall be adhered to by the Integrator on the I-4 Ultimate Managed Lanes Project:

1. Internal quality audits of components by the Integrator PM and staff will be conducted at an interval not to exceed one month.
2. Quality audits of the major subsystems conducted by the Integrator PM and SQM staff shall be conducted at an interval not to exceed three months.
3. The quality audit documentation shall be developed by the Integrator and submitted to FDOT D5 for review and approval. Once approved, it shall be distributed to all I-4 Ultimate Managed Lanes Project team members.
4. The audit documentation shall contain, at a minimum, recommendations for improvements, if any, to the various quality procedures that have been used as the basis for the development of the audit documentation. The documents will be prepared according to the relevant ISO 9001 standards or an equivalent standard.
5. The audit shall follow an established format proposed by the Integrator and approved, in writing, by FDOT D5 within the SQMP.

6 Typical Quality Assurance & Control Check List

Presented below is a sample checklist for use as part of the quality audit for tolling, pricing and ITS design projects. This checklist is for informational purposes only, since the Integrator will develop and use their own detailed checklists as part of the quality audit procedures and guidelines as detailed in the SQMP, and monitored by FDOT D5.

Table 1 – Typical Quality Assurance and Control Checklist

YES	NO	Checklist Description
		Are project tracking activities in place?
		Is project tracking and oversight being conducted?
		Are all plan reviews conducted according to plan checklists?
		Are all issues arising from peer reviews addressed and properly closed?
		Are status and review meetings conducted according to the schedule?
		Has a contract Work Breakdown Structure (WBS) that supports all project deliverables and long-term tasks been developed?
		Are system changes being managed according to the Configuration Management Plan (CMP)?
		Have all deviations from standards and procedures documentation been approved by FDOT D5?
		Are project roles and responsibilities clearly defined and adhered to?

Appendix E: System Development Plan Guidelines

1 General

The Electronic Toll Collection, Pricing And ITS Integrator (Integrator) will develop a detailed System Development Plan (SDP) based on these guidelines. The SDP will describe the methodology required to ensure that the I-4 Express Lanes system development work is conducted efficiently and effectively. The SDP will also include the Integrator's approach to managing the project and planned software development and integration processes.

2 Roles and Responsibilities

The Integrator will be solely responsible for designing and developing the I-4 Express Lanes software in a manner that complies with all of the functional system and equipment requirements presented in the RFP and the other contract documents. The Integrator will make certain that the subsystem and full system integration process is conducted to ensure all requirements are met by the delivered tolling system. FDOT D5 will closely monitor and approve, in writing, all system design, integration, testing and deployment activities by the Integrator.

3 Program Management Document

The Integrator will be requested to develop a Program Management Document (PMD) to provide the framework for developing and implementing the Electronic Toll Collection, Pricing and ITS for the I-4 Express Lanes in a controlled and managed environment. The PMD will describe the project management objectives, structure, methods, and reporting process that will be used to monitor and control the overall program. The Integrator shall provide with the PMD a detailed Integrator Project Schedule. The purpose of the PMD is to ensure that the I-4 Express Lanes Electronic Toll Collection, Pricing and ITS is delivered on schedule and within the established budget.

3.1 Referenced Project Documents

The PMD shall explain the relationships between the following documents:

- The Project Installation Plan (PIP);
- The System Verification (Test) Plan (SVP); and
- The System Design Documents, including the Preliminary Design Document (PDD) and the Detailed Design Document (DDD)

3.2 Program Management Approach

The Integrator will examine the technology risk areas and the management requirements that need to be considered as part of the PMD for implementing the Electronic Toll Collection, Pricing and ITS contract specifications within the stated time periods. The Integrator will then detail all of the features and benefits of the proposed program management approach to ensure that the system is delivered on schedule, within the established budget, and operates in accordance with system specification requirements.

4 Program Management Implementation

4.1 FDOT D5 Program Responsibilities

Overall scheduling of all field construction activities will be under the direction of FDOT D5. FDOT D5 will manage the roadway construction activities and has the responsibility to make sure that the roadway Integrator coordinates work with the Integrator. Resolution of any conflicts that might arise between the Integrator and FDOT D5 Integrator will be administered by FDOT D5. The Integrator shall be responsible to FDOT D5 for compliance with the Electronic Toll Collection, Pricing and ITS RFP and other contract documentation requirements, all drawings, work quality, project schedule, etc. Any subsequent reference to FDOT D5 in this document shall also include the possible involvement of their representatives.

4.2 FDOT D5 Weekly Meetings

It is expected that FDOT D5 will conduct regular meetings with all Integrators on the I-4 Express Lanes Project. The meetings will typically be held weekly at a location to be determined by FDOT D5. The purpose of the meetings will be to review the scheduling and coordination of each of the Integrator's work within the requirements of the overall I-4 Express Lanes construction and implementation program.

The Integrator shall be involved with these meetings during the phases of the I-4 Express Lanes Project in which they will be involved. The Integrator shall provide an on-site manager during the Electronic Toll Collection, Pricing and ITS equipment and system installation phase of the project.

4.3 Key Contacts

The key Integrator program contacts shall be listed in the PMD. The list, which will be subject to approval by FDOT D5, will be updated as changes occur during the project. All requests for changes must be made in writing to FDOT D5. Approval by FDOT D5 shall also be in writing. The Integrator's Program Manager, who shall also be approved by FDOT D5, will be made accessible to FDOT D5 on a 24 hour-per-day, 7 day-per-week basis, either in person or via mobile telephone.

4.4 Integrator Project Schedule

The Integrator Project Schedule will define a normal design and development process, the timeline for required program phases and milestones, documentation deliverables, meeting dates, and other deliverables/milestones defined in FDOT D5's Overall Project Schedule (see 4.9 below). To avoid any confusion, the approved FDOT D5 Overall Project Schedule will supersede all other schedule-related requirements presented by the Integrator on this project. The Integrator Project Schedule shall include the system development activities, tasks, dates, and milestones described in Section 7 below.

4.5 Communications

The communication requirements between the Integrator and other project staff will be discussed at the Project Kick-Off Meeting. The Integrator will communicate all project-related matters to FDOT D5 and consultant staff as directed by FDOT D5. The FDOT D5 District Secretary of Transportation will determine whether to hold weekly conference calls with the Integrator and consultant staff, and when these calls will be held. Communications requirements will conform to the guidance set out in the Communications Management Plan. E-mail will be the preferred method of communication for all program correspondence. The Integrator Project Manager (PM) will be instructed as to which project staff should be copied on correspondence.

4.6 Status Reporting

The Integrator shall provide a Monthly Status Report to FDOT D5, to be submitted on the first working day after the 15th of each month. Reports will be presented according to the status reporting requirements established in the RFP.

5 On Site Installation

The Integrator will develop an Installation Plan containing detailed plans and the management approach for the on-site installation team and related activities. The Installation Plan will be subject to the review and approval of FDOT D5.

During the installation phase of the program, the Integrator will provide a resident installation manager accessible to FDOT D5 from a local office. This person is a local resource for FDOT D5, their engineers, and other Integrators. With direction from the Integrator's PM, the installation manager will assist and follow the program through the initial design, installation, and commissioning phases. The installation manager will be knowledgeable in all aspects of the program, including scope, schedule, and systems.

6 I-4 Express Lanes System Testing

The Integrator will develop and provide detailed test documents in support of the various equipment and system tests that will be performed on this project. The Integrator's test plans and test procedures will contain testing activities, criteria, and the management approach for all system testing, as presented in the System Verification (Test) Plan.

6.1 System Design and Development

Creation of the I-4 Express Lanes Electronic Toll Collection, Pricing and ITS, as detailed in the Integrator Project Schedule, will follow the V- Model software development, system design and development process, as described below. Project phases and milestones, including those specific to the Integrator, are defined in the Overall Project Schedule. To avoid any confusion, FDOT D5 approved Overall Project Schedule shall supersede all other schedule-related requirements and it must be adhered to by the Integrator.

6.2 Work Breakdown Structure

The Integrator will develop, submit and routinely update a comprehensive work breakdown structure (WBS), which will be used in the Integrator Project Schedule, and will separate large tasks into manageable units for all aspects of the required work to be accomplished by the Integrator. The Integrator will be required to submit WBS details, when requested by the FDOT D5 District Secretary of Transportation, that clearly and concisely describe project administration, toll system design, system development, testing and implementation work that will be conducted.

6.3 Management Reporting And Monitoring

The Integrator shall be expected to use a range of management reports to track the progress of all work activities. The PM will review reports to monitor each activity to troubleshoot real or potential schedule and budgetary issues so they can be addressed before they become problems. When this analysis reveals that work on any single milestone is trending toward greater cost or time than planned, the report(s) will flag the problem, which will then be discussed by the PM with the FDOT D5 District Secretary of Transportation. In the event that there is an effect on the project cost and/or schedule, these issues can be immediately addressed by FDOT D5.

The Integrator will, on a monthly basis, re-assess the number of calendar days required to complete the remaining work of each task. This assessment will identify the appropriate resources necessary to complete each task, in order to avoid shortages of resources. To supplement the continuing evaluation of each work task, the critical path of the entire program will be evaluated at least monthly to identify any changes or potential scheduling problems.

The Integrator PM will be expected to organize their resources to complete the design, development, integration, test, installation, field test, and commissioning of the I-4 Express Lanes Electronic Toll Collection, Pricing and ITS in accordance with the requirements in the RFP and the Contract documents. The Integrator team will execute the program to fulfill FDOT D5's requirements.

6.4 I-4 Express Lanes Program Action Items

For the I-4 Express Lanes Electronic Toll Collection, Pricing and ITS, Integrator staff will record, monitor, and control all program action items. The Integrator will be expected to track and provide the status of all action items on at least a weekly basis.

6.5 System Configuration Management

The Integrator shall provide strict configuration control on the I-4 Express Lanes Electronic Toll Collection, Pricing and ITS Project. Any changes to the tolling system shall be approved, in writing by FDOT D5, and properly documented. A method shall be used to identify the relationship of configuration items to the overall system. System configuration guidelines shall be developed by the Integrator and a copy supplied, for review and approval, to FDOT D5.

Each configuration item, whether delivered to FDOT D5 or only used internally by the Integrator, will be issued a control number from the system configuration management database.

6.6 System Configuration Approval

Each configuration document will have a specially formatted approval sign-off coversheet added. The coversheet will clearly identify the document name, the control number, the project number, revision history, and a list of required names of those people that will be reviewing, providing comments and approving that specific document. Adequate space will be made available on the form for signature and date. The signed approval page will then be filed with the hardcopy of the document. Once a document has been approved, an electronic file (PDF) will be made so that no further changes can be made.

6.7 Subcontractor Control

The Integrator will check to make sure that all equipment, supplies, components, systems, subsystems, and any other services procured from subcontractors and vendors conform to the RFP and all other contract requirements. These responsibilities include the establishment of procedures for the selection of qualified suppliers, the flow down of all system design and operating requirements, the internal technical evaluation of the procured item to ensure that it meets all requirements.

6.8 integrator project schedule

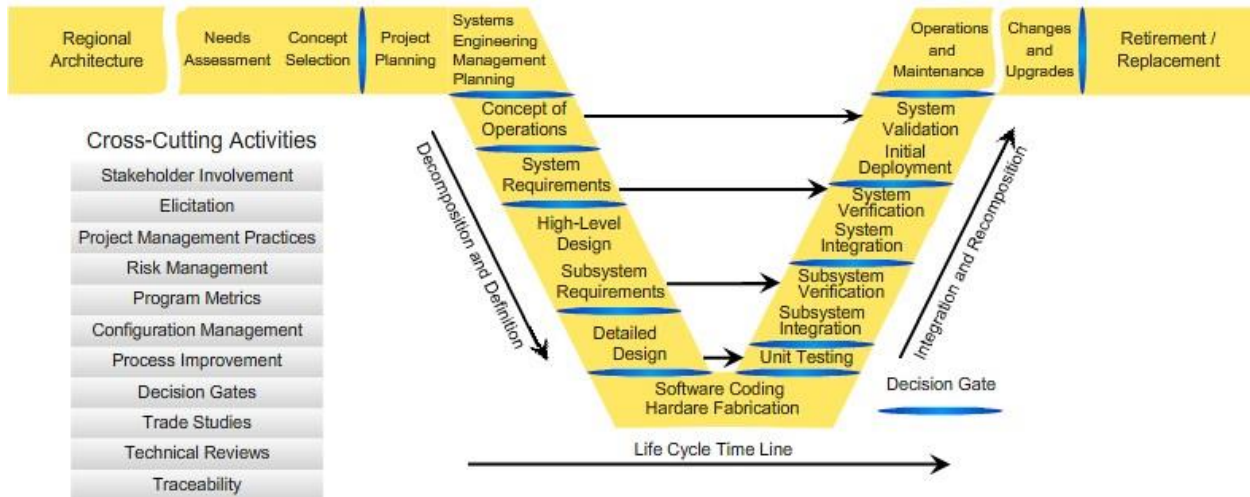
A comprehensive Integrator Project Schedule detailing all system related development tasks, inputs and outputs, shall be submitted by the Integrator as part of the PDD phase of the Electronic Toll Collection, Pricing and ITS Development. The Integrator Project Schedule shall be prepared using Primavera, or an equivalent program that has been approved by FDOT D5, and will show measurable aspects of work that have clear requirements to be met within the indicated time frames established in the Overall Project Schedule.

All Critical Path items shall be kept on schedule by the Integrator. To prevent Critical Path items from disrupting the Overall Project Schedule, the Integrator shall add any and all necessary project staff in order to keep those tasks from slipping.

6.9 Software development

The software development process will ensure that the I-4 Express Lanes Electronic Toll Collection, Pricing and ITS operates according to the requirements outlined in the RFP and the Contract documents. Software development procedures are typically represented by a phased, chronology-based model. Each software development work phase corresponds to certain development activities, which need to be performed in a sequential manner to ensure program success. The model that will be used on this Project for the software development process is the V Model, which is presented below.

Phase -1	Phase 0	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5
Interfacing with Planning and the Regional Architecture	Concept Exploration and Benefits Analysis	Project Planning and Concept of Operations Development	System Definition and Design	System Development and Implementation	Validation, Operations and Maintenance, Changes & Upgrades	System Retirement / Replacement



218 V -Cycle

The V-Cycle software development model involves a two phase process. The first phase includes the development of the software (the downward leg) and the second phase pertains to the software integration and testing process (the upward leg).

During the first phase, the initial task is to develop the software specifications, which is directly linked to the system functional requirements that are presented in the RFP and the Contract documents. Once the specification is completed, the process leads directly to the preliminary and detailed design tasks. Once the system design is complete, the Integrator then develops the actual software code.

The second phase of the software development process integrates the newly developed software with the system hardware to fully integrate the entire I-4 Express Lanes Electronic Toll Collection, Pricing and ITS. To ensure that the system is properly integrated and complies with the various requirements, the software (and system) is subjected to an extensive test and validation process. Once the testing process proves that the software is developed properly and is fully integrated into the entire tolling system, it will be ready to be deployed in a live environment.

7 Software Specification Development

At the beginning of the software development process it is important to verify and document the definition of requirements. This step allows for the correct development of the software specification. The Integrator shall carefully define the various interfaces between the pieces of

system hardware, between the internal subsystems and with external systems. The Integrator shall also be required to separate the software development process into functional components and subsystems and define the information flow between the functions, sub-functions and subsystems. At this point, the Integrator staff shall verify that the hardware and software requirements that are to be implemented are consistent with the required functionality of each component.

One of the most important tasks is to develop the Software Specification Document (SSD). This initial work effort will clearly and comprehensively define all of the Electronic Toll Collection, Pricing and ITS related software requirements. This would include each piece of equipment and subsystem in the tolling system, the roadside ETC antennas and readers, the tolling zone lane controllers, the vehicle detection station equipment, the video surveillance subsystems, the Mobile Enforcement Readers (MERs), the hand-held enforcement devices, the tolling zone beacons, the FTE Tolls Back Office hardware and software, the interfaces to the FTE Tolls Back Office and the Statewide ETC system account management system, the interface to the FDOT D5 RTMC, the interface to the MERs and held-held units.

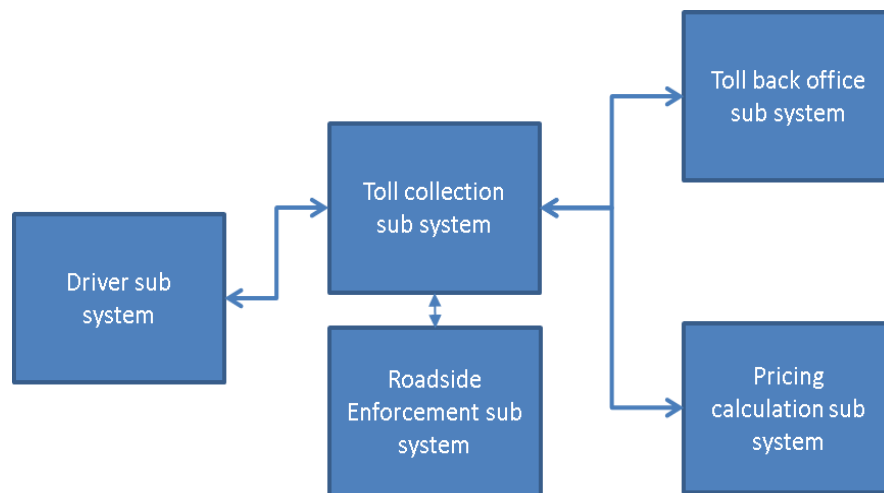


Figure 2: High level architecture for the electronic toll collection and pricing system.

The requirements should be defined from the RFP and the other contract documents. The next step is to define the interfaces between all of the system components and the subsystems. During this task it will be important to identify any potential constraints that might impede system operations.

At this point, it is also important to start laying out the activities that will be incorporated into the Integrator's internal software validation test process. The outline for this process should be initiated early on in the process since a heavy emphasis of the first phase is to determine the

requirements and how the software will be developed to allow the system to operate to meet the stated requirements.

8 Preliminary and Detailed System Design

The next step will define the system software architecture by strategically breaking the software into modules. This will enhance the software development, integration and validation processes. The next task is to verify that all the requirements that are stipulated in the SSD have been taken into account.

The Integrator shall define the overall structure of the Electronic Toll Collection, Pricing and ITS. Integrator staff shall set up the software integration and validation strategy, as well as the different scenarios and implementation methods that will be used. It will be important to take into account various maintainability and testability constraints, if there are any.

The design process then continues with the development of the PDD, specifying the internal software and hardware structure and detailing the various interfaces of the components and subsystems that were previously identified in the SSD. At this time, the Integrator should prepare whatever equipment shop tests will be required, such as the software that will be required to support the operation of those pieces of equipment.

Once the PDD has been reviewed, brought to final form by the Integrator and approved by FDOT D5, the next step will be to develop the Detailed Design Documents (DDD). This task will also include coding components and documenting the source code. In particular, the following activities will be addressed, at a minimum, during this task:

- Verifying and completing module interfaces;
- Defining the internal structure of the modules;
- Installing detailed design codes in the shape of comments in the source list; and
- Creating a list of tests to be applied to each of the modules.

1.1. Software Code Development

This task includes the actual development of the I-4 Express Lanes software. This involves translating each DDD module into the programming language that the Integrator has chosen. It will also include developing software to support the various dynamic pricing algorithms that will support the toll price determinations as they are described in the DDD. The Integrator software development group will also ensure that the resulting compilation does not contain any mistakes and is compliant with all known software programming norms.

As the software is being developed, the Integrator software group will also be required to complete the equipment/shop tests to ensure that software and I-4 Express Lanes hardware operates within the specified requirements (from the RFP and the contract documents). The test scripts used for the equipment/shop tests will be updated by the Integrator by finalizing the procedures defined during the previous phases of the software development process.

9 Software Integration and Testing

The next task in the process is to conduct full integration testing of the entire I-4 Express Lanes system. At this point in the process, the software has been developed to about an 80% level and the Integrator software group shall conduct the system and subsystem integration testing process. The integration tests will be performed to ensure that the newly developed software and I-4 Express Lanes hardware is fully integrated and operates within the specified Electronic Toll Collection, Pricing and ITS requirements. The test scripts used for these integration tests will be updated by the Integrator by finalizing the procedures defined during the previous phases of the software development process.

Various work activities during this task are to assemble the software modules and make sure that the software architecture complies with the DDD of the tolling system. Integrator software staff will also prepare for the equipment, subsystem and full system test and validation tasks. Integrator staff shall then carefully test each software component individually and verify conformity to the DDD for each stated operating requirement.

In support of full integration testing, the Integrator software group will integrate the software modules according to the procedures defined in the integration test procedures, as they previously developed. The software group will also validate the system architecture defined during the PPD and DDD phases of the project. Integrator staff shall also ensure that the various software exchanges between the components and subsystems that were identified during the preliminary and detailed design phases are functioning correctly.

If the integration tests reveal any inconsistencies, then corrective measures shall be taken by the Integrator software group. They shall conduct the integration tests again for those areas in which the problems were discovered and corrected to ensure that the defined operating requirements are met. The equipment and system integration process shall be verified via the performance of factory testing by FDOT D5.

Regression testing will be conducted by the Integrator once the software modifications are made to ensure that basic system functionality has not been compromised as a result of a software modification. The integration test documents shall be used as the basis for regression testing. The regression testing will be complete when the results correspond to those expected, and the software modification can then be deployed into the production system.

9.1 Software Validation

This task will confirm that the functionality of the software complies with the SSD, the DDD and the other relevant Contract documents. The Integrator will draw up a reference version of the validated software. This will involve running additional tests, by the Integrator, to verify that the software complies with the various requirements. Previously used system test scripts will be used for this testing.

These validation tests will focus mainly on the functionality of each component, subsystem and the overall system as well as the various interface requirements with the FTE Tolls Back Office, the FDOT D5 RTMC, the MER units, the hand-held devices and FDOT D5 website. The validation tests shall also verify the performance and endurance of the system equipment and various subsystems and also determine that the full system data loads can be effectively handled.

When validation has been approved, the first software reference version can be created. The validation test results and the state of the software documentation can then be verified. If this review proves satisfactory, progress to the subsequent system qualification phases can then be authorized, which includes performance of the Factory Acceptance Test (FAT) and the follow up on-site system acceptance tests. The FAT shall be optional if the device has already received APL approval.

9.2 Software Documentation

Software documentation will be provided for each applicable component. This will include textual descriptions, pseudo code, data flow diagrams, flowcharts and functional diagrams. For third-party software, vendor documentation shall be provided. Custom software documentation will include User Manuals and Technical Manuals with operational and module-level **descriptions embedded with the source code. Relevant training shall also be provided.**

4.1 Software Documentation Control

The Integrator shall identify which product will be used for software configuration control and source code management. The chosen version control product should support team development of the software applications. It should also be able to automatically track and store changes to a file so the software code developers are able to view the history of each file, return to earlier versions of that file, and develop programs concurrently. It would also be beneficial to have a product that uses reverse delta technology in order to store only the changes to a file, not each complete version of the file itself. On handback of the system to FDOT, appropriate training shall be provided along with documentation.

9.3 Process Versioning

All software processes should have a version number associated with them. The version number should be easily obtained by locating the file in question and clicking on the file.

10 Conclusions

The System Development Plan, which will be developed by the Integrator, shall include all of the required information to clearly describe the management approach that will be implemented to ensure that the I-4 Express Lanes Electronic Toll Collection, Pricing and ITS development work is conducted properly. The Plan shall include all required information regarding the Integrator's approach to managing the Project, including planned hardware and software development, integration, and deployment processes.

Appendix F: Data Security and Safety Plan Guidelines

1 General

Security engineering focuses on the tools, processes, and methods required to design, implement, and test the electronic toll collection, pricing and ITS to ensure that it remains dependable once deployed. In the context of the I-4 Ultimate Express Lanes Project, it is also to ensure that the management and monitoring of the related transportation infrastructure continues unimpeded. Since the Central Florida regional transportation infrastructure is vital to the local economy, and plays a key role in public safety, and national security, it is vital that the system infrastructure be designed and built to survive threats man-made and natural threats.

With the increasing adoption of use of advanced technology that maximizes transportation capacity, new systems become mission critical. A dependence on the I-4 system is expected to evolve over the course of operations, requiring that all reasonable steps be taken to protect the system from intentional and unintentional threats. The payment card industry has recognized the potential vulnerability of electronic payment systems and developed robust standards for system security.

Therefore, in addition to the guidance provided in this document, the Integrator will also be expected to comply with the Payment Card Industry (PCI) Data Security Standard [3] and related PCI Security Standards Council guidance on best practices and risk management associated with electronic toll collection and pricing.

2 Roles and Responsibilities

Due to distributed responsibility for the implementation of security engineering, many parts of the I-4 Ultimate Express Lanes Project engineering organization will have roles and responsibilities in this area. Guidance for defining organizational responsibilities with respect to system security engineering are listed as follows:

3 Data Security Engineering

FDOT D5 and their consultants will have the following roles and responsibilities:

1. Approve the data security engineering-related processes, policies and operating procedures developed by the Integrator for the I-4 Ultimate Express Lanes Project.
2. Participate in project design reviews and provide approval for security-related features of project requirements, design, implementation, and testing.
3. Coordinate with industry groups to maintain an up to date knowledge base of present and emerging threats against Information Technology (IT), telecommunications and transportation assets relevant to the I-4 Ultimate Express Lanes.

3.1 System Engineering Consultant

Systems engineering staff for the I-4 Ultimate Express Lanes Project shall have the following roles and responsibilities:

1. Monitor the adherence of systems and software engineering to this Data Security Plan.

2. Offer technical assistance in the area of security engineering.
3. Provide regulatory guidance for security-related requirements in conjunction with FDOT D5 management staff.
4. Conduct threat analysis with support, as required, from security engineering.
5. Facilitate vulnerability analysis with support, as needed, from security engineering and software engineering.
6. Ensure that security engineering requirements and processes are passed down to project subcontractors.
7. Manage risk analysis to determine the vulnerabilities to be addressed.

3.2 Integrator Project Manager

The Integrator Project Manager shall have the following roles and responsibilities:

1. Create and maintain security engineering check lists to aid in the performance of the security work.
2. Prepare the test plans, and manage test execution of security evaluation and/or accreditation testing.
3. Design and implement countermeasures in accordance with security engineering guidelines and/or policies.
4. Review and evaluate software during design and development phases to identify additional vulnerabilities.

3.3 Data Security Engineering Process

Since the I-4 Ultimate Express Lanes Project is essentially a networked computer system, security engineering should focus on the various processes and methods to protect these networks, computer systems (i.e., hardware and software), and data. These areas are generally addressed under the umbrella of information security. Awareness and practice of information security is imperative to maintain the 24/7 operation of the I-4 Ultimate Express Lanes in light of potential threats, including those from new technologies.

This document is intended to provide guidance for the overall I-4 Ultimate Express Lanes Project security engineering processes, as well as serve as a template for tailoring project-specific security engineering plan.

4 Scope

Security engineering methodologies need to be applied throughout an organization and project to be effective. Security must be incorporated into the system design throughout the engineering process or the I-4 Ultimate Express Lanes might be vulnerable to any external threat. Similarly, focusing security awareness in only a portion of the Integrator's organization might result in the security mechanisms being applied topically, rather than integrated directly into the design.

From a project life-cycle perspective, it is important to consider security issues and practices during all phases of the project. Ignoring security issues during the system design and development phase could result in costly rework or less effective external solutions to meet

security certification requirements. Security engineering is an integrated discipline to be used during the system design, development and deployment process. It can be significantly more expensive, and have severe schedule impacts, to attempt to remediate security issues late in the project life-cycle.

Similarly, it is important to distribute awareness and practice of security engineering across FDOT D5 organization and Integrator staff. Concentrating all responsibility for design, development, implementation, and testing of security-related functionality in a specialized organization or individual will not yield a robust solution. Security engineering affects all engineering disciplines and responsibility should be distributed across the engineering organization in more detail.

Another dimension of the security engineering scope to consider is project type. Since security engineering is partly based on risk analysis, it is logical to assume that projects might require varying degrees and applications of security engineering. Express Lanes projects are particularly vulnerable because they utilize a distributed system with many touch points exposed to the public and there is a revenue collection component. The trend of providing public access to transportation IT via the Internet, and advances with intelligent vehicles, also increase the security risk over traditional system design projects.

5 Security Engineering Approach

Security engineering is fundamentally risk management – identifying possible vulnerabilities that might be exploited by potential threats and thereby adversely impact the I-4 Ultimate Express Lanes operation, and then determining practical solutions to protect the I-4 Ultimate Express Lanes against such threats. This process has been formalized into the threat-vulnerability-countermeasures methodology. With this process, potential threats to the system are identified, the system is analyzed to determine vulnerabilities to potential threats, and countermeasures are designed to mitigate the vulnerabilities to those threats.

The challenge for FDOT D5 in this process is to determine the extent to which each identified vulnerability should be addressed. It is impractical, both from an affordability and operational impact standpoint, to completely address all vulnerabilities within a system. The goal is to assess the effect on the system mission, along with the probability of the threat, and then design countermeasures whose cost and effect on system operation are proportional. The approach should minimize the vulnerabilities most likely to occur, rather than necessarily protect against all conceivable threats.

A threat analysis will be part of the Integrator system design and development process. Threats should be viewed as part of the system's operational context. Vulnerabilities and countermeasures should be integral considerations to the design, development and implementation of the I-4 Ultimate Express Lanes and security evaluation, and accreditation must be part of the system integration and testing phases.

5.1 Data Security Engineering Administration

5.1.1 Organizational Structure Overview

The most effective security solution is one where all of the engineering disciplines participate. Thus, the greatest asset in operating a secure system is creating awareness by the designers, operators, and users. The FDOT D5 District Secretary Of Transportation should ensure that security concerns are included in the criteria used to assess the quality and completeness of the I-4 Ultimate Express Lanes Project.

While most of the security engineering effort will be performed by the Integrator engineers tasked with the design, development and implementation of the I-4 Ultimate Express Lanes, FDOT D5 will use consultants that are responsible for ensuring the quality and compliance of the security engineering work performed.

5.1.2 Security Engineering Management

The security engineering process will be managed by engineering reviews, audits against applicable policies/standards, and measurement via appropriate metrics. Integrator staff will bear this management responsibility.

5.1.3 Reviews

In order to integrate security engineering practice across all of the Integrator engineering disciplines, all project design reviews should address security engineering aspects. It is recommended that the Integrator security engineering staff prepare checklists to include in the system design review procedures, in order to assist other engineering disciplines in properly addressing the security domain in their reviews. It is also suggested that the Integrator security engineering staff attend Preliminary Design Reviews (PDRs) and Detailed Design Reviews (DDR) to properly assess system security issues.

5.1.4 Governance

The FDOT D5 will approve policy and guidelines developed by the Integrator to govern the execution of security engineering activities. While security engineering plans based on this document are a primary form of governance, it is also good practice to develop additional technical guidelines/policies to ensure uniform compliance with proven best practices as well as flow-down of applicable regulatory requirements.

5.2 Data Security Engineering Process

5.2.1 Standard Practices

The FDOT D5 will approve Integrator developed security engineering guidelines. Integrator engineering staff shall conduct their security engineering efforts in accordance with these guidelines. In addition, project activities shall comply with any security engineering guidelines or other security engineering governance as discussed previously in this document.

5.2.2 Project-Specific Processes

The Integrator may tailor their security engineering process via the project security engineering guidelines. For instance, the verification process will often be adjusted based on whether the project has external interfaces that are required to conform to formal security policies or regulations. Security verification to industry standards should be conducted for interoperability with external systems or the public. Practices dealing with Internet connectivity may also be modified in cases where the project system does not directly connect to public networks.

5.2.3 Threat Analysis

Comprehensive identification and accurate assessment of threats to a system is critical to developing a cost-effective security policy. Without an accurate threat model in place, systems could be overprotected, which might cause system design countermeasures for potential vulnerabilities that never materialize. Two threat model aspects will be discussed; identification of threats, and assessing the capability and probability of the threats.

5.2.4 Identification

Threats must first be identified before meaningful security engineering can be conducted. A matrix will be developed by the Integrator that presents all of the threats that are identified, which will be used later in the process by the Integrator staff. Staff performing threat identification shall consider potential threats to the system in the following potential categories:

- **Human Threat** – a deliberate or accidental act by any person, whether they are authorized to have access to the system or not. It will be useful to further categorize these threats as internal and external to FDOT D5. Examples may include user errors, unauthorized access attempts and data sabotage.
- **Technical Threats** – a intended or unintended attack by external software or network. Common examples would include viruses, worms, Trojans, network level Denial-of-Service (DoS) attacks, etc.
- **Physical Threats** – intended or unintended damage to a system through physical acts. Examples may include hardware sabotage or failure. These types of threats primarily affect system availability, as opposed to privacy or confidentiality. This category also normally includes acts of war or civil disturbance and unauthorized access to facilities.
- **Natural/Environmental Threats** – These are natural or man-made events that damage or impair a system. Common examples include fire, flood, storms (including lightning), and

earthquakes.

- **Internal threats** – possibility of damaging actions from inside the organization by a disgruntled/imbalanced employee or potential terrorist. This type of threat requires a different approach as it emanates from inside the typical system defenses.

Sources of threat identification include:

- **Law Enforcement** – The FDOT D5 security engineering staff should establish an ongoing working relationship with federal, state, and local law enforcement agencies to obtain general and specific threat information.
- **Professional Organizations** – Computer security organizations such as the SANS Institute (SysAdmin, Audit, Network, and Security) and CERT maintain extensive databases of threats and vulnerabilities, and countermeasures.
- **Operation History** – Operational histories are valuable sources of threat information in the analysis of incidents in existing systems.
- **Design Engineers** – The same hardware and software engineers that design the system often have the capability to identify threats to the system so these threats can be mitigated.
- **Hacker Web Sites/Publications** – Spying on potential attackers is effective, but time consuming (the signal-to-noise ratio is quite poor).
- **Computer software vendor web sites** – catalogs of known threats and case studies.

5.2.5 Assessment of Threat Potentials

Once threats are identified, project staff shall assess the possibility of various threats to damage or otherwise undermine the I-4 Ultimate Express Lanes system. In addition to estimating the possibility of a threat, staff shall also attempt to assess the probability of the threat occurring. Important factors to consider are the possible motivation of the attacker and the perceived value of the target system. For example, it is unlikely that an attacker would launch a sophisticated technical attack requiring national technical assets against a target system with no significant national security value.

5.2.6 Vulnerability Assessment

Vulnerability assessment identifies the consequences to the system from a specific threat, should that threat occur, and predicts the impact to FDOT D5.

5.2.7 Identification

Once threats are identified via threat analysis, system vulnerabilities to those threats must be determined. These vulnerabilities are often comprised of a first and second order effect. The first order effect is the immediate result of a successful attack (i.e., the attacker gaining access to a valid user account via the threat of password guessing). The secondary effect is the consequence to the system function or users (i.e., the compromised user's information being altered or stolen).

The Integrator shall create and maintain a threat management matrix that correlates a system vulnerability to specific system components (e.g., a software module). Using this matrix, engineering staff can easily identify which vulnerabilities need to be reassessed as software or hardware is redesigned or modified.

5.2.8 Impact Assessment

The Integrator shall prepare an assessment of the impact to the I-4 Ultimate Express Lanes and/or the business operations that rely on the system in the event that a vulnerability is exploited by a threat. These impact assessments shall include, at a minimum, interruptions to the system services provided by FDOT D5, potential civil liabilities incurred as a result of the vulnerabilities, regulatory and/or statutory failures, and the impact to operating budgets..

5.2.9 Risk Analysis

The final stage of vulnerability assessment shall weigh the vulnerabilities identified based on the threat probability and impact assessment. This assessment will be conducted by the entire Smart Lane Team. The goal is to provide a prioritized list of potential vulnerabilities. Vulnerabilities that are the result of high probability threats having significant impacts to the I-4 Ultimate Express Lanes Project operation and/or public safety should be weighted more heavily.

Once the vulnerabilities are ranked, Integrator staff should incorporate additional system requirements into the requirements traceability matrix. FDOT D5 will also incorporate security **risk identification, assessment and analysis into the Risk Management Plan for the project.**

5.2.10 Countermeasure Design

The final basic activity under the security engineering process is the design of the countermeasures within the software that address the vulnerabilities to the identified threats. This work will be performed by the Integrator software engineers.

5.2.11 Security Architecture

Successfully integrating security engineering into the I-4 Ultimate Express Lanes Project will require the Integrator to adopt security architecture. The security architecture will provide structure and cohesiveness to a security design, in the same manner that software and hardware architectures are necessary to organize the design and implementation of the respective engineering solutions.

Security architectures are typically constructed around security guidelines or policies. These guidelines and policies are often derived from an underlying formal security model, although many are merely expressions of security strategy based upon empirical data (i.e., best practices information) rather than a rigid mathematical model. Whatever the genesis, security guidelines/policies are necessary to provide guidance to the software engineer(s) developing the security design.

5.2.12 Candidate Trade Studies

Once the architecture is defined, the Integrator shall identify candidate solutions to address specific vulnerabilities. These solutions shall conform to the security policies and architecture. This phase of the security engineering process is similar to any other engineering design trade study.

It is important to consider not only the capability of a candidate countermeasure to address the vulnerability, but any potential side effects on system operation as a result of the security design. It is easy to adopt invasive countermeasures that effectively address vulnerabilities, but also unacceptably impact normal system operation. Security engineering is, like any other engineering discipline, a compromise between technical function, affordability and mission. The Integrator shall incorporate into the I-4 Ultimate Express Lanes the selected countermeasure designs into the software and hardware requirements where applicable.

5.2.13 Security Verification and Testing

Comprehensive and accurate testing of a design is necessary to ensure that it is robust. Verification and testing of a security design is typically separated into two activity types referred to as assurance and evaluation. Assurance is the process of determining whether the system will function as designed, and evaluation is the process of proving it to others.

5.2.14 Assurance

Security assurance is a process consisting of the traditional engineering techniques of analysis, inspection, and testing to verify that the Smart Lane I-4 Ultimate Express Lanes is secure. By integrating security requirements into the system, and component requirements and specifications as presented throughout this plan, FDOT D5 and consultant staff will confirm that the Integrator has taken all appropriate steps that are identified in the Data Security Plan. (See Verification Plan.)

5.2.15 Evaluation

FDOT D5 and their consultations will perform the security evaluation. Relying party evaluation uses the current system engineering staff to define and accept the results of the testing program. In the case of the I-4 Ultimate Express Lanes Project, the relying party would be FDOT D5 and its consultant representatives. The organization responsible for conducting and reviewing the testing would be FDOT D5 and consultants.

In cases where part, or all, of the system security requirements are dictated by other state or federal agencies, the relying organization may be the agency that created the requirements or that is charged with administering the regulations. This form of evaluation will be planned and conducted similarly to system-level acceptance testing.

Third party evaluations are performed by third party organizations with no financial or operational interest in the outcome of the evaluation testing. These evaluations can also involve certification, also referred to as accreditation, by the third party to previously established standards or processes. This aspect of evaluation is addressed in the following section.

It is recommended that FDOT D5 develop security engineering guidelines and evaluation criteria for the I-4 Ultimate Express Lanes Project since this project includes the following characteristics:

- The I-4 Ultimate Express Lanes Project provides direct public electronic access, either via the Internet or by dedicated devices/protocols (SunPass)
- This project will connect to other regional toll facilities or state/federal systems via public infrastructure (i.e., the Internet, wireless communication, etc.) and
- The I-4 Ultimate Express Lanes Project will connect to external systems that, in turn, offer public access

FDOT D5 staff should work towards mandating evaluation guidelines for the I-4 Ultimate Express Lanes Project to be used as the basis for future electronic toll collection, pricing and ITS projects under the jurisdiction of FDOT D5 in the region and FTE statewide.

Appendix G: Configuration Management Plan Guidelines

1 General

The primary purpose of the Configuration Management Plan (CMP) guidelines is to define arrangements for establishing and maintaining the integrity and control of software/hardware products and documents supplied by the Integrator during the life cycle of the I-4 Ultimate Express Lanes Toll Collection, Pricing and Intelligent Transportation Systems. The life cycle includes the following phases:

- Planning and conceptual design
- Design
- Implementation
- Testing and verification
- Operation and maintenance

The CMP for the I-4 Ultimate Express Lanes will address the management and control of content, change, and status of shared information within the I-4 Ultimate Express Lanes System development and implementation. This includes products such as performance requirements, functional and physical requirements, and design and operation information.

The CMP shall identify both technical and administrative direction for the control of change and integrity of the I-4 Ultimate Express Lanes System product data and documentation. The CMP shall identify the configuration of the software and hardware, including commercially-off-the-shelf (COTS) products, at given points in time, systematically controlling changes to the configuration, and maintaining the integrity and traceability of the configuration throughout the project's life cycle.

2 Roles and Responsibilities

The I-4 Ultimate Express Lanes CMP for the project implementation stage shall follow the configuration management guidelines presented in this document. The CMP shall be developed by the selected Integrator during the early part of the system design phase.

Listed below are suggested starting points for defining organizational responsibilities pertaining to the Configuration Management (CM) activities required to ensure program success.

2.1 FDOT D5

The FDOT D5 shall have full contractual responsibility for all I-4 Ultimate Express Lanes configuration management activities and will work closely with the consultant staff to ensure that configuration management during the overall design, development, testing, installation, and deployment of the system. Configuration management will enable successful project completion and efficient ongoing support and maintenance for the duration of the I-4 Ultimate Express Lanes Project. The FDOT D5 shall have final approval of the CMP.

2.2 Consultant Staff

The FDOT D5 I-4 Ultimate Express Lanes consultants will have the following roles and responsibilities:

- Review the CMP developed by the Integrator for completeness and compliancy with the functional requirements presented in the Request for Proposal (RFP) and other contract documents
- Audit the CM process that has been developed by the Integrator to ensure that the process is correct and that there are built-in control mechanisms that will lead to a successful project
- Establish a specific hierarchy of information for both project non-deliverables and deliverables
- Create a CM process to support change evolution of the I-4 Ultimate Express Lanes System software and hardware
- Monitor the I-4 Ultimate Express Lanes System application system delivery and release management procedures that shall be developed by the Integrator

2.3 Integrator Systems Engineer(s)

The Integrator engineering personnel for the I-4 Ultimate Express Lanes Project shall have the following roles and responsibilities:

- Develop a comprehensive CMP for the I-4 Ultimate Express Lanes project I-4 Ultimate Express Lanes System design, build and deployment phases
- Identify and document the functional and physical characteristics of the system, software, hardware, and operational components so that these relationships may be managed, maintained, controlled, and assured
- Record and report the status of proposed changes consistent with the established CM process, approval of any proposed changes and the status of the implementation of approved changes
- Disseminate baseline information to the project management (FDOT D5/Consultant) personnel, and establish and maintain a Status Tracking and Reporting and reporting system that records the baseline, authorized changes to the baseline, and verification of changes incorporated into the documentation and/or product
- Configuration management plan components

3 Integration Activities

The Software/Hardware Configuration Management Plan for the I-4 Ultimate Express Lanes I-4 Ultimate Express Lanes System project shall contain the following integrated activities, as reflected below in Figure 3.

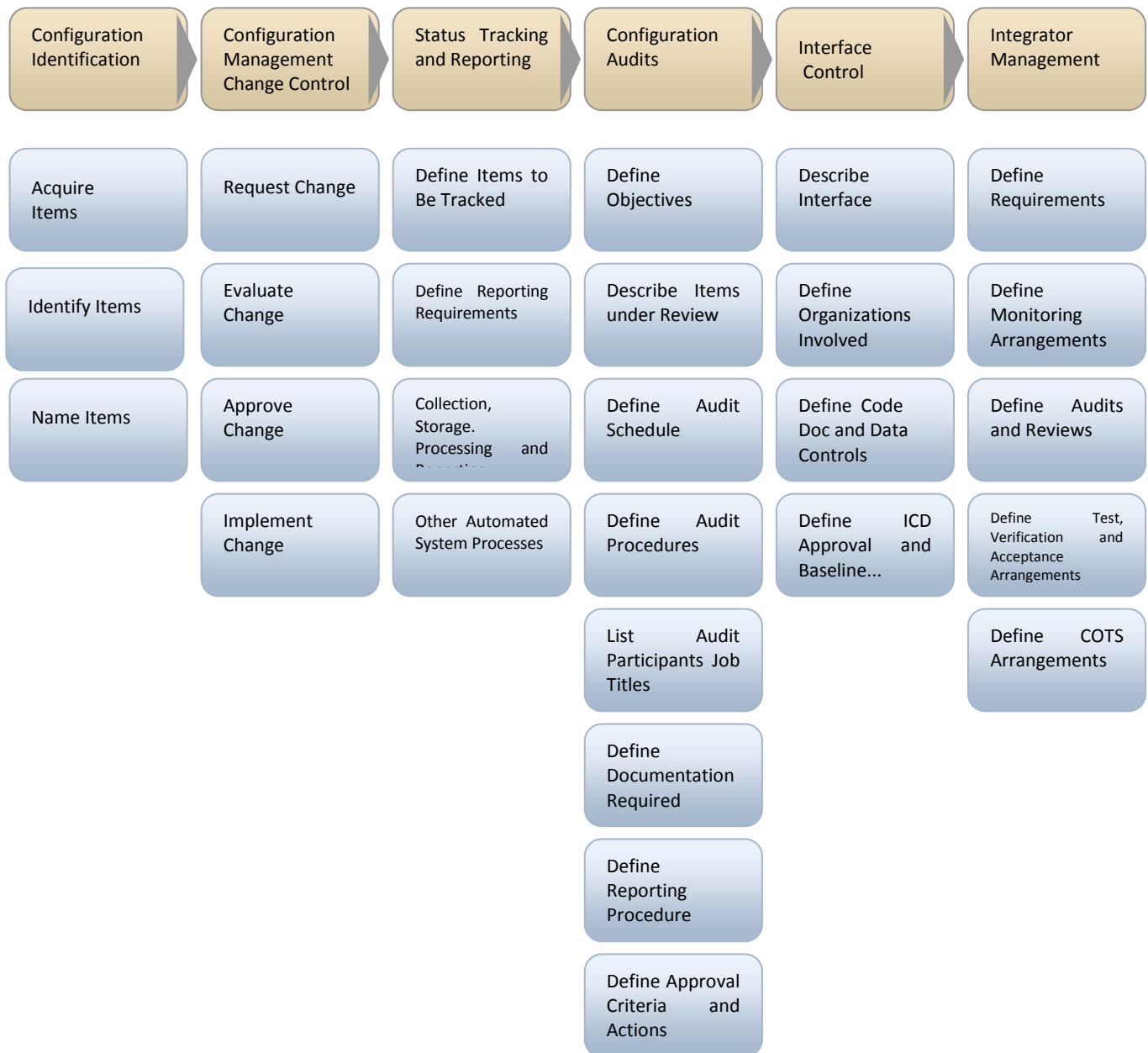


Figure 4: Configuration Management Plan Elements

Configuration management elements are summarized below

- **Configuration Identification** of work products that shall be developed and utilized by the Integrator
- **Configuration Change Control** of information, including the impact of changes to I-4 Ultimate Express Lanes System application development tasks, management schedules, budgets, technical or quality assurance activities, testing or retest requirements, and project status reporting mechanisms
- **Status Tracking and Reporting** of work products developed and used by the Integrator during the design, development, integration, testing, deployment, operations, and maintenance of the I-4 Ultimate Express Lanes System application system
- **Configuration Audits** that assess the status and acceptability of products controlled or released by the Integrator
- **Interface Control** process to manage all external interface integrity and control procedures
- **Integrator Management** to monitor I-4 Ultimate Express Lanes System application system delivery and release management procedures

The Integrator shall perform the work associated with these components that are consistent with the complexity of the I-4 Ultimate Express Lanes ETS.

3.1 Configuration Identification

The configuration identification component of the I-4 Ultimate Express Lanes CMP shall specify what information has been approved for concurrent use on the project, who owns the information, how the information was approved for CM control.

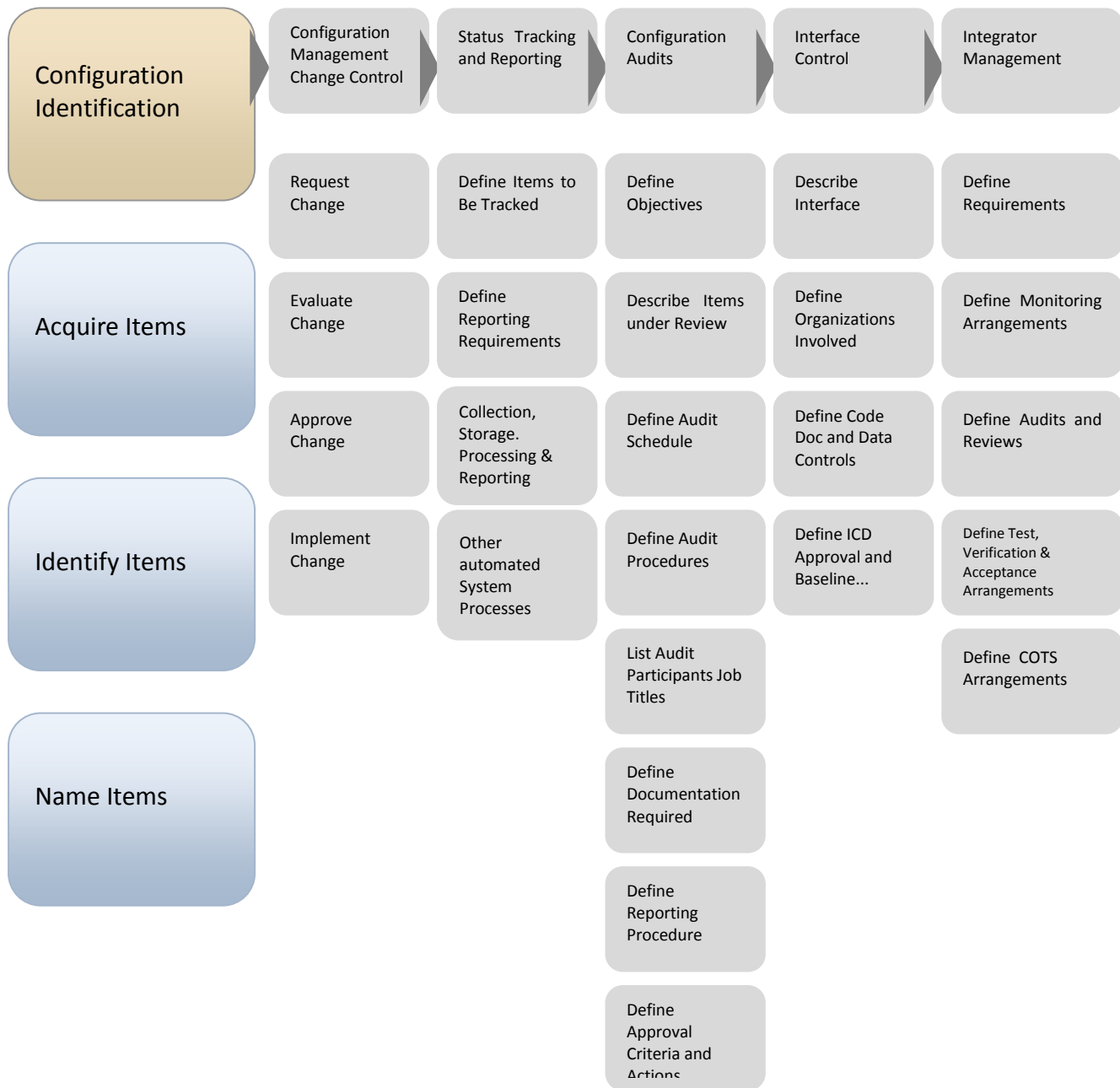


Figure 5: Configuration Identification

3.2 Acquiring Configuration Items

The CMP for the I-4 Ultimate Express Lanes project shall identify the controlled software libraries for the project and describe how the code, documentation, and data of the identified baselines are to be physically placed under control in the appropriate library. For each library the format, location, documentation requirements, receiving and inspection requirements, and access control procedures shall be specified.

Based on the RFP and other Contract requirements, the CMP shall specify procedures for the actual storage of documents and magnetic media, including the identification of software/hardware items. Data retention periods and disaster prevention and recovery procedures, which will be identified in the RFP, shall also be described.

Procedures shall describe how to retrieve and reproduce controlled items from library storage. These activities include verifying labeling, tracking controlled copies, and protecting proprietary and security information.

3.3 Configuration Item Identification

The CMP shall record the items to be controlled, the project Configurable Items (CIs), and their definitions as they evolve. The CMP shall also describe how the list of items and the structures are to be maintained for the project. At a minimum, all CIs that are to be delivered shall be listed.

Appropriate baselines shall be defined at control points within the project life cycle in terms of the following:

1. The event that creates the baseline
2. The items that are to be controlled in the baseline
3. The procedures used to establish and change the baseline
4. The authority required to approve changes to the approved baseline documents

A means of identifying changes and associating them with the affected CIs and the related baseline shall be specified.

3.4 Naming Configuration Items

The CMP shall specify an identification system to assign unique identifiers to each CI. It shall also specify how different versions of each are to be uniquely identified. Identification methods shall include naming conventions and version numbers and letters.

The CMP shall describe the methods for naming controlled items for purposes of storage, retrieval, tracking, reproduction, and distribution. Activities may include version marking,

labeling documentation and executable software, serialization, and altered item marking for executable code.

COTS software, vendor proprietary software, and support software may require special identification schemes and labeling.

3.5 Configuration Management Change Control

The CMP shall define the configuration control process and procedures designating the level of control through which each software /hardware work product must pass (for example, author control, project-level control, acquirer control); identifying the persons or groups with authority to make changes at each level (for example, the programmer/analyst, the software/hardware lead, the project manager, the acquirer) the steps to be followed to obtain required authorization for changes, to process change requests, to track changes, to distribute changes, and to maintain past versions.

The Integrator's internal software modification control procedures that shall be used in support of the I-4 Ultimate Express Lanes System software/hardware development and testing efforts shall be identified in the CMP. The CMP shall also include the various Integrator internal and external interface processes and procedures.

For each project software/hardware components of the I-4 Ultimate Express Lanes System solution, the CMP shall describe the change controls imposed on the baseline CIs. The CMP shall identify the following sequence of configuration control specific steps when a change is required:

1. Request a change
2. Evaluate the change request
3. Approve or disapprove the request
4. Implement the change

Presented below, in Figure 6, are the Configuration Control steps that shall be followed by the Integrator:

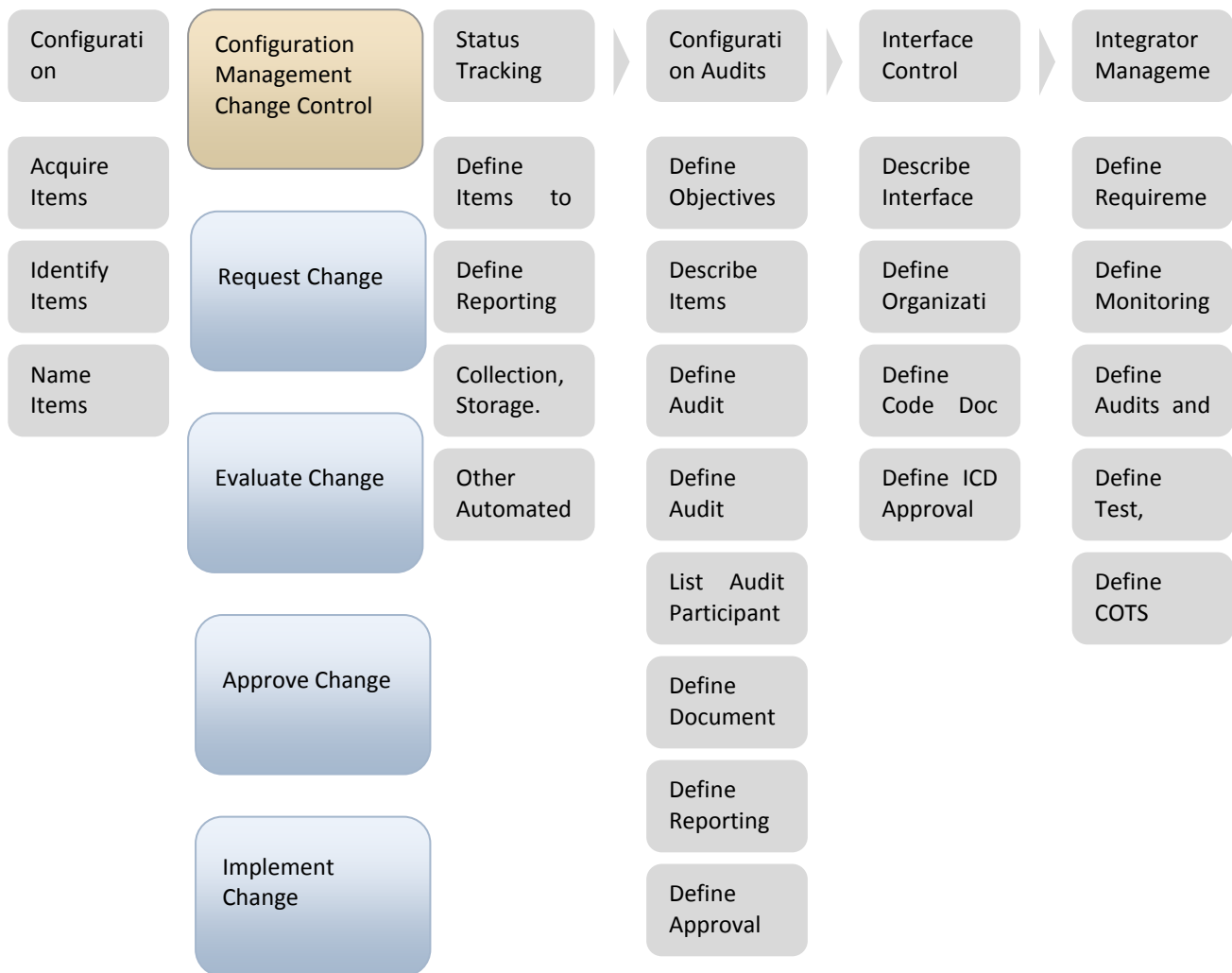


Figure 6 - Configuration Control Process

The CMP shall identify the records to be used for tracking and documenting this sequence of steps for each change. Any differences in handling changes based on the origin of the request shall be explicitly documented.

3.6 Request Change

The CMP shall specify the procedures for requesting a change to a baseline CI and the information to be documented for the request. At a minimum, the information recorded for a proposed change shall contain the following:

- The name(s) and version(s) of the CIs for which a change is proposed
- Originator's name and organization
- Date of request
- Indication of urgency
- The need for the change
- Description of the requested change

Additional information, such as priority or classification, must be included to clarify the significance of the request and to assist in its analysis and evaluation. Other information, such as change request number, status, and disposition, shall be recorded for change tracking.

3.7 Evaluating Change

The CMP shall specify the analysis required to determine the impact of the proposed change and the procedures for reviewing the results of the analysis. Changes should be evaluated to determine their effect on the deliverable, their impact on cost, project resources and potential impact on project schedule.

3.8 Approve or Disapprove Change

The FDOT D5, or their designee, shall serve as the configuration control person responsible for the approval or disapproval of the proposed changes. The FDOT D5 Secretary of Transportation shall document the decision, in writing, reflecting any changes to the Integrator's scope of work regardless of whether it impacts the budget or schedule of the I-4 Ultimate Express Lanes Project.

3.9 Implement Change

The CMP shall specify the activities for verifying and implementing an approved change. The information recorded for the completion of a change shall contain the following at a minimum:

- The change request(s)
- The names and versions of the affected items
- Verification date and responsible party
- Release or installation date and responsible party
- The identification of the new version

Additional information, such as software fault metrics or identification of the supporting software used to implement the change, may be included.

The CMP may also specify activities for release planning and control, for example coordinating multiple changes, reconfiguring the CIs, and delivering a new baseline.

3.10 Status Tracking and Reporting

The CMP shall define Status Tracking and Reporting activities which record and report the status of I-4 Ultimate Express Lanes System CIs. The Plan shall include, as a minimum, the following as illustrated in Figure 7:

- Data elements to be tracked and reported for baselines and changes
- Types of Status Tracking and Reporting reports are to be generated and their frequency
- How information is to be collected, stored, processed, and reported
- How access to the status data is to be controlled
- If an automated system is used for any Status Tracking and Reporting activity, its function shall be described or referenced

The following minimum data elements shall be tracked and reported for each CI:

- Initial approved version
- The status of requested changes
- Implementation status of approved changes

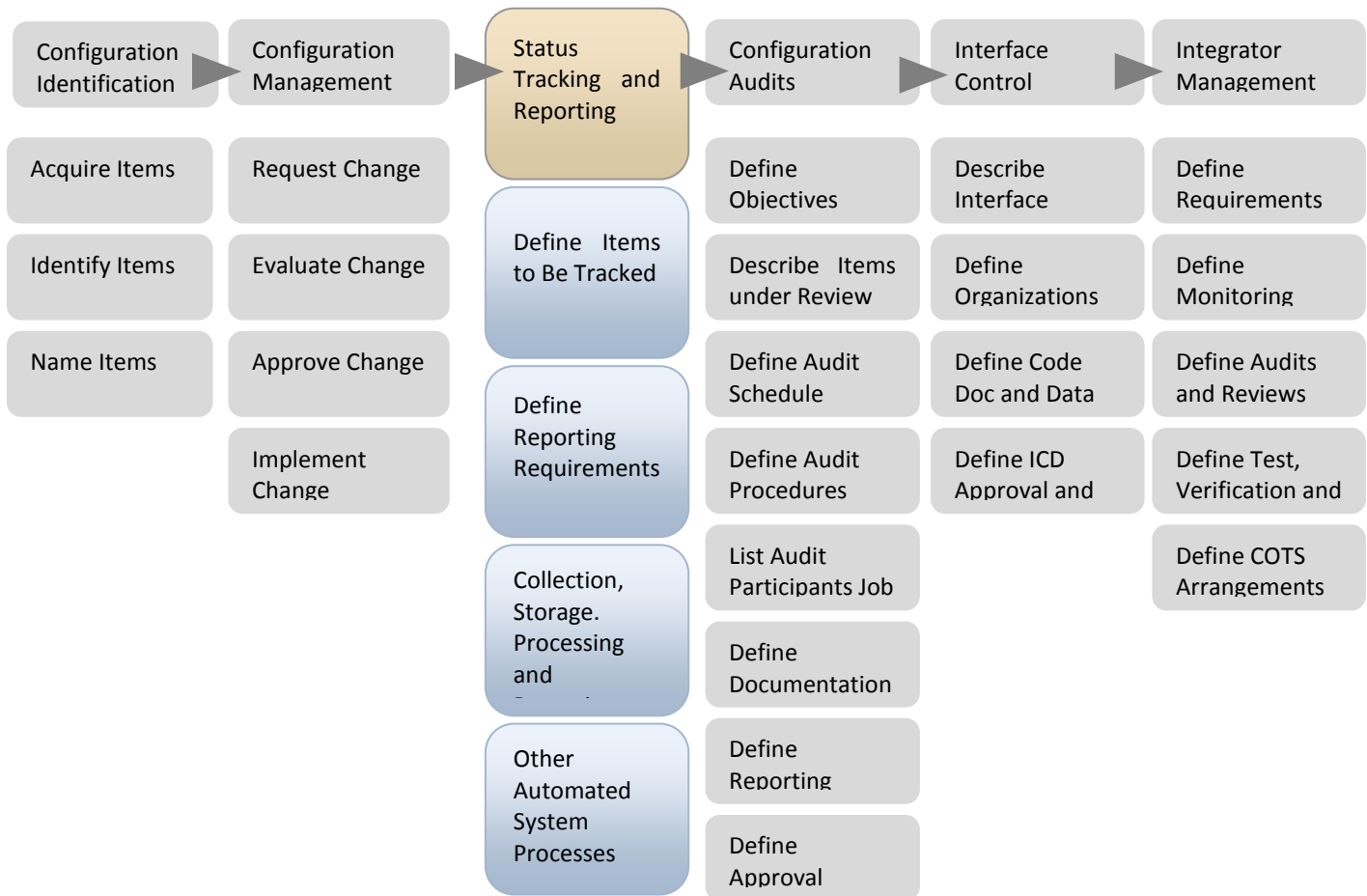


Figure 7: Status Tracking and Reporting

3.11 Configuration Audits

The CMP shall identify the I-4 Ultimate Express Lanes System implementation configuration audits that shall determine to what extent the actual software/hardware configuration items reflect the required physical and functional characteristics. Configuration reviews are management tools for establishing a baseline. The CMP shall identify the configuration audits and reviews to be conducted on the project. At a minimum, a configuration audit shall be performed on all the software/hardware configuration items prior to its release. For each planned configuration audit or review, the CMP shall define the following as illustrated in Figure 8:

- The objective of the audit
- The software/ hardware CIs under audit or review
- The schedule of audit or review tasks
- The procedures for conducting the audit or review
- The audit participants by job title

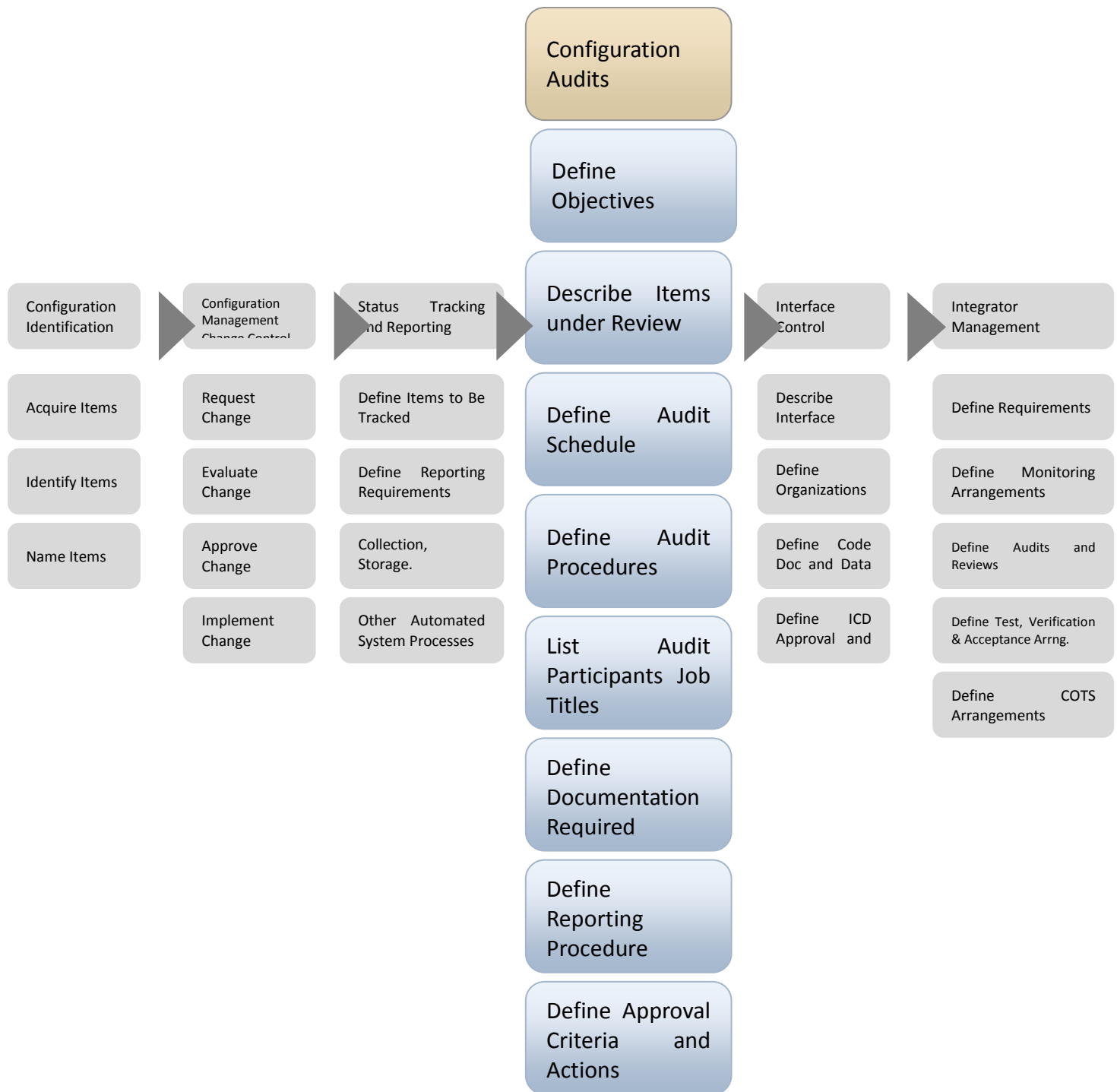


Figure 8: Configuration Audits

- The documentation required to be available for review or to support the audit or review
- The procedure for recording any discrepancies and reporting of corrective actions
- The approval criteria and the specific action(s) to occur upon approval

3.12 Interface Controls

The CMP shall identify the Interface Control (IC) activities to support external interfaces to FTE and other entities within the I-4 Ultimate Express Lanes end to end solution. The IC activities shall coordinate changes to the interfacing items outside the scope of the I-4 Ultimate Express Lanes System CIs. Hardware, system software and support software, as well as other components and deliverables, should be examined for potential interfacing effects on the overall project.

The CMP shall identify the external items to which the project software/hardware interfaces. For each interface the CMP shall define, as a minimum, the following as illustrated in Figure 9:

- The nature of the interface
- The affected organizations
- How the interface code, documentation, and data are to be controlled
- How the interface control documents are approved and released into a specified baseline

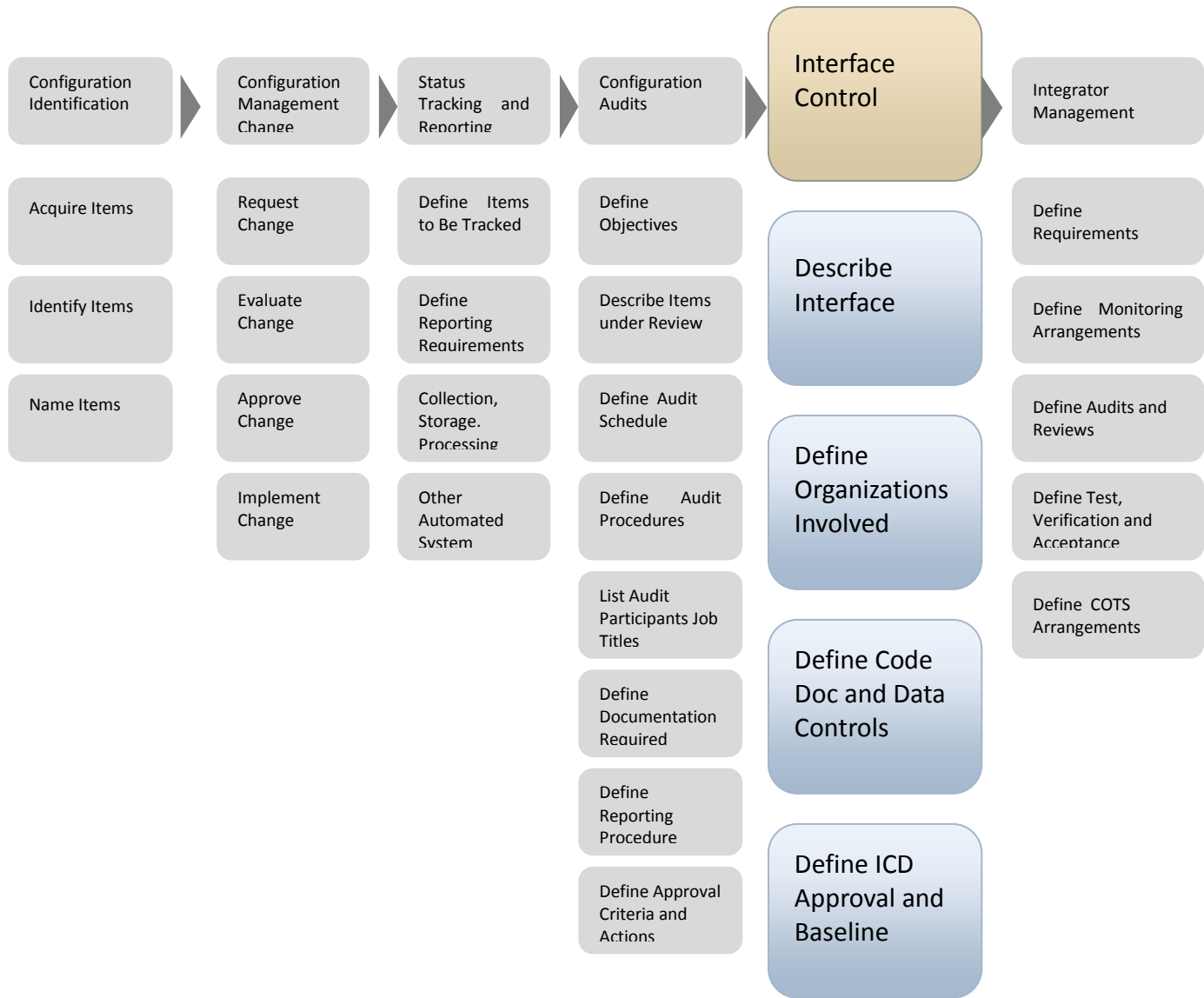


Figure 9: Interface Control

3.13 Integrator Management

Integrator control activities described herein ensure that items developed for the I-4 Ultimate Express Lanes System for the overall I-4 Ultimate Express Lanes Project CIs meet the requirements of the RFP and the Contract documents and approved changes. For both Integrator

furnished and COTS software or hardware, the CMP shall define the activities to incorporate these items into the I-4 Ultimate Express Lanes Project.

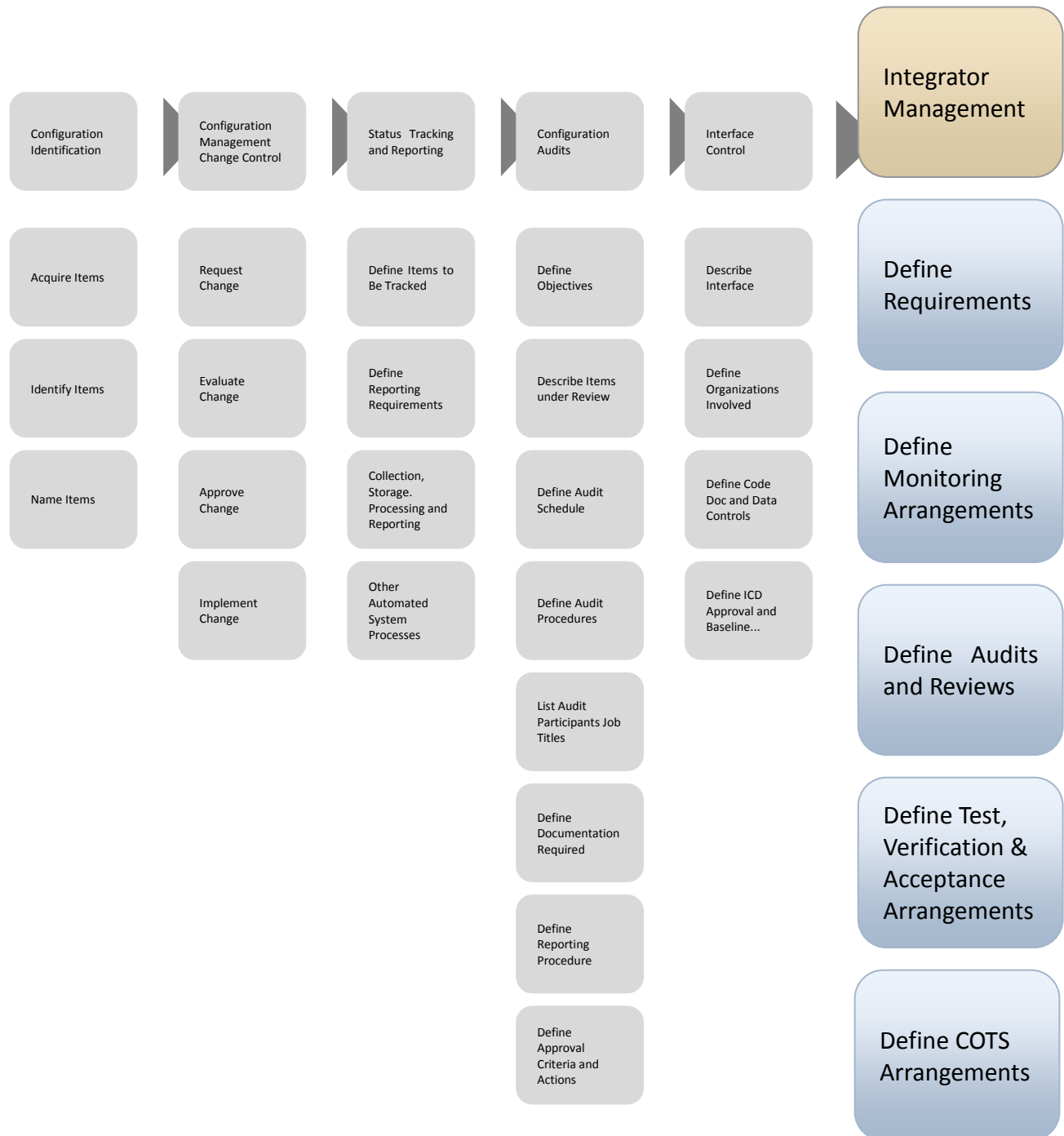


Figure 10: Integrator Management

For Integrator supplied software/hardware, the CMP shall describe, at a minimum, the activities illustrated in figure 11 and as follows:

- What I-4 Ultimate Express Lanes System requirements, including the system implementation plan, are to be part of the Integrator agreement
- How the Integrator will be monitored for compliance
- What configuration audits and reviews of Integrator items will be held
- How external code, documentation, and data will be tested, verified, accepted, and merged with the overall project
- How proprietary items will be handled for security of information and traceability of ownership (e.g., copyright and royalties)
- How changes are to be processed, including the Integrator participation

Appendix H: Risk Management Plan

1 Introduction

This section explains why risks exist and highlights the purpose and importance of the risk management plan. It provides a general description of why risk management is essential to effectively managing the I-4 Ultimate Toll Collection and ITS system and describes what is needed before risk management can begin.

As organizations begin new advanced transportation technology projects they begin operating in an area of uncertainty that comes along with developing new and unique products or services. By doing so, these organizations take chances which results in risk playing a significant part in any project. The purpose of this risk management plan is to establish the framework in which the project team will identify risks and develop strategies to mitigate or avoid those risks. However, before risks can be identified and managed, there are preliminary project elements which must be completed. These elements are outlined in the risk management approach.

Before risk management begins it is imperative that a foundation is established for providing structured project information, thus, the following project elements were completed and defined prior to developing this Risk Management Plan:

- Define work scope, system schedule, resources, and cost elements
 - Develop system project WBS/WBS dictionary
 - Develop system master schedule and detailed schedules
 - Estimate project cost and finalize budget
 - Identify required and available resources
 - Establish performance measurement metrics
- Define minimum and maximum baseline thresholds
 - Schedule
 - Resources
 - Cost
- Baseline reporting requirements
 - Format
 - Frequency of distribution
 - Distribution list
- Define Risk Management Roles and Responsibilities
 - Project Manager chairs the risk assessment meetings
 - Project team participates in risk assessment meetings and members serve as meeting recorder and timekeeper
 - Key stakeholders participate in risk assessment meetings
 - Project Sponsor may participate in risk assessment meetings

2 Risk Management Approach

This section provides a general description for the approach taken to identify and manage the risks associated with the project. It should be a short paragraph or two summarizing the approach to risk management on this project.

The approach we have taken to manage risks for this project included a methodical process by which the project team identified, scored, and ranked the various risks. The most likely and highest impact risks were added to the project schedule to ensure that the assigned risk managers take the necessary steps to implement the mitigation response at the appropriate time during the schedule. Risk managers will provide status updates on their assigned risks in the bi-weekly project team meetings, but only when the meetings include their risk's planned timeframe. Upon the completion of the project, during the closing process, the project manager will analyze each risk as well as the risk management process. Based on this analysis, the project manager will identify any improvements that can be made to the risk management process for future projects. These improvements will be captured as part of the lessons learned knowledge base.

2.1 Risk Identification

This section explains the process by which the risks associated with this project were identified. It should describe the method(s) for how the project team identified risks, the format in which risks are recorded, and the forum in which this process was conducted. Typical methods of identifying risks are expert interview, review historical information from similar projects and conducting a risk assessment meeting with the project team and key stakeholders.

For this project, risk identification was initially conducted one of the weekly project status update meetings and has been continued on a weekly basis. The initial project risk assessment meeting. The method used by the project team to identify risk is described as follows:

2.2 Expert Consultant Review

An expert consultant, with in-depth experience of similar electronic toll collection, pricing and ITS projects, reviewed previous project deployment histories for lessons learned and practical experiences related to risk. Combining information from this exercise with personal experience, a risk register matrix was populated. This initial risk matrix was initially used at a special progress update meeting and has been used on a weekly basis since.

2.3 Risk Qualification and Prioritization

Once risks are identified it is important to determine the probability and impact of each risk in order to allow the project manager to prioritize the risk avoidance and mitigation strategy. Risks which are more likely to occur and have a significant impact on the project will be the highest priority risks while those which are more unlikely or have a low impact will be a much lower priority. This is usually done with a probability – impact matrix. This section explains risks were qualified and prioritized for the I-4 Express Lanes project.

In order to determine the severity of the risks identified by the team, a probability and impact factor was assigned to each risk. This process allowed the project manager to prioritize risks based upon the effect they may have on the project. The project manager utilized a probability-impact matrix to facilitate the team in moving each risk to the appropriate place on the chart.

Once the risks were assigned a probability and impact and placed in the appropriate position on the chart, the recorder captured the finished product and the project manager moved the process on to the next step: risk mitigation/avoidance planning.

2.4 Risk Monitoring

This section should discuss how the risks in the project will be actively monitored. One effective way to monitor project risks is to add those risks with the highest scores to the project schedule with an assigned risk manager. This allows the project manager to see when these risks need to be monitored more closely and when to expect the risk manager to provide status updates at the bi-weekly project team meetings. The key to risk monitoring is to ensure that it is continuous throughout the life of the project and includes the identification of trigger conditions for each risk and thorough documentation of the process.

The most likely and greatest impact risks have been added to the project plan to ensure that they are monitored during the time the project is exposed to each risk. At the appropriate time in the project schedule a Risk Manager is assigned to each risk. During the weekly project team meeting the Risk Manager (responsible person) for each risk will discuss the status of that risk; however, only risks which fall in the current time period will be discussed. Risk monitoring will be a continuous process throughout the life of this project. As risks approach on the project schedule the FDOT D5 project manager will ensure that the appropriate risk manager provides the necessary status updates which include the risk status, identification of trigger conditions, and the documentation of the results of the risk response.

2.5 Risk Mitigation and Avoidance

Once risks have been qualified, the team must determine how to address those risks which have the greatest potential probability and impact on the project. This section explains the considerations which must be made and the options available to the project manager in managing these risks.

The FDOT D5 project manager, assisted by the expert consultants has led the project team in developing responses to each identified risk. As more risks are identified, they will be qualified and the team will develop avoidance and mitigation strategies.

The risks for this project will be managed and controlled within the constraints of time, scope, and cost. All identified risks will be evaluated in order to determine how they affect this triple constraint. The project manager, with the assistance of the project team, will determine the best way to respond to each risk to ensure compliance with these constraints.

In extreme cases it may be necessary to allow flexibility to one of the project's constraints – schedule or cost.

2.6 Risk Register

Every project must maintain a risk register in order to track risks and associated mitigation strategies. This section describes the risk register criteria as well as where the risk register is maintained and how these risks are tracked in the project schedule.

The Risk Register matrix for this project is a log of all identified risks, their probability and impact to the project, the category they belong to, mitigation strategy, and when the risk will occur. The register was created through the initial project risk review conducted by the expert consultants, led by the FDOT D5 project manager. During this review and subsequent meeting, the project team identified and categorized each risk. Additionally, the team assigned each risk a score based on the probability of it occurring and the impact it could potentially have. The Risk Register also contains the mitigation strategy for each risk as well as when the risk is likely to occur.

Based on the identified risks and timeframes in the risk register, each risk has been added to the project plan. At the appropriate time in the plan—prior to when the risk is most likely to occur—the project manager will assign a risk manager to ensure adherence to the agreed upon mitigation strategy. The each risk manager will provide the status of their assigned risk at the bi-weekly project team meeting for their risk’s planned timeframe.

The Risk Register will be maintained as separate document that will be incorporated into the RFP and shared with the successful concessionaire.

Appendix I: System Integration Plan Guidelines

1 General

This document presents the I-4 Ultimate Managed Lanes System Integration Plan (Integration Plan) guidelines. The Integration Plan shall define the activities necessary to integrate the I-4 Ultimate Managed Lanes functional software components into the I-4 Ultimate Managed Lanes software application system.

The Integration Plan shall contain an overview of the system, a description of the major tasks involved in the integration, including the overall Integrator resources that are needed to fully support the integration effort.

The Integration Plan shall be developed by the Integrator during the system design and development phase and should be updated and used during the Integration and Test Phase. The final version would be provided in the Implementation Phase for approval by FDOT D5. The Integration Plan shall outline the different types of internal Integrator software integration tests that shall be conducted to ensure that the I-4 Ultimate Managed Lanes is designed and operates according to the RFP and the other Contract documents. The Integration Plan shall also identify the roles and responsibilities of each Integrator internal group that will be working on this project.

2 Roles and Responsibilities

To ensure that the delivered I-4 Ultimate Managed Lanes operates according to the Smart Lane RFP and the other Contract document requirements, many parts of the Smart Lane project engineering organization will have various roles and responsibilities. Listed below are suggested starting points for defining organizational responsibilities pertaining to the system integration activities required to ensure program success.

2.7 FDOT D5 Personnel

The FDOT D5 shall have full contractual responsibility for all Smart Lane equipment and system integration activities, and will work closely with the consultant staff to ensure that the I-4 Ultimate Managed Lanes integration is accomplished properly. The FDOT D5 shall review and approve the Integration Plan prior to it being used by the Integrator.

2.8 Project Consultant Staff

The Express Lanes tolling system consultant staff shall have the following roles and responsibilities:

1. Review and provide comments on the Integration Plan and all I-4 Ultimate Managed Lanes integration methods, integration test plans and procedures, integration schedule, policies and validation procedures for the Smart Lane Project. It should be noted that the referenced integration tests are internal tests to be conducted by the Integrator and, therefore, are separate from the Smart Lane tests that will be performed by FDOT D5 as identified in the Verification (Test) Plan.
2. Participate in all facets of integration activities and provide recommendations to FDOT D5 for

- verification testing during integration stages of the project.
3. Provide technical assistance to the Integrator and FDOT D5 staff during the integration process.
 4. Provide guidance during Integration with live traffic in conjunction with FDOT D5 management staff.
 5. Maintain a liaison with FDOT D5 and Integrator staff to incorporate additional Integration testing procedures and additional operational scenario management based on external requirements.

2.9 Integrator System Engineering Staff

The Integrator systems engineering personnel for the I-4 Ultimate Managed Lanes shall have the following roles and responsibilities:

1. Develop a comprehensive Integration Plan to effectively support the I-4 Ultimate Managed Lanes Application system. The Integration Plan shall be approved by FDOT D5.
2. Perform all Integration tests described in the plan including performance requirements, and detailing to FDOT D5/consultant group each procedure that is being conducted and why.
3. Ensure that the sub-system and end-to-end integration testing requirements and processes satisfy the RFP requirements by utilizing the trace matrix.
4. Develop a detailed integration report detailing all the integration tests that were run, any problems that were discovered, and how those problems would be corrected.
5. Perform any required re-integration activities identified by FDOT D5 and consultant staff. Re-integration documentation shall be submitted to FDOT D5.
6. System integration tasks

The I-4 Ultimate Managed Lanes Integration Plan shall detail a task-based integration process that will accommodate the various sub-systems of the I-4 Ultimate Managed Lanes application system.

The System Integration Plan shall clearly describe the following phases:

- Task 1 - Field Sub-systems Integration
- Task 2 – FTE Tolls Back Office System Integration
- Task 3 - Communications System Integration
- Task 4 – End-to-End Application Integration

3 Integration Phases

Presented below in Figure 12 is a schematic that shows the distinct I-4 Ultimate Managed Lanes integration phases and how each phase relates with one another.

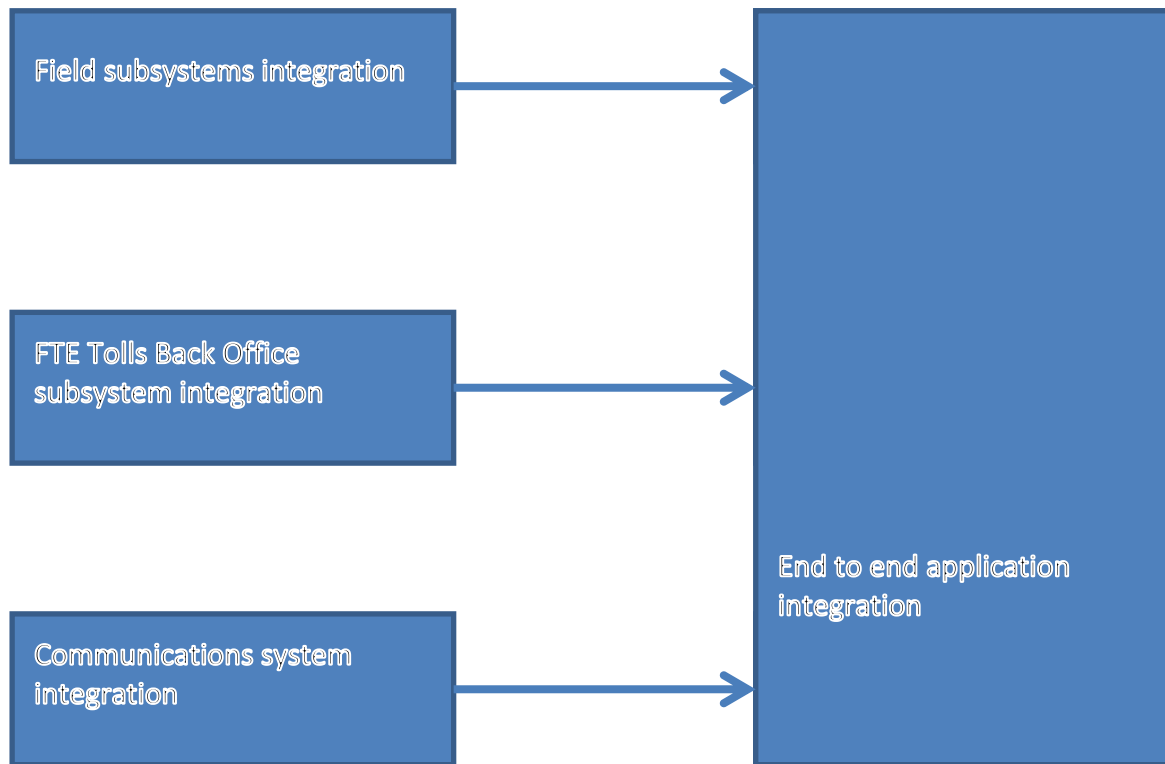


Figure 12 – Integration Process

3.1 Field Sub-Systems Integration

The Integration Plan shall define in detail the integration of each of the field sub-systems of the Smart Lane tolling solution. This would include, at a minimum:

- The electronic tolling and pricing system
- The Vehicle Detection Station (VDS) system
- The Smart Lane enforcement system
- The Dynamic Message Sign (DMS) system
- The Closed Circuit Television (CCTV) system

The Integrator sub-system integration tests should include, at a minimum, the following test environments to satisfy the functional requirements in the RFP and other Contract documents:

- Verify data integrity (no loss of data)
- Verify diagnostic messages

- Introduce failures and threats
- Degraded mode performance
- Verify diagnostic messages
- Normal transaction tests

3.2 FTE Tolls Back Office System Integration

The Integration Plan shall define in detail the integration of each of the FTE Tolls Back Office sub-systems of the Smart Lane tolling solution. This would include, at a minimum;

- Customer Service Representative (CSR) workstations
- Management workstations
- Dynamic pricing application servers
- I-4 Ultimate Managed Lanes application servers
- Network components
- Interface to the RTMC
- Interface to the FTE RCSC
- Interface to the Smart Lane enforcement sub-systems
- FDOT D5 website
- Device monitoring and control devices

The following internal Integrator integration tests, at a minimum, should be identified in the Integration Plan:

- Verify diagnostic messages
- Normal transaction tests
- Tolling zone operational tests
- FTE Tolls Back Office trip generation and algorithm process
- FTE Tolls Back Office interface to the FTE RCSC
- FTE Tolls Back Office interface to the RTMC
- FTE Tolls Back Office interface to the enforcement sub-system
- Proper association of vehicle and transponder.

3.3 Communications System Integration

The Integration Plan shall define in detail the full integration of the entire communications system in support of the Smart Lane solution. This would include, at a minimum:

- Roadside communications, including the wired and wireless communication links
- FTE Tolls Back Office to tolling zone communications, which includes the wired links
- FTE Tolls Back Office to the VDSs that are not connected directly through one of the tolling zones, which includes wired links
- FTE Tolls Back Office to the FTE RCSC
- FTE Tolls Back Office to the RTMC
- FTE Tolls Back Office to the enforcement sub-systems

The following, at a minimum, internal Integrator communications system integration tests should be identified in the Integration Plan:

- Reliability of connectivity tests
- Communications data throughput tests
- Communications error handling tests
- Tests to verify communications recovery processes for both wireless and wire line environments

3.4 End-To-End Application Integration

The Integration Plan shall define in detail the integration of each sub systems to the others thus constituting an end-to-end Smart Lane solution. The plan shall detail each of the Integration tests that would address the integration of all of the sub-systems in a structured manner to achieve the desired outcome of the Smart Lane application, including, at a minimum, the following:

- Operation of the FTE Tolls Back Office, including the dynamic pricing algorithms and the trip generation process
- Interface to the RTMC
- Integration between the FTE Tolls Back Office and the FTE RCSC

3.5 Integration Plan Components

The basic Integration Plan developed by the Integrator shall contain a series of activities to be executed as part of the System Integration tasks.

Integration testing activities and scenarios shall include complete end-to-end testing of all functions and operations of the Smart Lane System. This integration testing will involve using live traffic at the Integrator's production facility.

3.6 Integration Activities

The following System Integration activities would be identified in the Integration Plan for the I-4 Ultimate Managed Lanes application system. These activities would be carried out on all I-4 Ultimate Managed Lanes integration tasks and associated integration tests. The Integration Plan shall describe the following activities in detail to provide a comprehensive audit of the I-4 Ultimate Express Lanes integration task of the Smart Lane Project.

1. Provide overall planning and coordination for Integrator activities of the I-4 Ultimate Managed Lanes application integration
2. Provide appropriate training for personnel to carry out the integration
3. Provide appropriate documentation on each sub-system for integration
4. Provide audit or review reports
5. Document sub-system software unit and database
6. Establish integration test procedures
7. Conduct sub-system integration testing
8. Integrate sub-systems into final I-4 Ultimate Managed Lanes application system.

The FDOT D5 and their representatives shall be permitted to participate in or otherwise observe any and all of these Integration Tasks. Tentative dates for conducting the various Integration phases shall be included in the Integration Plan document submitted by the Integrator during the system design phase of the Contract. Reasonable modifications to these dates may be permitted during the course of the work by FDOT D5 provided a written request for such change is made at least two weeks prior to the revised Integration Phase test date. The actual change approval must be granted, in writing, by FDOT D5.

3.7 Steps Related To Activities

This section of the Integration Plan shall provide a detailed description of each major Integrator step required for the full integration of the I-4 Ultimate Managed Lanes. The Integrator shall also develop an internal integration schedule for when these tasks are expected to be completed.

The following information shall be included in the description of each major step, as appropriate:

1. What the step will accomplish
2. Resources required to accomplish the step
3. Key person(s) responsible for the step
4. Criteria for successful completion of the step

3.7.1 Step Accomplishment

This sub-section of the Integration Plan shall describe the expected results of each of the integration steps to be carried out by the Integrator to complete the Smart Lane System application.

3.7.2 Resource Requirements

This section of the Integration Plan shall contain project developed equipment and software products to be integrated, including any support equipment such as special software, test hardware, software drivers, and simulations of sub-systems to be integrated during the system integration task.

3.7.3 Key Integration Staff

This section shall identify the key system integration specialists, including the external system interface knowledge engineers to enable successful integration of major sub-systems of the I-4 Ultimate Managed Lanes application system.

3.7.4 Criteria for Step Completion

The Integration Plan shall provide both the Integrator and FDOT D5 a mechanism for verifying and documenting successful integration of all the sub-systems throughout the integration testing. Testing procedures and scenarios, which will be developed by the Integrator and subject to

FDOT D5 approval, shall be built upon the previously used unit and sub-system scripts and test steps.

3.8 Integration Support

The Integration Plan shall describe the support software, materials, equipment, and facilities required for the integration, as well as the personnel requirements and training necessary for the Managed Lane application integration.

3.9 Resources and their Allocation

The plan shall list all support software, materials, equipment, and facilities required for the end-to-end Smart Lane application integration. The Integration Plan shall describe the test environment and any resources needed. The Plan shall describe the number of personnel needed and availability.

4 Training

The Integration Plan shall identify the training necessary to prepare for the integration and maintenance of the Smart Lane application system.

5 Testing

The Integration Plan shall list all the test requirements for each set of integration test scenarios. It should include a description for each suite of integration tests, including the data included, procedures for testing, who is responsible for the testing and the internal integration testing schedule. This could be accomplished in one plan or several, depending on the complexity of the suite of integration tests being tested.

Any failures encountered during integration testing must be resolved and retested before commencement of the Operational Performance Test (OPT), which is described in the Verification (Test) Plan. The integration problems identified will be tracked by the Integrator and the matrix shall be provided to FDOT D5, if requested.

Appendix J: Verification (Test) Plan

1 General

This document will present the I-4 Ultimate Managed Lanes equipment and system verification testing process. It will outline the different types of tests that shall be conducted and identify the roles and responsibilities of each group that will be working on this project.

2 Roles and Responsibilities

Based upon the recommended distributed responsibility for the successful implementation of test procedures to ensure that the delivered tolling system operates according to the Request for Proposal (RFP) and Contract requirements, the I-4 Ultimate Managed Lanes project engineering organization will have various roles and responsibilities. Listed below are recommended starting points for defining organizational responsibilities pertaining to the verification test activities that are required to ensure program success.

2.1 Florida Department of Transportation District 5 (FDOT D5) Staff

4. FDOT D5 shall have full contractual responsibility for all of I-4 Ultimate Managed Lanes equipment and system verification testing activities and will work closely with the consultant staff to ensure that the testing is accomplished properly.

2.2 Project Consultant Staff

FDOT D5's I-4 Ultimate Managed Lanes Program and tolling system consultant staff shall have the following roles and responsibilities:

1. Create and maintain all system verification and testing engineering related processes, policies and operating procedures for the Managed Lanes project.
2. Participate in all facets of testing activities and provide recommendations to FDOT D5 for verification testing related aspects of the project.
3. Provide technical assistance to the Integrator and FDOT D5 staff during the testing process.
4. Provide regulatory guidance for security-related requirements in conjunction with FDOT D5 management staff.
5. Maintain a liaison with FDOT D5 and Integrator staff to incorporate additional testing procedures and ad hoc tests into the I-4 Ultimate Managed Lanes verification and testing process.

2.3 Integrator Systems Engineering Staff

The Integrator systems engineering staff for the I-4 Ultimate Managed Lanes Project shall have the following roles and responsibilities:

1. Develop the various test scripts and procedures that are required to effectively support the I-4 Ultimate Managed Lanes verification and testing process.
2. Perform the various tests that are required and detailing to FDOT D5/Consultant group each procedure that is being conducted and why.
3. Ensure that the various system and equipment testing requirements and processes are properly flowed down from the RFP and the Contract documents by utilizing comprehensive requirements trace matrix.

4. Develop a detailed testing report that identifies all of the tests that were run, any problems that were discovered and how those problems would be corrected.
5. Perform any required re-testing activities that are identified by FDOT D5 and Consultant staff.

3 Test Plan

The Integrator shall prepare a detailed plan for testing all hardware, software and the full integration of the I-4 Ultimate Managed Lanes System. The test plan shall be developed to confirm that the various functional requirements that are presented in the RFP, the system design documentation and the other Contract documents are met by the equipment and/or system operations. The Test Plan and subsequent testing activities shall be developed and executed for three (3) distinct phases. Each test phase shall commence only upon the successful completion of the previous phase. The three (3) test phases that will be conducted by the Integrator, in the following order, are presented below:

1. Factory Acceptance Test (FAT);
2. On-site Integration and Commissioning Test; and
3. Operational Performance Test.

The Integrator shall be responsible to develop comprehensive test scripts and test plans to ensure that the system development meets all of the system requirements that are presented in the RFP and the other contract documents. The test scripts and plans will be reviewed and approved by FDOT D5 staff or its designated representatives. The test scripts and plans shall be closely adhered to during each phase of equipment and system testing. At the completion of each test the Integrator shall submit final test results to FDOT D5 for final approval. FDOT D5 District Secretary of Transportation, or designated staff/Consultant staff, will approve the test results. Presented below in Figure 13 is a schematic that shows the three (3) distinct I-4 Ultimate Managed Lanes Program testing phases and how each phase inter-relates with the others.

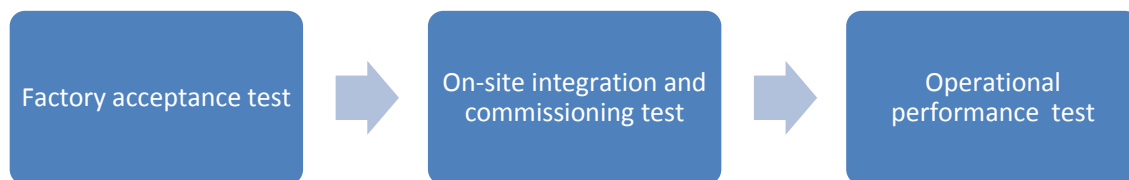


Figure 13: Testing Process

FDOT D5 and their representatives will be permitted to participate in or otherwise observe any and all of these tests at FDOT D5's sole discretion. Tentative dates for conducting the various tests shall be included in the Test Plan document that shall be submitted by the Integrator during the system design phase of the Contract. Reasonable modifications to these dates may be permitted during the course of the work by FDOT D5 provided a written request for such change is made at least two (2) weeks prior to the revised test date. The actual change approval must be granted, in writing, by FDOT D5.

3.1 Equipment Environmental Testing

As a preliminary effort prior to factory acceptance testing, the Integrator shall also provide test results, certified by a testing laboratory approved by FDOT D5, confirming that all proposed system equipment that is to be installed is suitable to operate within its respective environment. If certified test results are not available or the results are not satisfactory to FDOT D5, the Integrator shall arrange for such tests to be conducted or re-conducted at no additional cost to FDOT D5. The Integrator shall provide FDOT D5 with certified test results for all equipment that is to be installed outside, or in any other non-environmentally controlled location. For equipment that is to be installed inside a building, cut sheets showing environmental operating requirements will be acceptable.

3.2 Factory Acceptance Test (FAT)

The intent of the FAT, which will be held at the Integrator's system development office, is to allow the Integrator to conclusively represent that the I-4 Ultimate Managed Lanes equipment, subsystems and overall system complies with the system functional requirements. Representatives from FDOT D5, the Consultant group, and FTE are expected to be present at the FAT. The FAT shall be successfully completed, and accepted by FDOT D5, 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 FAT shall be resolved, retested and acknowledged as being resolved by FDOT D5 prior to issuance of FAT approval to the Integrator.

It is possible that certain components that comprise the overall I-4 Ultimate Managed Lanes System may not be available during factory testing. The Test Plan shall indicate those portions or components that will not be able to be verified during performance of the FAT. Where applicable, the Integrator shall attempt to simulate the missing components to represent a fully functioning system.

Components used in the FAT shall be production models, which would otherwise be suitable for installation in the I-4 Ultimate Managed Lanes System. Testing and careful evaluation of samples and prototypes shall be completed prior to the commencement of the FAT.

The FAT is the culmination of the design, development, fabrication and pre-test of the Managed Lanes System equipment, subsystems and overall system. The FAT shall be performed by the Integrator under the supervision of, and with the participation of, FDOT D5. Performance of the

FAT shall be witnessed by FDOT D5, and their representatives, with acknowledgment of scenario success and/or failure by FDOT D5.

The Integrator shall prepare detailed test scripts that will be used as the basis for the FAT. FAT Scripts shall cover test set-up, step-by-step procedures and pre-determined expected results. FAT scripts shall be submitted and approved by FDOT D5 prior to the commencement of the FAT. FAT scripts shall be submitted for review and approval no less than 60 days prior to scheduling of the factory test.

The following are recommended features of the Managed Lanes System that are, at a minimum, to be demonstrated during the FAT:

- Equipment power up tests
- Verify initialization
- Verify data integrity (no loss of data)
- Verify diagnostic messages
- Introduce failures and threats
- Degraded mode performance
- Verify diagnostic messages
- Normal transaction tests
- Tolling zone operational tests
- Proper association of vehicle and transponder
- Tolling zone stand-alone tests
- Operation of the FTE Tolls Back Office modules including the dynamic pricing algorithms and the trip generation process
- Interface to FDOT D5 Regional Traffic Management Center (RTMC)
- Communication link between the tolling zones and the FTE Tolls Back
- Generation of traffic, toll revenue and reconciliation reports
- Data analysis
- Integrity checking
- System audit and
- Others yet to be identified

3.3 On-Site Integration and Commissioning Test

The On-site Integration and Commissioning Test (OICT) shall be comprised of equipment, subsystem and system-wide testing of the Managed Lanes System. The purpose of the OICT is to provide both the Integrator and FDOT D5 a mechanism for verifying and documenting successful system performance throughout the installation process up to the point of approval to Commission the lane. Testing procedures and scenarios, which will be developed by the Integrator and subject to FDOT D5 approval, shall be built upon the previously utilized FAT scripts and test steps.

At the subsystem and component level(s), the OICT shall cover installation check-out and performance verification at each applicable location throughout the I-4 Ultimate Managed Lanes

System. At the system wide level, the OICT shall also cover end-to-end testing that represents a fully integrated and functional Managed Lanes System with all subsystems and components successfully integrated on-site. The intent of end-to-end testing during the OICT phase is to ensure readiness for the subsequent Commissioning Test.

The Integrator shall prepare detailed test scripts for the OICT. OICT scripts shall be designed to verify the equipment installation and confirm that the subsystem and/or component(s) are ready for operation on the Managed Lanes System and the Commissioning Test can then commence.

The tests to be performed shall be defined in the Integrator's test plan and test scripts. The detailed test scripts and scenarios of the Test Plan shall be submitted and approved by FDOT D5 prior to commencement of any of the specific tests. Performance of the various tests shall be witnessed by FDOT D5 with acknowledgment of scenario success, failures or potential system or equipment threats.

The commissioning portion of the OICT will be conducted in order to represent the operational readiness of the system prior to deployment. Testing activities and scenarios during these tests shall include complete end-to-end testing of all functions and operations of the Managed Lanes System. This testing will involve live traffic in the Managed Lanes, both real traffic and test vehicles. To ensure that all of the stated RFP and Contract operating requirements are effectively met, the Integrator shall develop a comprehensive requirements trace matrix and confirm, in writing to FDOT D5, that the tolling system has met each and every stated requirement.

Any failures that are encountered during the Commissioning Test must be resolved, retested and acknowledged by FDOT D5 before opening of the I-4 Ultimate Managed Lanes and commencement of the Operational Performance Test (OPT). The tests to be performed shall be similar to the tests in the FAT and shall be conducted under the supervision of, and with the participation of FDOT D5, and their representatives, in accordance with the test plan and test scripts that were previously approved. Testing results and corresponding documentation regarding the completion of the OICT shall be submitted to FDOT D5 for approval. Approval of the OICT must be granted prior to commencement of the Commissioning Test.

3.4 Operational Performance Test (OPT)

The final phase of testing of the I-4 Ultimate Managed Lanes System is the OPT. This test shall serve to closely monitor the performance of the managed lanes under live traffic operating conditions once the managed lanes are open to toll-paying vehicles. Activities during this period of testing will include all necessary scripted test documentation, unscripted ad-hoc tests as well as monitoring of day-to-day functions of the Managed Lanes System, including the operation of the equipment at the three (3) tolling zones, the operation of the FTE Tolls Back Office, trip building functionality at the FTE Tolls Back Office.

The OPT shall be conducted over a 30-day continuous period without degradation in performance or failure in compliance with contract system requirements. Throughout the 30-day

test period any system problems, errors, failures or malfunctions that are not in compliance with the contract requirements shall be categorized based on its level of severity. The typical four (4) levels of severity are:

- Severity 1 – Hardware or Software component or process that is critical to the operation of the Managed Lanes that does not function and there is the possibility of loss of revenue and/or loss of data.
- Severity 2 – Hardware or software component or process that does not function. There is no risk of loss of revenue or data; however there is the possibility of negative impact to patron usage.
- Severity 3 – Hardware or software component or process that does not meet the design functionality and/or impedes the operation of the system but does not affect the collection of revenue or negatively impact the patron usage.
- Severity 4 – Hardware or software component or process that does not meet the design functionality and/or is “cosmetic” in nature. Failure is transparent in nature to both the patron and FDOT D5.

The success or failure of the 30-day OPT shall be determined by the number and type of severity levels encountered during the test. The following represents the impact of each of the severity levels on the eventual outcome of the test.

3.4.1 Severity 1

- Indicates a failure of the 30-day test.
- The 30-day test is stopped. Once the problem is resolved, the 30-day test is restarted from Day 1.
- Milestone payments regarding the 30-day test are withheld.
- Warranty period will not begin until successful conclusion of the OPT.

3.4.2 Severity 2

- Does not indicate a failure of the 30-day test.
- The 30-day test is stopped. Once the problem is resolved, the 30-day test will resume from the date in which it left off. Once the problem is resolved the implemented fix shall operate without flaw for seven (7) consecutive days, which may extend the 30-day test period.
- Milestone payments regarding 30-day test will be withheld.
- Warranty period will not begin.
- Reoccurrence of the same problem that should have been resolved might raise the level of the issue to Severity 1.

3.4.3 Severity 3

- Does not indicate a failure of the 30-day test.
- The 30-day test is stopped. Once the problem is resolved, the 30-day test will resume from the point in which it left off. Once the problem is resolved the fix shall operate without failure for a minimum of seven (7) consecutive days, which may extend the

30-day test period.

- Milestone payments will continue to be paid to the Integrator.
- The Warranty Period will not begin.

3.4.4 Severity 4

- Does not indicate a failure of the 30-day test.
- The 30-day test is not stopped. The problem is resolved in a timely fashion.
- Milestone payments will continue to be paid.
- The Warranty Period will not begin.

All I-4 Ultimate Managed Lanes hardware and software will be carefully tested. Verification that all reported problems have been resolved will be obtained using several methods, including event logs and service call logs and other additional information that can be gleaned from the Maintenance On-Line Management System maintained by the Integrator or other data sources approved by FDOT D5. Multiple meetings per week will be scheduled during the 30-day test to ensure that FDOT D5 is fully aware of all system and equipment failures and the meetings will provide a forum in which FDOT D5 and Integrator staff can review system/equipment failures and classify the severity levels.

Appendix K: Deployment Plan Guidelines

1 General

The I-4 Ultimate Express Lanes Deployment Plan will provide the details of planned installation of the I-4 Ultimate Express Lanes I-4 Ultimate Express Lanes roadside, FTE, Regional Traffic Management Center, and system enforcement equipment and subsystems. This document provides guidelines for the creation of the Deployment Plan by the Integrator.

2. Roles and Responsibilities

To ensure successful I-4 Ultimate Express Lanes deployment and operations, and to make certain that the delivered tolling, pricing and ITS operates according to the RFP and contract requirements, the I-4 Ultimate Express Lanes project engineering organization will have various roles and responsibilities. Guidelines for defining organizational responsibilities are listed below in the following sections. are starting points for defining the various organizational responsibilities.

2.1. FDOT D5 Staff

FDOT D5 shall have contractual responsibility for all of the I-4 Ultimate Express Lanes system deployment activities, and will work closely with consultants and Integrator staff to ensure that equipment performs correctly and that the system deployment is correct.

2.2. Project Consultant Staff

FDOT D5's I-4 Ultimate Express Lanes consultant staff will be responsible for ensuring that the Integrator develops and maintains system deployment engineering related processes, policies, and operating procedures. Consultant staff shall participate in all facets of the deployment activities at critical points in the process to verify that the deployment activities are conducted and administered correctly. The consultant shall provide any required technical assistance to the Integrator and FDOT D5 staff during the system deployment process.

2.3. Integrator's Engineering Staff

The Integrator's system engineering Staff for the I-4 Ultimate Express Lanes Project shall be responsible for developing all documents required to support the I-4 Ultimate Express Lanes system deployment process. Integrator staff shall perform all work associated with deploying the I-4 Ultimate Express Lanes, including the required field testing, as described in the Verification (Test) Plan, RFP, and the contract documents.

The Integrator shall ensure that the system deployment requirements and processes are adhered to, including confirmation that the requirements within the trace matrix are met.

Integrator staff shall develop all required system deployment documentation, which will be subject to review and approval by FDOT D5. Integrator staff shall also perform any required testing and re-testing activities identified by FDOT D5 and consultant staff. Details of the Integrator's staff are described in Section 4 below.

3. Purpose of Deployment Plan

The Deployment Plan shall include, at a minimum, a comprehensive Installation Plan that includes a detail schedule, a Training Plan, and an Installation Safety Plan.

The equipment and software deployment techniques that will be used on the I-4 Ultimate Express Lanes Project by the Integrator shall be clearly defined in the Installation Plan. If accepted by FDOT D5, the Installation Plan will be applied to all equipment, subsystem, and software installations. Step-by-step scenarios for the installation of roadside equipment, telecommunications network, FTE Tolls Back Office equipment, enforcement equipment, and the Regional Traffic Management Center subsystem shall be provided by the Integrator, combined with the Installation Plan Schedule for these various activities. The Installation Plan Schedule, which will be a sub-schedule of the Integrator Project Schedule, as described in the Development Plan Guidelines, shall match the relevant milestone dates in the Overall Project Schedule.

The following outline sequence of deployment activities will be performed by the Integrator. The detailed Installation Plan Schedule, to be provided by the Integrator, will show the individual tasks associated with the installation of equipment for each subsystem.

- Pre-Installation Activities as follows:
 - Verify civil and conduit work
 - Work with FDOT D5 to finalize the Installation Plan, Installation Schedule and other deployment documents
 - Ensure that all safety procedures are in place
 - Secure FDOT D5 Encroachment Permit
- Roadside Equipment Installation as follows:
 - SunPass Antennas and Readers
 - Tolling Zone Lane Controllers
 - Enforcement Beacons
 - Vehicle Detection System (VDS) Equipment
 - CCTV Equipment
 - Communications Network Equipment
 - Other equipment as identified in the RFP and civil plans
- FTE Tolls Back Office Equipment Installation as follows:
 - Trip Processor Hardware and Software
 - Customer Service Representative Workstations
 - FDOT D5 I-4 Ultimate Express Lanes Website
 - Interface to the SunPass Customer Service Center
 - Interface to FDOT D5 Regional Traffic Management Center
 - Interface to the Enforcement Agency Enforcement Equipment
 - Other equipment as identified in the RFP and civil plans
- Post-Installation Activities as follows:
 - Verify that all the equipment and software is installed properly
 - Verify that each internal subsystem communicates properly to each other
 - Verify that all install equipment and software operates properly by conducting end-to-end systems testing

4. System Deployment Staff

4.1. I-4 Ultimate Express Lanes Integrator

The Integrator shall be fully responsible for all I-4 Ultimate Express Lanes deployment activities and will provide leadership in the management of the system integration, installation, testing, and commissioning process. The Integrator shall provide the, complete I-4 Ultimate Express Lanes, with integration of the various other subsystem components that are expect to be procured from vendors, including the SunPass equipment, VDS equipment, CCTV equipment, workstations, etc. It will be the responsibility of the Integrator to conduct the electrical work or to bring an Electrical Subcontractor on board to perform this work. The chosen Electrical Subcontractor shall be approved by FDOT D5 prior to any work that is conduct in the field.

4.2. Integrator Staff Qualifications

Only qualified Integrator staff and their subcontractor representatives shall be present on site to perform any pre-installation or actual installation work. Integrator staff should have all required electrical licenses and other required installation permits prior to starting any work. Only highly

skill Integrator staff, with many years of toll system implementation experience, shall oversee the system deployment activities.

4.3. Integrator Management Support and Services

During the system deployment, and operational testing activities (as defined in the Verification Plan), the Integrator shall provide an integrated, well organized I-4 Ultimate Express Lanes Management Team of staff from the Integrator and any of their subcontractors, including the SunPass equipment vendor. All system deployment Team members shall be knowledgeable and experienced in their respective fields of expertise, and will provide a quality product within the scheduled parameters that are established by FDOT D5. As part of the response to the RFP, the Integrator shall provide an organization chart clearly depicting the deployment Team along with documentation of their qualifications. The staffing shall be subject to the approval of FDOT D5.

4.4. Integrator Project Manager

The Integrator shall nominate a Project Manager (PM) subject to the approval of FDOT D5. The Integrator's PM shall be FDOT D5's primary point of contact throughout the duration of the project. During the deployment effort, the Integrator PM's primary responsibilities shall include, at a minimum:

- Primary communications with FDOT D5 and consultants
- I-4 Ultimate Express Lanes contract administration
- Ensure adherence to the quality assurance and control process
- Schedule and administer the I-4 Ultimate Express Lanes Project status meetings
- Interface with the Integrator's Installation Manager and all of the Integrator's subcontractors
- Coordinate with Florida regulatory agencies, FDOT D5 staff, FTE Tolls Back Office staff, permitting agencies, vendors, etc.

The Integrator PM shall ensure that all resources are allocated to the I-4 Ultimate Express Lanes Project and are used in the most advantageous manner. Additional Integrator Deployment Team members are listed below with their areas of expertise and their specific responsibilities.

4.5. Chief Technical Officer

The Integrator Chief Technology Officer (CTO) shall be responsible for all technical functions on the I-4 Ultimate Express Lanes Project. During the system deployment and installation activities, the CTO's responsibilities, at a minimum, shall include:

- Equipment specifications (hardware and software)
- Contractual documentation
- Testing and acceptance procedures
- Integration testing and debugging
- 90-Day System Performance Testing

4.6. Installation Manager

The Integrator's Installation Manager shall be responsible for the proper installation of all on site equipment, local installation support requirements and purchases. The Installation Manager will remain on site during the entire system installation phase of the I-4 Ultimate Express Lanes Project, including the post-commissioning testing phase. The Installation Manager will be responsible for confirming that all subcontractor work is completed properly and meets the System Requirements. The Installation Manager shall recommend acceptance of the system by FDOT D5.

The Installation Manager's responsibilities would include, at a minimum:

- Site survey;
- Verify civil work;
- Supervise cable and fiber optic installation, splicing and testing;
- Supervise equipment installation and start-up;
- Warehouse and inventory control;
- Maintain field records and installation logging; and
- Develop and maintain safety records.

4.7. Hardware Installation Engineer

The Integrator's Hardware Installation Engineer shall be responsible for the hands-on installation of all roadside equipment and all hardware installation at the FTE Tolls Back Office, on the Enforcement Agency vehicles, and at the FDOT D5 Regional Traffic Management Center. The Hardware Installation Engineer shall be on-site as necessary during the installation phase of the I-4 Ultimate Express Lanes Project and shall have, at a minimum, the following responsibilities:

- Supervision of other Integrator hardware installation staff
- Installation of the roadside equipment
- Supervision of any subcontractors that might provide SunPass, CCTV, Vehicle Detection System (VDS) and enforcement equipment
- Supervision of the Electrical Subcontractor, if the Integrator chooses to use the services of a subcontractor, on roadside equipment power wiring terminations
- Terminations of roadside, enforcement and FTE Tolls Back Office equipment control wiring
- Lane equipment start-up and verification testing

4.8. FTE Tolls Back Office Installation Engineer (Hardware and Software)

The Integrator's FTE Tolls Back Office Installation Engineer shall be responsible for the required hands-on installation of FTE Tolls Back Office hardware and software, including the interfaces to FDOT D5 Regional Traffic Management Center, the SunPass Customer Service Center, and the Enforcement Agency vehicles in support of the enforcement process. The FTE Tolls Back Office Installation Engineer shall be on-site after the communications network has been successfully install and test. The FTE Tolls Back Office Installation Engineer shall have, at a minimum, the following responsibilities:

- Supervise other FTE Tolls Back Office related Integrator hardware and software staff
- Install all required switches and hubs to the FTE Tolls Back Office patch panels
- Test the FTE Tolls Back Office local area network (LAN) to ensure its proper operation
- Install all the FTE Tolls Back Office servers and software
- Configure FTE Tolls Back Office servers operating system
- Configure and install the various FTE Tolls Back Office workstations and peripheral hardware
- Install the application software on the FTE Tolls Back Office servers and workstations
- Test roadside, FTE Toll Back Office, FDOT D5 and Enforcement Agency enforcement equipment connectivity and data transfer process

4.9. Roadside Equipment Software Support Engineer

The Integrator shall also appoint a Roadside Equipment Software Support Engineer to the I-4 Ultimate Express Lanes Project who will be responsible for overseeing the Integrator's roadside equipment and subsystem testing activities. The Engineer shall be on-site as necessary subsequent to the successful installation and pre-testing of the roadside equipment by the Integrator's Hardware Installation Engineer. The Roadside Equipment Software Support Engineer shall have, at a minimum, the following responsibilities:

- Oversee the fine tuning of the SunPass equipment once the antennas have been successfully tuned by the vendor
- Oversee the Integrator testing activities of the roadside I-4 Ultimate Express Lanes equipment to include both the low speed and high speed testing (of up to 100 mph)
- Ensure that the SunPass lanes provide the correct data and other system information to the lane controllers and on to the FTE Tolls Back Office, in close cooperation with the FTE Tolls Back Office Installation Engineer

4.10. Subcontractors

All I-4 Ultimate Express Lanes work to be performed by a subcontractor(s) shall be clearly defined in the Integrator's Technical Proposal, and in the system deployment and installation documentation that they shall be required to develop. FDOT D5 shall have the right to accept or reject any subcontractor

4.11. Installation Equipment and Tools

During the system installation process, the Integrator installation crews will have at their disposal all the necessary drills, cutters, and hardware tools to support the installation effort. The Integrator shall provide a detail list of all required equipment and tools needed to support the deployment effort. Below is a typical list of the types of equipment and tools required to properly install electronic toll collection systems elements.

- All required safety equipment necessary for a safe system installation, including (but not limited to) steel-toe boots, safety cones, hard hats, eye protection, fall protection to 6 feet,

- safety vests, first aid kits, etc.
- All necessary layout, electrical and mechanical drawings
- Platform truck for canopy installation and a palette jack and/or truck lift gate to unload heavy equipment
- Fiber optic polishing and termination tool kit, mesh slings to grasp cable ends that must be pull from conduits, conduit mandrill to clean out block conduits, cable markers, a bonding product to secure loop and wires in a VDS loop cut, inductive loop cutting machine, loop sealant
- An assortment of tools, including hammers, measuring tapes, hacksaws, pliers, screwdrivers, step ladders in varying sizes, tools for terminating various types of cables, etc.

During the initial 90-Day Operational Performance Test, a complete software development system shall be made available by the Integrator for quick on-site debugging capabilities.

5. Electronic Toll System Documentation

A complete and updated set of I-4 Ultimate Express Lanes related documentation shall be kept by the Integrator at their I-4 Ultimate Express Lanes Project office, which should be located near the three tolling zone locations and the FTE Tolls Back Office site. Integrator technicians shall retain their own set of documentation in accordance with their specific needs in a secure manner, which will periodically be check by the appropriate Integrator manager to ensure its revision validity. All documentation shall be conveyed to FDOT D5 both in hard copy and electronically. FDOT D5 shall retain an updated version documentation file for project consistency.

6. Installation Considerations

6.1. Installation Safety

Job safety is of paramount importance. All Integrator staff, before being allowed to provide direct installation support, shall comply with all safety and drug screening requirements establish by FDOT D5. Integrator staff working on the installation phase of the I-4 Ultimate Express Lanes Project shall also participate in a FDOT D5 approved safety orientation session, which will include information about FDOT D5 encroachment permit requirements. The Integrator installation staff is also required by FDOT D5 to use the following staff safety equipment:

- Hard hats
- Eye protection
- Steel-toe boots
- Reflective safety vests
- Fall Protection (up to 6 feet)

All Integrator and subcontractor installation staff shall be provided with a copy of FDOT D5 safety requirements to ensure that they are familiar with the various on-site job safety requirements. The Integrator shall also provide weekly safety briefings that involve all

Integrator and subcontract staff to confirm that they are adhering to FDOT D5 safety requirements. The Integrator shall be required to develop, submit for FDOT D5 approval, and periodically update a General Safety Plan. This Plan shall be adhered to in order to ensure the safety of all staff, motorists and pedestrians.

6.2. Code and Industry Standards

All applicable codes and standards shall be adhered to by the Integrator. FDOT D5 will periodically check to confirm that all required standards are being met by the Integrator.

6.3. Installation Planning

As described previously in this document, a detail Installation Schedule shall be developed by the Integrator, submitted to FDOT D5 for approval and periodically updated. Any changes are subject to approval by FDOT D5. The Installation Schedule shall be updated on a weekly basis, showing progress of tasks in a percentage completed format. The Installation Schedule will be formatted to provide a separate two-week look ahead feature to be used during the Integrator/FDOT D5 weekly progress and planning meetings. The Integrator will be expect to coordinate work with other I-4 Ultimate Express Lanes contractors to ensure that simultaneous work efforts can be accomplish as quickly as possible.

6.4. Weather And Productivity

The Integrator should make every effort to plan for weather delays and productivity concerns during bad weather conditions. For example, some of the work at the FTE Tolls Back Office could be saved as a fall back for when bad weather appears. The emphasis during good weather should be focus on outside work, including gantry or canopy equipment and conduit installation.

6.5. Shop Drawing Submittals

The Integrator shall be required to develop and submit shop drawings prior to the installation, to enable sufficient time for FDOT D5 review and approval process. The drawings shall be updated and revised to reflect the actual installation conditions. The updated shop drawings would be resubmitted by the Integrator as final As Built drawings.

6.6. Installation Daily Cleanup

The Integrator and their Subcontractors shall thoroughly clean up their work area on a daily basis and leave the installation site in an orderly manner.

Installation Records

A detail installation log of the Integrator's work effort at each location shall be develop, maintain carefully, and submitted as part of the weekly review meetings with FDOT D5.

7. System Testing and Acceptance

When the I-4 Ultimate Express Lanes system has been subject to complete verification testing and commissioning as defined in the Verification Plan, the Operational 90-Day Test period shall commence to provide proof that the system is operating at a level that warrants acceptance by FDOT D5. During the Operational Performance Test period, the Integrator shall provide system support and maintenance. Refer to the Verification (test) Plan for additional details.

During this testing period, Integrator staff shall be available on-site to perform all their required duties. Integrator staff shall perform all preventive, corrective, and emergency maintenance, as necessary, to ensure the proper performance and operation of the I-4 Ultimate Express Lanes system. Equipment, subsystem, and overall system reliability is the primary concern during this period. The Integrator shall adhere to all FDOT D5 mandated maintenance and testing procedures. This will assist the Integrator to achieve required levels of performance, reliability, maintainability, system availability and performance. The objectives is for the Integrator to provide FDOT D5 with sufficient evidence that the installed I-4 Ultimate Express Lanes system meets the reliability and operating requirements specified in the RFP and other contract documents. During the test, the maintainability requirements shall also be demonstrated by the Integrator.

7.1. Operational Performance Test Records

Integrator staff will keep operational and maintenance records during the test period. All problems, failures, malfunctions, service calls, and any performance issues relating to equipment, software, subsystems, or the overall system shall be documented and submitted for review by FDOT D5 on a weekly basis, at a minimum.

7.2. Corrective Action

Problems encountered during the 90-Day Test that might indicate that a system component or module does not meet the operational, reliability, maintainability or accuracy requirements, will be analyzed and resolved by implementing an appropriate revision. FDOT D5 shall be informed of the issue. On resolution of the issue, FDOT D5 will be provided with details of the revision and/or solution that was implemented.

7.3. Observation And Operational Performance Test Records

A copy of service reports shall be submitted by the Integrator to FDOT D5 on a monthly basis, at a minimum. FDOT D5 staff will have access to service records at all times. A hardware and software Maintenance Log shall be kept by Integrator staff. All preventive, corrective, emergency maintenance, software changes, and/or upgrades performed on any equipment during the Test period will be carefully noted in the Maintenance Log.

The Maintenance Log will contain a description of the fault, the effort required to repair it, the serial numbers and description of the equipment, date and time of the start and finish of the work, technician's name(s), problem notification time, tolling zone location, and signature boxes for both FDOT D5 and Integrator staff to sign. This data will provide records of system operation to assist FDOT D5 and the Integrator in establishing accurate preventive maintenance schedules, required inventory levels, maintenance staff requirements, and an indication of recurring problems with particular system components. This data will be valuable as the Integrator tracks equipment, subsystem and total system operation during the 12-month Warranty Period.

7.4. Installation Schedule

As described previously, the Integrator shall develop and submit, for FDOT D5 review and approval, a detail I-4 Ultimate Express Lanes Installation Schedule. The Installation Schedule shall include concise description of the equipment, subsystem, etc., that the Integrator proposes to install and the proposed installation location. The expected time for each system component, subsystem, etc. to be installed, tested and deployed, shall also be documented in this schedule. Integrator and FDOT D5 staff shall comply with the dates stated in the Installation Schedule to ensure the I-4 Ultimate Express Lanes system deployment process stays on scheduled.

8. Integrator Training

The training of FDOT D5 staff shall be provided prior to hands-on operation of the I-4 Ultimate Express Lanes system. The training process overview is as follows:

8.1. FTE Tolls Back Office Supervisor staff:

1. FTE Tolls Back Office system operator overview
2. FTE Tolls Back Office workstation overview
3. Interface to the FTE Toll Back Office SunPass account management system
4. Interface to FDOT D5 Regional Traffic Management Center
5. Interface to the Enforcement Agency enforcement system
6. Navigation of FDOT D5 website
7. Access to the Maintenance On-Line Management System (MOMS)
8. Access to Integrator maintenance staff
9. Access to I-4 Ultimate Express Lanes Operations staff (if FDOT D5 chooses to use the Integrator or a second source company)

8.2. FTE Tolls Back Office Customer Service Representative staff:

10. FTE Tolls Back Office system Customer Service Representative overview
11. FTE Tolls Back Office workstation overview
12. Interface to the FTE Toll Back Office SunPass account management system
13. Interface to FTE Toll Back Office Customer Service Representatives
14. Navigation of FDOT D5 Website

9. Conclusions

The Integrator will develop System Deployment Plan Guidelines that clearly describe the management approach that will be implemented to ensure that the I-4 Ultimate Express Lanes I-4 Ultimate Express Lanes deployment activities are performed correctly. The Integrator's Deployment Plan shall include all required information regarding the approach to managing the equipment, software, system installation, deployment process and planned testing procedures that will be used.

Appendix L: Electronic Tolling and Pricing Requirements

Sub System Name	Sub System Number	Requirement Number	Functional Requirement Label	Functional Requirement Description
Dynamic tolling System	1100	1	Traffic Pricing Calculation	The FDOT D5 dynamic tolling system shall periodically and dynamically calculate the toll rate based upon traffic information from both the Managed Lanes and the General Use lanes gathered from the vehicle detection system and traffic sensor devices installed along the facility
Dynamic tolling System	1100	2	Traffic Pricing Calculation	The toll rate setting process shall accommodate the objective to minimize congestion and maximize gross toll revenue obtained subject to a maximum toll, minimum level of service and support dynamic re-pricing intervals of no less than 5 minutes
Dynamic tolling System	1100	3	Traffic Pricing Calculation	The Contractor shall maintain sufficient design flexibility to permit incorporation of objectives such as maintenance of minimum LoS or other policy objectives in the future
Dynamic tolling System	1100	4	Traffic Pricing Calculation	dynamic, real-time, parameter- or heuristic-driven toll rate calculation program that successfully achieves the stated toll and operational objectives and constraints

Sub System Name	Sub System Number	Requirement Number	Functional Requirement Label	Functional Requirement Description
Dynamic tolling System	1100	5	Traffic Pricing Calculation	toll rate calculation process that accounts for traffic flow densities in both the Managed Lanes and vehicle travel times in the General Use lanes
Dynamic tolling System	1100	6	Traffic Pricing Calculation	toll rate calculation program that accounts for disparities in traffic densities occurring simultaneously at various locations over the entire length of the I-4 Ultimate Managed Lanes corridor
Dynamic tolling System	1100	7	Traffic Pricing Calculation	toll-rate reset interval (e.g., every 5 minutes) that successfully controls Managed Lanes demand without creating driver confusion by changing too frequently, or sacrifices facility objectives by not changing frequently enough
Tolling Zone Lane Controller	200	8	Traffic Pricing Calculation	individual operator adjustable toll rate increment in dollars and cents that successfully manages Managed Lanes demand to system criteria
Dynamic tolling System	1100	9	Traffic Pricing Calculation	user settable minimum toll rate in dollars and cents

Sub System Name	Sub System Number	Requirement Number	Functional Requirement Label	Functional Requirement Description
Dynamic tolling System	1100	10	Traffic Pricing Calculation	dynamic pricing structure that provides the ability to toll by segment.
Dynamic tolling System	1100	11	Traffic Pricing Calculation	The toll rate setting process shall assess a per-mile toll rate for each of the three segments that reflect the balancing of the value of traveling in the Managed Lanes as opposed to traveling in the General Use Lanes
Dynamic tolling System	1100	12	Traffic Pricing Calculation	A dynamic, real-time, parameter-driven toll rate setting process that successfully meters Managed Lanes traffic demand and ensures that the acceptable Managed Lanes LOS and other operational constraints are maintained. The toll rate setting process may consist of mathematical functions, algorithms, statistical procedures, and hardware and software implementations of such
Dynamic tolling System	1100	13	Traffic Pricing Calculation	A toll rate setting process that accounts for traffic densities in the Managed Lanes and vehicle travel times in the General Use Lanes

Sub System Name	Sub System Number	Requirement Number	Functional Requirement Label	Functional Requirement Description
Dynamic tolling System	1100	14	Traffic Pricing Calculation	A toll rate setting process that accounts for disparities in traffic densities occurring simultaneously throughout the entire length of the Managed Lanes corridor
Dynamic tolling System	1100	15	Traffic Pricing Calculation	An interval of change for the toll rate (i.e. possibly every 5 minutes) that successfully controls Managed Lanes demand without creating driver confusion by changing too frequently
Dynamic tolling System	1100	16	Traffic Pricing Calculation	An individual operator adjustable toll rate increment that successfully controls Managed Lanes demand. Toll increment to be user programmable
Dynamic tolling System	1100	17	Traffic Pricing Calculation	A user settable minimum toll rate
Dynamic tolling System	1100	18	Traffic Pricing Calculation	A user settable maximum toll rate
Dynamic tolling System	1100	19	Traffic Pricing Calculation	A dynamic pricing structure that provides the ability to toll by segment

Sub System Name	Sub System Number	Requirement Number	Functional Requirement Label	Functional Requirement Description
Dynamic tolling System	1100	20	Traffic Pricing Calculation	Ability to support the following operating modes: incident management mode, evacuation mode, total system failure mode. For instant management mode the system will have the ability to display zero tolls during the course of the incident. For evacuation mode the system shall have the ability to display zero tolls for a predefined period. For system failure mode the system shall have the ability to charge a toll based on historical data for the time of day day of week and year of operation
Dynamic tolling System	1100	21	Traffic Pricing Calculation	Methods for automatic, manual or semi-manual refinement of the process and sub-processes
Dynamic tolling System	1100	22	Traffic Pricing Calculation	Methods for seeding and training of any dynamic toll optimization routines employed
Dynamic tolling System	1100	23	Traffic Pricing Calculation	An internally consistent, and theoretically justified, method for accommodating the inherently variable value(s) of time of patrons so as to meet revenue objectives.

Sub System Name	Sub System Number	Requirement Number	Functional Requirement Label	Functional Requirement Description
Dynamic tolling System	1100	24	Traffic Pricing Calculation	The process shall have a means of reporting the implied value of time of the patrons for each 24-hour period
Dynamic tolling System	1100	25	Traffic Pricing Calculation	The period at which the FDOT D5 dynamic tolling system calculates the toll rate shall be a user-settable, table-driven parameter in the ETC System
Dynamic tolling System	1100	26	Traffic Pricing Calculation	The specific calculation interval shall be initially set during the ETC System design phase of the project, but the system shall provide the ability for the FDOT D5 Secretary of Transportation, or his/her designee, to modify the parameter at any time in the future
Dynamic tolling System	1100	27	Traffic Pricing Calculation	The setting of the calculation shall be possible by non-technical persons, and designed so as to alert management and supervisors to extreme overrides

Sub System Name	Sub System Number	Requirement Number	Functional Requirement Label	Functional Requirement Description
Dynamic tolling System	1100	28	Traffic Pricing Calculation	The toll rate setting process will be able to make use of at least the following real-time and archived historical performance information - cross-sectional vehicle volumes and speeds upstream of pricing location and at each pricing location, real-time and archived toll revenue and paying vehicle volumes at each pricing location and any other information deemed absolutely necessary by the Client to achieve the toll-optimization and management objectives
Dynamic tolling System	1100	29	Traffic Pricing Calculation	The traffic data shall be collected from the Managed Lanes via traffic sensors that will be installed in the Managed Lanes approximately every half mile
Dynamic tolling System	1100	30	Traffic Pricing Calculation	To capture traffic performance in the General Use Lanes, traffic sensing devices shall be installed on the outside roadway approximately every mile along the I-4 ultimate Managed Lanes corridor. Traffic sensing equipment shall be used to collect travel time data from the General Use Lanes and shall also be used as back-up for the I-4 Ultimate Managed Lanes traffic flow density and speed

Sub System Name	Sub System Number	Requirement Number	Functional Requirement Label	Functional Requirement Description
				information
Dynamic tolling System	1100	31	Traffic Pricing Calculation	The FTE Tolls Back Office shall collect traffic density and travel time data at a minimum interval of every 15 seconds. However, the actual time interval of collection of this roadway vehicle data by the FTE Tolls Back Office shall be determined by the ETC System Integrator (Contractor) during the system design phase of the ETC System Project.
FTE Tolls Back Office	100	32	Managed Lanes Trip Assembly	The FTE Tolls Back Office system shall be responsible for gathering and compiling vehicle, transponder, and toll rate data from all tolling zone lane controllers and creating individual trip revenue transaction records

Sub System Name	Sub System Number	Requirement Number	Functional Requirement Label	Functional Requirement Description
FTE Tolls Back Office	100	33	Managed Lanes Trip Assembly	When a SunPass™ transponder enters the Managed Lanes and passes through a tolling zone, the transponder is detected by the antenna/reader and the lane controller verifies that the transponder is valid by comparing the transponder number to the tag status file that is resident in the lane controller's memory. Data, including the transponder number, date, time, tolling zone location of the transponder read, and the toll rate that was in effect when that vehicle entered the Managed Lanes shall be sent to the FTE Tolls Back Office system. This series of events occurs every time a vehicle that is equipped with a SunPass™ transponder passes through a Managed Lanes tolling zone. Therefore, if it is a through-trip, each time the vehicle traverses a tolling zone a distinct transaction record shall be generated

Sub System Name	Sub System Number	Requirement Number	Functional Requirement Label	Functional Requirement Description
FTE Tolls Back Office	100	34	Managed Lanes Trip Assembly	If a transponder is detected but it is determined to be invalid, the lane controller shall send a command to illuminate the tolling zone beacon. The beacon shall illuminate within 0.1 seconds from the time in which the lane controller makes this determination. For each invalid transponder read a transaction record shall be developed by the lane controller and sent to the FTE Tolls Back Office system for future use
FTE Tolls Back Office	100	35	Managed Lanes Trip Assembly	The FTE Tolls Back Office system computer shall then compile each of the vehicle transaction records and event data collected throughout the specific vehicle trip and determine where the trip began, which segments were traveled, when the trip ended, and which toll should be charged
FTE Tolls Back Office	100	36	Managed Lanes Trip Assembly	The FTE Tolls Back Office system shall then determine whether or not there is a more recent Managed Lanes tolling zone transaction than the most recently received record by comparing the record times to indicate that the specific trip is now complete

Sub System Name	Sub System Number	Requirement Number	Functional Requirement Label	Functional Requirement Description
FTE Tolls Back Office	100	37	Managed Lanes Trip Assembly	Based upon internal calculations, the FTE Tolls Back Office system shall develop a I4 Ultimate Managed Lanes trip record, store this record in the proper location, post to the SunPass™ customer account and collect the revenue associated with that I4 Ultimate Managed Lanes trip. The FTE Tolls Back Office system shall be designed to store I4 Ultimate Managed Lanes trip records for at least 12 months
FTE Tolls Back Office	100	38	Managed Lanes Trip Assembly	The I-4 Managed Lanes System shall include parameters that define the maximum duration for a single trip and logic that accounts for events such as a change in direction of travel or a communications failure with one or more tolling zone lane controllers
FTE Tolls Back Office	100	39	Managed Lanes Trip Assembly	The I4 Ultimate Managed Lanes system shall be configured to charge one toll per trip, for example the toll rate that is displayed on the DMS as the vehicle enters the I4 Ultimate Managed Lanes, but the I-4 Managed Lanes System shall also include functionality that allows for segment-

Sub System Name	Sub System Number	Requirement Number	Functional Requirement Label	Functional Requirement Description
				based tolling
FTE Tolls Back Office	100	40	Toll Rate Safeguards	When a vehicle enters the I4 Ultimate Managed Lanes, the toll rate might change between the time at which the driver views the toll rate on the DMS and the time at which the driver passes through the tolling zone. Based upon near real-time traffic density and speed data, the FTE Tolls Back Office system shall calculate the amount of time it takes for a vehicle to view the toll rate and then pass through the tolling zone that is immediately downstream from the DMS that conveyed the toll rate to that vehicle operator. If the toll rate changes during that interval of time, the driver shall be charged the lesser of the two rates
FTE Tolls Back Office	100	41	Toll Rate Safeguards	The FTE Tolls Back Office system shall also include logic that accounts for DMS communication failures that result in the display of incorrect toll

Sub System Name	Sub System Number	Requirement Number	Functional Requirement Label	Functional Requirement Description
				rates
FTE Tolls Back Office	100	42	Trip Reconciliation	The FTE Tolls Back Office system shall include I4 Ultimate Managed Lanes trip audit and reconciliation functionality. It shall provide a secure user interface which will allow FTE Tolls Back Office system staff to view and reconcile I4 Ultimate Managed Lanes trips and revenue data. The interface shall also include reporting capabilities that allow users to create, execute, and store reports
FTE Tolls Back Office	100	43	Trip Reconciliation	The interface shall provide detailed transaction data such as tag-read times and locations, toll rate data, and other supporting raw transaction information. This information shall then be used to verify that trips were properly created and can be reconciled

Sub System Name	Sub System Number	Requirement Number	Functional Requirement Label	Functional Requirement Description
FTE Tolls Back Office	100	44	Trip Reconciliation	The interface shall allow authorized users to make adjustments to the data and correct errors in compiled revenue bearing trips. Users shall be able to adjust individual transactions or bulk transactions if it is determined that a I4 Ultimate Managed Lanes trip needs to be developed and/or modified
FTE Tolls Back Office	100	45	Trip Reconciliation	The FTE Tolls Back Office system database shall store configurable audit parameters, and provide a permanent audit record, or trail, of any adjustments that are made to summary or detail information
FTE Tolls Back Office	100	46	Tolling Zone Operation Monitoring	The FTE Tolls Back Office system shall include a secure, web-based monitoring interface that shall allow authorized users to view raw and summarized transaction and event data, as it occurs in real-time, at each tolling zone
Tolling zone lane controller	200	47	Tolling Zone Operation Monitoring	The tolling zone lane controllers shall broadcast data in near real-time to the FTE Tolls Back Office system and this data shall be compiled and displayed in an easily understood, graphical

Sub System Name	Sub System Number	Requirement Number	Functional Requirement Label	Functional Requirement Description
				manner
FTE Tolls Back Office	100	48	Tolling Zone Operation Monitoring	The interface shall support FDOT D5 defined user roles, which includes providing different data to different user categories. The interface is intended for use by customer service representatives, operations staff and maintenance personnel
FTE Tolls Back Office	100	49	Tolling Zone Operation Monitoring	The interface shall protect customer information and operate under the requirements of State of Florida privacy legislation
FTE Tolls Back Office	100	50	FTE Tolls Back Office System Reporting	The FTE Tolls Back Office system shall provide a fully integrated reporting module to support trip generation and reconciliation, I4 Ultimate Managed Lanes operations and FDOT D5 managerial system monitoring requirements
FTE Tolls Back Office	100	51	FTE Tolls Back Office System Reporting	The module shall include predefined traffic, revenue and CSR audit reports as well as support for ad hoc reporting needs

Sub System Name	Sub System Number	Requirement Number	Functional Requirement Label	Functional Requirement Description
FTE Tolls Back Office	100	52	FTE Tolls Back Office System Reporting	The reporting system shall allow users to browse, choose, and run reports through a clearly displayed and user-friendly Graphical User Interface (GUI).
FTE Tolls Back Office	100	53	FTE Tolls Back Office System Reporting	The reporting interface shall allow users to schedule reports to be run in the future
FTE Tolls Back Office	100	54	FTE Tolls Back Office System Reporting	The reporting interface shall allow reports to be output, saved, or printed in at least the following formats: On-screen; PDF; HTML and Excel.
FTE Tolls Back Office	100	55	FTE Tolls Back Office System Reporting	When accessing or running reports, the execute-to-display or execute-to-print time shall be less than one minute for each request
FTE Tolls Back Office	100	56	FTE Tolls Back Office System Reporting	The FTE Tolls Back Office system report server shall be operational and available 24 hours per day, seven days a week
Tolling Communications Network	1000	57	Data Transmission	Data transmissions originating from the FTE Tolls Back Office system shall occur automatically and utilize guaranteed delivery protocol

Sub System Name	Sub System Number	Requirement Number	Functional Requirement Label	Functional Requirement Description
Tolling Communications Network	1000	58	Data Transmission	Data communication between the FTE Tolls Back Office system and the I4 Ultimate Managed Lanes website shall be via an Ethernet connection
FTE Tolls Back Office	100	59	FTE Tolls Back Office System Security	The FTE Tolls Back Office system shall securely maintain I4 Ultimate Managed Lanes data through a standard login and password-based security system
FTE Tolls Back Office	100	60	FTE Tolls Back Office System Security	Secure user accounts shall be administered through a system administration interface
FTE Tolls Back Office	100	61	FTE Tolls Back Office System Security	The system shall operate under the provisions of State of Florida privacy laws. For example, customer data that is output for uses other than internal I4 Ultimate Managed Lanes operations shall be masked to maintain customer privacy
FTE Tolls Back Office	100	62	FTE Tolls Back Office System Security	The database shall use security service enterprise authentication for connections to the database. This will centralize database security in one location

Sub System Name	Sub System Number	Requirement Number	Functional Requirement Label	Functional Requirement Description
FTE Tolls Back Office	100	63	FTE Tolls Back Office System Security	All users shall have their own user name and password that is the same across all databases
FTE Tolls Back Office	100	64	FTE Tolls Back Office System Security	Users shall have individual resource usage limits set for them to prevent unauthorized or excessive utilization of system resources
FTE Tolls Back Office	100	65	FTE Tolls Back Office System Security	Profiles shall be used to define resource usage limits by work activity or job type
FTE Tolls Back Office	100	66	FTE Tolls Back Office System Security	Users shall be granted profiles according to their job needs
FTE Tolls Back Office	100	67	FTE Tolls Back Office System Security	The database shall be able to restrict data access down to the row level
FTE Tolls Back Office	100	68	Mobile Enforcement Equipment Data Transmission	The FTE Tolls Back Office system shall send tag status data to wireless on-board mobile enforcement equipment terminals to enable the enforcement agency officers to enforce the I4 Ultimate Managed Lanes

Sub System Name	Sub System Number	Requirement Number	Functional Requirement Label	Functional Requirement Description
Tolling Communications Network	1000	69	Mobile Enforcement Equipment Data Transmission	The secure data communications application shall be hosted on a wireless network to enable enforcement vehicles to obtain the tag status file data in a real-time basis
Tolling Communications Network	1000	70	System to System Interfaces	The FTE Tolls Back Office system shall provide the FDOT D5 RTMC with traffic density and speed data from the I4 Ultimate Managed Lanes and travel time data from the General Use lanes
FTE Tolls Back Office	100	71	System to System Interfaces	The incident detection process shall be the responsibility of FDOT D5. In the event that an incident does occur that would require temporary suspension of the I-4 Managed Lanes System and/or I4 Ultimate Managed Lanes closure, this shall be accomplished via a command issued by the RTMC Manager to the FTE Back office system
Tolling Communications Network	1000	72	System to System Interfaces	As part of the I4 Ultimate Managed Lanes enforcement effort, the FTE Tolls Back Office system shall also interface to the enforcement equipment that is provided to enforcement agency

Sub System Name	Sub System Number	Requirement Number	Functional Requirement Label	Functional Requirement Description
FTE Tolls Back Office	100	73	System to System Interfaces	The FTE Tolls Back Office system shall download the full tag status file at least once per day to the lane controllers, the MERs and the hand held enforcement devices. Incremental tag status file updates shall also be automatically sent from the FTE Tolls Back Office system to the lane controllers and the enforcement equipment
FTE Tolls Back Office	100	74	System to System Interfaces	There will be incidents on the I-4 that may necessitate the closing of the I4 Ultimate Managed Lanes or the diversion of General Use Lane traffic to the I4 Ultimate Managed Lanes. These actions should only be taken by authorized FDOT D5 RTMC staff, with input from the relevant enforcement agency
FTE Tolls Back Office	100	75	System to System Interfaces	The RTMC shall be included in the system network in order to facilitate emergency actions in the I4 Ultimate Managed Lanes
FTE Tolls Back Office	100	76	System to System Interfaces	All actions taken by RTMC personnel shall be logged into the I4 Ultimate Managed Lanes FTE Tolls Back Office system database and reports

Sub System Name	Sub System Number	Requirement Number	Functional Requirement Label	Functional Requirement Description
				generated that detail those actions
FTE Tolls Back Office	100	77	System to System Interfaces	The FTE Back office shall support an interface with the FDOT D5 Dynamic tolling System. This shall support the transmission of appropriate toll rates from FDOT D5 to FTE and a verification message to confirm that the toll has been displayed and charged
Tolling Communications Network	1000	78	Equipment Interfaces	The FTE Tolls Back Office system shall interface to each tolling zone lane controller via a real-time Ethernet connection
Tolling Communications Network	1000	79	Equipment Interfaces	The interface will support the transmission of raw vehicle, transponder, and event data. It will also support the transmission of daily incremental transponder status files and periodic toll rate data
Tolling Communications Network	1000	80	Equipment Interfaces	The interface shall be automatic and not require human intervention
Tolling Communications	1000	81	Equipment	The interface control document will be developed by the Contractor during the system design phase

Sub System Name	Sub System Number	Requirement Number	Functional Requirement Label	Functional Requirement Description
Network			Interfaces	of the project
Tolling Communications Network	1000	82	Dynamic Message Sign Rate Display	The FTE Tolls Back Office system shall interface with each DMS via a real-time data and communications connection
Tolling Communications Network	1000	83	Dynamic Message Sign Rate Display	The interface shall support the transmission of message data as well as system status requests and be NTCIP compliant
Tolling Communications Network	1000	84	Dynamic Message Sign Rate Display	The DMS Interface Control Document (ICD) shall be supplied by the vendor that is selected by the Contractor
FTE Tolls Back Office	100	85	FTE Tolls Back Office System Hardware Requirements	Primary and back-up computers that shall provide the processing capabilities that are described in this document. The back-up FTE Tolls Back Office system computer shall automatically assume primary operating capabilities when the primary unit experiences failure
FTE Tolls Back Office	100	86	FTE Tolls Back Office System Hardware	Personal Computer (PC) based workstations that shall provide all necessary operating functions at

Sub System Name	Sub System Number	Requirement Number	Functional Requirement Label	Functional Requirement Description
			Requirements	the FTE Tolls Back Office system
FTE Tolls Back Office	100	87	FTE Tolls Back Office System Hardware Requirements	Printers that shall be used to generate SunPass™ reports and other FTE Tolls Back Office system based reports;
FTE Tolls Back Office	100	88	FTE Tolls Back Office System Hardware Requirements	Other equipment that is necessary to support the FTE Tolls Back Office system
FTE Tolls Back Office	100	89	FTE Tolls Back Office System Hardware Requirements	Secured drop box, routers and other equipment to support file exchange processes
FTE Tolls Back Office	100	90	FTE Tolls Back Office System Operating Systems	The FTE Tolls Back Office system shall operate on the most recent, stable release of Microsoft's Windows Server operating system, or equivalent, as approved by FDOT D5
FTE Tolls Back Office	100	91	FTE Tolls Back Office System Database Requirements	The requirements for the FTE Tolls Back Office system database shall be consistent with FDOT D5 preferences, currently assumed to be Oracle-based, and will store raw data from the tolling

Sub System Name	Sub System Number	Requirement Number	Functional Requirement Label	Functional Requirement Description
				zones and compile detail and summary SunPass™ transaction data
FTE Tolls Back Office	100	92	FTE Tolls Back Office System Database Requirements	To support the enforcement subsystem, it shall also serve as a repository for necessary tag status file data
FTE Tolls Back Office	100	93	FTE Tolls Back Office System Database Requirements	The database shall provide a certain amount of data online for users to access and archive older, less frequently needed data offline
FTE Tolls Back Office	100	94	FTE Tolls Back Office System Database Requirements	The online/archive storage limitations shall be accessible to approved users as editable system parameters
FTE Tolls Back Office	100	95	FTE Tolls Back Office System Database Requirements	The database shall store individual I-4 Managed Lanes System events from the lane controllers installed at the tolling zones
FTE Tolls Back Office	100	96	FTE Tolls Back Office System Database Requirements	The FTE Tolls Back Office system database shall store summary and detail transaction information

Sub System Name	Sub System Number	Requirement Number	Functional Requirement Label	Functional Requirement Description
FTE Tolls Back Office	100	97	FTE Tolls Back Office System Database Requirements	The database shall store information related to status or state changes in the lane controller
FTE Tolls Back Office	100	98	FTE Tolls Back Office System Database Requirements	A record shall be stored in the lane controller at some regular interval (i.e. every 5 minutes) or every time the state of the lane controller changes
FTE Tolls Back Office	100	99	FTE Tolls Back Office System Database Requirements	The database shall store summary information for each status segment
FTE Tolls Back Office	100	100	FTE Tolls Back Office System Database Requirements	The transaction database shall store information about the facility, tolling zones, toll rates, equipment statuses, and any other relevant data related to I4 Ultimate Managed Lanes operations.
FTE Tolls Back Office	100	101	FTE Tolls Back Office System Database Requirements	The database shall store information supporting the Maintenance Online Management System (MOMS) as follows: Equipment type; Equipment description; Equipment manufacturer; Equipment model; Equipment cost; Equipment serial number; Date put in service; Projected service life

Sub System Name	Sub System Number	Requirement Number	Functional Requirement Label	Functional Requirement Description
				and Current status
FTE Tolls Back Office	100	102	FTE Tolls Back Office System Database Requirements	The database shall store information about the business day and business week
FTE Tolls Back Office	100	103	FTE Tolls Back Office System Database Requirements	The database shall store information regarding equipment that experiences degradation of operations and failures
FTE Tolls Back Office	100	104	FTE Tolls Back Office System Database Requirements	The database shall store information regarding system utilization and overall I4 Ultimate Managed Lanes system performance, including the Level of Service for each 5-minute interval throughout each 24-hour period
FTE Tolls Back Office	100	105	FTE Tolls Back Office System Database Requirements	The database shall store information about file uploads and downloads, transponder status files, VDS data files

Sub System Name	Sub System Number	Requirement Number	Functional Requirement Label	Functional Requirement Description
FTE Tolls Back Office	100	106	FTE Tolls Back Office System Database Requirements	The database shall retain 12 months of detailed data online and 2 years of summary data online
Dynamic toll rate display	300	107	Primary DMS Functions	The DMS shall be located approximately ½-mile upstream from each entry point to the I4 Ultimate Managed Lanes and shall be the primary method of informing the public of what the toll rate will be if drivers choose to use the I4 Ultimate Managed Lanes
Dynamic toll rate display	300	108	Primary DMS Functions	When the FTE Tolls Back Office system trip processor calculates a toll rate for an entry point, based on input from the D5 Dynamic tolling system, the rate shall be communicated to the DMS controller utilizing the IP address for that DMS controller
Dynamic toll rate display	300	109	Primary DMS Functions	The DMS controller shall send the display message to the Light Emitting Diode (LED) panel
Dynamic toll rate display	300	110	Primary DMS Functions	The panel shall interrogate itself and report back to the sign controller that the requested message

Sub System Name	Sub System Number	Requirement Number	Functional Requirement Label	Functional Requirement Description
				is being properly displayed
Dynamic toll rate display	300	111	Primary Functions DMS	The DMS controller shall then relay this information back to the trip processor, which is located at the FTE Tolls Back Office system.
Dynamic toll rate display	300	112	Primary Functions DMS	In addition to reporting what is being displayed on the sign at the time of the rate change, the DMS shall be polled by the FTE Tolls Back Office system at regular intervals (at least every 30 seconds) and shall in turn poll the LED panel and return the message being displayed for confirmation that the correct rate is being displayed
Dynamic toll rate display	300	113	DMS Equipment Requirements	The DMS shall be consistent with the FDOT approved signage program
Dynamic toll rate display	300	114	DMS Equipment Requirements	The I4 Ultimate Managed Lanes DMSs shall combine static sign information panels with dynamic panels
Dynamic toll rate display	300	115	DMS Equipment Requirements	The static part of the DMSs shall include displayed information that never changes (the I4 Ultimate Managed Lanes downstream exit points,

Sub System Name	Sub System Number	Requirement Number	Functional Requirement Label	Functional Requirement Description
				restricted hours, SunPass™ logo, etc.).
Dynamic toll rate display	300	116	DMS Equipment Requirements	The dynamic portion of the DMS shall include an LED panel attached to the sign that shall display the dynamically changing toll rates. This panel shall consist of at least 6 characters (alpha numeric) that are at least 12 inches in height
Dynamic toll rate display	300	117	DMS Equipment Requirements	The panel shall include an automatic feature that measures the ambient light and adjusts the intensity of the LEDs to be visible under all light conditions (full sun to full dark). In order to minimize the “halo” effect of certain colors, the LED color shall be amber
Dynamic toll rate display	300	118	DMS Equipment Requirements	The LED panel shall also include the ability for the sign to report to the FTE Tolls Back Office system what is being displayed by interrogating the sign pixels
Dynamic toll rate display	300	119	DMS Equipment Requirements	The DMS shall be managed by a sign controller which will be located either at roadside in a weather hardened enclosure or on the mounted

Sub System Name	Sub System Number	Requirement Number	Functional Requirement Label	Functional Requirement Description
				sign
Dynamic toll rate display	300	120	DMS Equipment Requirements	The DMS controller shall communicate to the FTE Tolls Back Office system's trip processor via a communications network utilizing the National Transportation Communications for ITS Protocol (NTCIP) standard or, if allowed by FDOT D5, Transmission Control Protocol/Internet Protocol (TCP/IP)
Dynamic toll rate display	300	121	DMS Equipment Requirements	The DMS controller shall have a unique IP address that identifies its location.
Tolling zone lane controller	200	122	Lane Controller Primary Functions	The tolling zone lane controller shall control and monitor the toll collection activities at each tolling zone and be primarily responsible for gathering SunPass™ transaction data and transmitting that information to the FTE Tolls Back Office system, in a secure environment, and without duplication, for trip compilation
Tolling zone lane controller	200	123	Lane Controller Primary Functions	The lane controller shall also interface with the FTE Tolls Back Office system to receive daily SunPass™ tag account status files on, at least, a

Sub System Name	Sub System Number	Requirement Number	Functional Requirement Label	Functional Requirement Description
				daily basis
Tolling zone lane controller	200	124	Lane Controller Primary Functions	Create and transmit vehicle count and transponder read data
Tolling zone lane controller	200	125	Lane Controller Primary Functions	Provide visual feedback of possible violations, through the use of an enforcement beacon installed at the tolling zone in such a position that it can be easily viewed by enforcement agency officers
Tolling zone lane controller	200	126	Lane Controller Primary Functions	Monitor its peripheral tolling zone equipment (i.e. SunPass™ reader, antenna, vehicle detection system equipment, etc.) and report on the status of these pieces of equipment;
Tolling zone lane controller	200	127	Lane Controller Primary Functions	Receive daily transponder account status update files from the FTE Tolls Back Office system
Tolling zone lane controller	200	128	Lane Controller Primary Functions	The lane controller shall accommodate a system administration and maintenance interface. This interface shall be used by operations and maintenance personnel to accomplish tasks such

Sub System Name	Sub System Number	Requirement Number	Functional Requirement Label	Functional Requirement Description
				as modifying system configuration files, extracting transaction data, performing preventive maintenance tasks,
Tolling zone lane controller	200	129	Lane Controller Primary Functions	The lane controller shall be capable of storing no less than 30 days of vehicle, event and SunPass™ transaction data
Tolling zone lane controller	200	130	Lane Controller Primary Functions	The lane controller shall store no less than 10 million SunPass™ transponder account status data
Tolling zone lane controller	200	131	Lane Controller Primary Functions	All lane controller messages (i.e. vehicle, event, SunPass™ transaction, maintenance, etc.) shall contain a unique sequence number.
Tolling zone lane controller	200	132	Lane Controller Primary Functions	The lane controller shall include at least the following information in the transaction record: Transponder number; Transponder status; SunPass™ transaction date; SunPass™ transaction time; Transponder handshake count; Lane controller date; Lane controller time; All pertinent VDS data; and Equipment states

Sub System Name	Sub System Number	Requirement Number	Functional Requirement Label	Functional Requirement Description
Tolling zone lane controller	200	133	Lane Controller Primary Functions	The lane controller's vehicle sequencing logic shall be self-correcting
Tolling zone lane controller	200	134	Lane Controller Primary Functions	The lane controller shall record all transponders that are read by the SunPass™ tolling zone subsystem.
Tolling zone lane controller	200	135	Lane Controller Primary Functions	The lane controller shall be able to operate normally without network communications, storing current records for later transmission to the FTE Tolls Back Office system
Tolling zone lane controller	200	136	Equipment Monitoring and Control	The lane controller shall monitor the following peripheral equipment through real-time data connections: Vehicle detection system equipment; SunPass™ transponder reader; SunPass™ antennas; Enforcement beacon and All other power supply and communications equipment that is located at the tolling zone

Sub System Name	Sub System Number	Requirement Number	Functional Requirement Label	Functional Requirement Description
FTE Tolls Back Office	100	137	Equipment Monitoring and Control	The system monitoring functionality shall include the ability to receive maintenance status messages from all subsystems and it shall incorporate logical processes, local to the lane controller, which evaluate operations and create maintenance alerts based upon a system of rules and expected conditions
FTE Tolls Back Office	100	138	Equipment Monitoring and Control	The maintenance alerts that are generated by the lane controller shall be sent to the MOMS
FTE Tolls Back Office	100	139	Equipment Monitoring and Control	The MOMS shall be responsible for compiling the raw maintenance data into a database and creating maintenance alerts and work orders that define actual maintenance events that need to be addressed
Tolling Communications Network	1000	140	Lane Controller Data and File Transmission	The Managed Lanes controllers shall be connected to the FTE Tolls Back Office system through an Ethernet connection and transmit files to the FTE Tolls Back Office system server in real-time.

Sub System Name	Sub System Number	Requirement Number	Functional Requirement Label	Functional Requirement Description
Tolling zone lane controller	200	141	Lane Controller Data and File Transmission	The lane controller shall transmit vehicle detection information, SunPass™ transaction data, equipment diagnostics and maintenance data
Tolling zone lane controller	200	142	Lane Controller Data and File Transmission	The lane controllers shall receive, at a minimum, daily SunPass™ tag account status update files, system configuration files, and toll rate files
Tolling zone lane controller	200	143	Lane Controller Data and File Transmission	The lane controller's serial ports shall be configurable as either RS-232 or RS-422
Tolling Communications Network	1000	144	Lane Controller Data and File Transmission	Serial communications interfaces shall provide for error detection protocols
Tolling zone lane controller	200	145	Lane Controller Equipment Requirements	Under normal conditions, the lane controller shall operate in an automated fashion without intervention from operational personnel
FTE Tolls Back Office	100	146	FTE Tolls Back Office System Database	All I-4 Managed Lanes System functions, including but not limited to, transaction assembly, file transmission, and toll rate assignment shall be

Sub System Name	Sub System Number	Requirement Number	Functional Requirement Label	Functional Requirement Description
			Requirements	designed to function independent of human interaction
Tolling zone lane controller	200	147	Lane Controller Equipment Requirements	The lane controller shall be environmentally hardened and housed in an environmentally shielded and controlled enclosure to operate under the weather conditions found in the Central Florida Region
Tolling zone lane controller	200	148	Lane Controller Equipment Requirements	The lane controller shall be designed with discrete input and output signal lines and use optical isolation circuitry for protection
Tolling zone lane controller	200	149	Lane Controller Equipment Requirements	The lane controller shall store data redundantly
Tolling zone lane controller	200	150	Lane Controller Equipment Requirements	The lane controller shall provide for a local user interface for maintenance purposes
Tolling zone lane controller	200	151	Lane Controller Equipment	The lane controller data storage process shall be based on First in First out (FIFO) technology

Sub System Name	Sub System Number	Requirement Number	Functional Requirement Label	Functional Requirement Description
			Requirements	
Tolling zone lane controller	200	152	Lane Controller Equipment Requirements	The lane controller performance shall be ample to handle all lane processes as designed at a rate of 2,500 vehicles per lane per hour, with 50% of those vehicles having transponders
Tolling zone lane controller	200	153	Lane Controller Equipment Requirements	For any 10 second period, the lane controller shall be capable of handling all I4 Ultimate Managed Lanes processes for transponder vehicle passage rates of 7,200 vehicles per lane per hour, assuming that all vehicles have transponders
Tolling zone lane controller	200	154	Lane Controller Equipment Requirements	The tolling zone system shall capture transponder reads for 99.98% of the vehicles with properly mounted transponders passing through the tolling zone
Tolling zone lane controller	200	155	Lane Controller Equipment Requirements	The tolling zone system shall be capable of determining the direction of travel for all vehicles in the I4 Ultimate Managed Lanes with an error rate in the determination of travel direction of no more than 0.01%.

Sub System Name	Sub System Number	Requirement Number	Functional Requirement Label	Functional Requirement Description
Tolling zone lane controller	200	156	Lane Controller Operating System	The lane controller Operating System (OS) shall be robust enough to support all of the operations of the tolling zone subsystems while meeting all of the requirements stated in the RFP
Tolling zone lane controller	200	157	Lane Controller Operating System	The OS of the lane controller shall function in such a way that it allows for the real-time collection and transmission of data across an Ethernet network as well as remote, real-time user connections (for maintenance purposes).
Tolling zone lane controller	200	158	Lane Controller Operating System	The lane controller shall provide TCP/IP network support and TCP utilities such as telnet, ping, and FTP
Tolling zone lane controller	200	159	Lane Controller Interface to the FTE Tolls Back Office	Each lane controller shall maintain a real-time interface with the FTE Tolls Back Office system. This interface shall allow for the transmission and reception, in real-time, of any data collected and assembled in the lane and any data compiled at the FTE Tolls Back Office system which is necessary for tolling zone subsystem operations

Sub System Name	Sub System Number	Requirement Number	Functional Requirement Label	Functional Requirement Description
Tolling zone lane controller	200	160	Lane Controller Interface to the FTE Tolls Back Office	The lane controller to FTE Tolls Back Office system interface shall be fully automated and not require human intervention
Tolling zone lane controller	200	161	Lane Controller Interface to the FTE Tolls Back Office	The lane controller shall broadcast lane events in near real-time to the FTE Tolls Back Office system to support the monitoring activities carried out by operations or maintenance personnel
Tolling zone lane controller	200	162	Lane Controller Interface to the FTE Tolls Back Office	The lane controller shall transmit a periodic heartbeat, or status, message to the FTE Tolls Back Office system
Tolling zone lane controller	200	163	Lane Controller Interface to the FTE Tolls Back Office	If communication between the lane controller and the FTE Tolls Back Office system fails, the lane controller shall periodically attempt to re-establish the connection until the connection is made

Sub System Name	Sub System Number	Requirement Number	Functional Requirement Label	Functional Requirement Description
Tolling zone lane controller	200	164	Lane Controller Interface to the FTE Tolls Back Office	The lane controller shall periodically (at least daily) receive tag status files from the FTE Tolls Back Office system. Upon receiving tag status files from the FTE Tolls Back Office system, the lane controller software shall subject the file to various sanity checks to ensure that the file is valid prior to integrating the new file into its static memory. Typical sanity checks would include checking the file type, the file size, the file header and footer data
Tolling zone lane controller	200	165	Lane Controller Interface to the FTE Tolls Back Office	The lane controller shall transmit an indicator of FTE Tolls Back Office system-initiated command execution, for example transmission is successful, it has failed
Tolling zone lane controller	200	166	Lane Controller Equipment Interface	All lane controller interfaces to peripheral equipment shall incorporate means of detecting whether the equipment is operating properly or if it experiences malfunction.
Tolling Communications Network	1000	167	Lane Controller Interface to the Vehicle Detection	The interface between the lane controller and the VDS equipment, at those locations in which this communications link is established, shall be in

Sub System Name	Sub System Number	Requirement Number	Functional Requirement Label	Functional Requirement Description
			Systems	real-time
vehicle detection system	500	168	Lane Controller Interface to the Vehicle Detection Systems	The VDS data that is gathered shall consist of vehicle speed and traffic volume data (from the I4 Ultimate Managed Lanes) and travel time information from the managed lanes. The necessity of the accurate and timely exchange of data between the two systems is essential to successful dynamic pricing operations
Tolling Communications Network	1000	169	Lane Controller Interface to the SunPass™ Reader	The interface between the lane controller and the SunPass™ transponder reader shall be in real-time and not be encumbered by latency
Tolling Communications Network	1000	170	Lane Controller Interface to the SunPass™ Reader	The bidirectional interface shall allow for the exchange of lane controller commands and SunPass™ system transponder data. The necessity of the accurate and timely exchange of data between the two systems is essential to successful I-4 Managed Lanes System operations

Sub System Name	Sub System Number	Requirement Number	Functional Requirement Label	Functional Requirement Description
Tolling Communications Network	1000	171	Lane Controller Interface to the Enforcement Beacon	The lane controller shall interface with the tolling zone enforcement beacon in real-time and immediately send the proper commands to the beacon when a valid SunPass™ transponder is processed
Tolling Communications Network	1000	172	Uninterruptible Power Supply	The lane controller shall interface with a UPS to ensure that battery power back-up is available to the controller if commercial power fails
Tolling zone lane controller	200	173	Uninterruptible Power Supply	The use of UPS equipment shall also ensure that the lane controller software is shut down in an orderly fashion if commercial power is not restored prior to the UPS battery power running out
vehicle detection system	500	174	VDS Equipment	The primary functions of the VDS equipment shall be to accurately and in near real-time detect vehicles in the I4 Ultimate Managed Lanes to determine the traffic density and the speed of vehicles that are traveling in that lane

Sub System Name	Sub System Number	Requirement Number	Functional Requirement Label	Functional Requirement Description
vehicle detection system	500	175	VDS Equipment	Inductive loops shall be installed along the I4 Ultimate Managed Lanes, approximately one mile apart. Double loops shall be installed according to the most currently available Caltrans loop installation standard
vehicle detection system	500	176	VDS Equipment	Remote traffic sensing devices shall be installed, on the outside shoulder, and shall collect travel time data from vehicles that are traveling in the managed lanes.
vehicle detection system	500	177	VDS Equipment	The traffic sensing subsystems shall also be used as back-up in collecting traffic speed and density data from the I4 Ultimate Managed Lanes if the loops experience failure
vehicle detection system	500	178	VDS Equipment	The VDS equipment shall function independently of the lane controller and send raw traffic data that shall be compiled by the lane controller
vehicle detection system	500	179	VDS Equipment	The VDS shall include functionality that allows for a direct maintenance data connection, both locally and remotely

Sub System Name	Sub System Number	Requirement Number	Functional Requirement Label	Functional Requirement Description
vehicle detection system	500	180	VDS Equipment	The VDS equipment shall detect and sequence all vehicles that pass through a focused point with an accuracy of at least 99.9% accuracy in all weather conditions
vehicle detection system	500	181	VDS Equipment	The VDS equipment shall provide self-diagnostic and fault detection messages to the lane controller
vehicle detection system	500	182	VDS Equipment	The VDS equipment shall detect and calculate the speed and density of vehicles traveling no less than six inches apart in the Managed Lanes at the above described accuracy rate
SunPass reader	600	183	Primary Functions of the SunPass™ Reader and Antenna	The SunPass™ reader, and its peripheral equipment including the antenna, shall accomplish the primary functions of transponder detection and reporting process
SunPass reader	600	184	Primary Functions of the SunPass™ Reader and Antenna	The reader's state, for example whether the RF module searches for transponders or not, shall be determined by the lane controller

Sub System Name	Sub System Number	Requirement Number	Functional Requirement Label	Functional Requirement Description
SunPass reader	600	185	Primary Functions of the SunPass™ Reader and Antenna	The SunPass™ reader and antenna shall operate within the technical requirements presented in the SunPass™ specifications
SunPass reader	600	186	Reader and Antenna Equipment Requirements	The SunPass™ transponder reader and antenna shall be compatible and interoperable with all other electronic tolling systems that are deployed in Florida by complying with all operating and configuration requirements presented in the SunPass specification
SunPass reader	600	187	Reader and Antenna Equipment Requirements	The reader/antenna shall be required to read a transponder mounted inside a vehicle traveling at highway speeds from 0 to 100 miles per hour
SunPass reader	600	188	Reader and Antenna Equipment Requirements	The reader shall transmit date, time, and tolling zone location data back to the transponder for possible future use
SunPass reader	600	189	Reader and Antenna Equipment Requirements	The reader shall have incorporated functionality that ensures only transponders in the I4 Ultimate Managed Lanes are read and transponders in the adjacent managed lanes are not read

Sub System Name	Sub System Number	Requirement Number	Functional Requirement Label	Functional Requirement Description
SunPass reader	600	190	Reader and Antenna Equipment Requirements	Algorithms that are used by either the reader or the lane controller shall be used to filter out improper cross-lane transponder reads
SunPass antenna	700	191	Reader and Antenna Equipment Requirements	SunPass™ antennas shall be installed over the middle of the I4 Ultimate Managed Lanes and shall be capable of reading transponders that are installed either on the windshield behind the rear-view mirror or on the lower left portion of the windshield (approximately 2 inches from the bottom and 2 inches from the edge).
SunPass antenna	700	192	Reader and Antenna Equipment Requirements	The reader shall not be located more than 75 feet from the overhead mounted antenna
SunPass antenna	700	193	Reader and Antenna Equipment Requirements	The AVI system shall record transponders with an accuracy of at least 99.98%.
roadside enforcement sub system	400	194	Primary Functions of the Tolling Zone Beacon	The primary function of the enforcement beacon shall be to visually alert enforcement agency officers to the presence of a potential I4 Ultimate

Sub System Name	Sub System Number	Requirement Number	Functional Requirement Label	Functional Requirement Description
				Managed Lanes violator in the tolling zone
roadside enforcement sub system	400	195	Primary Functions of the Tolling Zone Beacon	The beacon shall have the illumination capability to provide visual feedback to enforcement agency officers that are located within 100 feet of the beacon
roadside enforcement sub system	400	196	Primary Functions of the Tolling Zone Beacon	The beacon shall be located to allow vehicle operators that are traveling through the tolling zone to also see the device illuminate while maintaining a safe vehicle operating environment
roadside enforcement sub system	400	197	Beacon Equipment Requirements	The tolling zone beacons shall provide a visual signal and be directly controlled by the lane controller
roadside enforcement sub system	400	198	Beacon Equipment Requirements	The beacons shall be installed at the tolling zone in such a location that allows it to be seen by enforcement agency officers and motorists that are driving through the tolling zone

Sub System Name	Sub System Number	Requirement Number	Functional Requirement Label	Functional Requirement Description
vehicle detection system	500	199	Vehicle Detection Stations	As described in Section 4.3.3, the VDS equipment shall be deployed to measure real-time traffic flow and vehicle speed and serve as input into the dynamic setting of tolls for I4 Ultimate Managed Lanes usage
vehicle detection system	500	200	Vehicle Detection Stations	VDSs shall collect the current traffic volume, and speed data from specific roadway sections that are noted in the preliminary design plans. This information shall be transmitted to the FTE Tolls Back Office system which will be located at the FTE facility for analysis and dynamic pricing applications.
vehicle detection system	500	201	VDS Locations	An analysis was conducted to determine the appropriate ingress and egress locations which in turn helped to determine the location of the VDS equipment.
vehicle detection system	500	202	VDS Locations	Inductive loops shall be installed in the I4 Ultimate Managed Lanes and traffic sensing devices shall be installed on the roadway outside shoulder

Sub System Name	Sub System Number	Requirement Number	Functional Requirement Label	Functional Requirement Description
vehicle detection system	500	203	VDS Locations	Loops shall collect traffic volume and speed data from the I4 Ultimate Managed Lanes and the traffic sensing devices shall collect traffic data from the managed lanes which shall be utilized by the FTE Tolls Back Office system to develop travel time data
vehicle detection system	500	204	VDS Equipment Requirements	The VDS equipment shall be installed in standard FDOT cabinet as indicated in the preliminary plans
vehicle detection system	500	205	VDS Equipment Requirements	The VDS equipment shall be designed and operate in accordance with all current FDOT specifications
vehicle detection system	500	206	VDS Equipment Requirements	The VDS equipment shall be installed with a Model 170E Controller, which is the FDOT standard for such equipment
vehicle detection system	500	207	VDS Installation Requirements	The VDS controller cabinet shall be installed along the roadway adjacent to corresponding vehicle detection loops
vehicle detection system	500	208	VDS Installation	The cabinet shall be easily accessible from the ramp and/or the mainline by maintenance and

Sub System Name	Sub System Number	Requirement Number	Functional Requirement Label	Functional Requirement Description
			Requirements	operations personnel
vehicle detection system	500	209	VDS Installation Requirements	The cabinet locations shall be protected from traffic by placing them behind a guardrail or other similarly protected area
vehicle detection system	500	210	VDS Installation Requirements	The cabinet shall also be placed out of the flood plain and above the water level
vehicle detection system	500	211	VDS Installation Requirements	The loop detectors and traffic sensing devices shall be installed in accordance with standard FDOT practice
Tolling Communications Network	1000	212	Interface to FDOT Traffic Management Center	The VDS data shall be sent to the FDOT RTMC, via the FTE Tolls Back Office system communications link, for operational use by FDOT
Tolling Communications Network	1000	213	Interface to FDOT Traffic Management Center	The FTE Tolls Back Office system shall also have a direct communications link to the RTMC to allow FDOT staff to issue messages for display on the DMSs if incidents occur that warrant FDOT control of the I4 Ultimate Managed Lanes operation

Sub System Name	Sub System Number	Requirement Number	Functional Requirement Label	Functional Requirement Description
Tolling Communications Network	1000	214	Interface to FDOT Traffic Management Center	The FDOT D5 Secretary of Transportation shall also be part of the decision making process when incidents occur that require FDOT RTMC intervention
CCTV	900	215	Closed Circuit Television Cameras	Closed Circuit Television (CCTV) cameras shall be deployed for traffic condition surveillance, monitoring of the tolling zones and for safety reasons
CCTV	900	216	Closed Circuit Television Cameras	CCTV cameras shall also be used to assist FDOT staff in detecting incidents and to track the progress of incident response and clearance
CCTV	900	217	Closed Circuit Television Cameras	Video from these cameras shall be sent to the FTE Tolls Back Office system and RTMC where it is made available to third parties over the Internet. However, during normal operational periods FDOT D5 staff shall have control over the pan, tilt and zoom camera features and FDOT staff shall have only view access. During emergency situations, control of the video shall be provided to RTMC staff

Sub System Name	Sub System Number	Requirement Number	Functional Requirement Label	Functional Requirement Description
CCTV	900	218	Closed Circuit Television Cameras	The CCTV camera equipment shall include the following components: CCTV camera; Camera mounting pole; Pole foundation; CCTV control cabinet and Video and communication components and cables
CCTV	900	219	Closed Circuit Television Cameras	CCTV cameras shall be able to turn 360 degrees and contain pan, tilt and zoom capabilities
CCTV	900	220	Closed Circuit Television Cameras	The CCTV subsystem shall use Ethernet-based communications and protocols
CCTV	900	221	CCTV Camera Locations	The CCTV cameras shall be installed at locations according to the preliminary plans
roadside enforcement sub system	400	222	I4 Ultimate Managed Lanes Enforcement Overview	The high-level objective of the I4 Ultimate Managed Lanes enforcement process is to provide fair and transparent enforcement which results in an acceptable level of I4 Ultimate Managed Lanes use compliance and public acceptance

Sub System Name	Sub System Number	Requirement Number	Functional Requirement Label	Functional Requirement Description
roadside enforcement sub system	400	223	I4 Ultimate Managed Lanes Enforcement Process	The I4 Ultimate Managed Lanes will be separated from the General Use lanes by a physical barrier
roadside enforcement sub system	400	224	I4 Ultimate Managed Lanes Enforcement Process	Drivers shall only be able to legally access the I4 Ultimate Managed Lanes at designated access points marked with on-ramp and off-ramp striping
roadside enforcement sub system	400	225	I4 Ultimate Managed Lanes Enforcement Process	Tolling zones shall be located just downstream from the I4 Ultimate Managed Lanes entry point
roadside enforcement sub system	400	226	I4 Ultimate Managed Lanes Enforcement Process	I4 Ultimate Managed Lanes enforcement will be accomplished by enforcement agency officers who are either parked in pre-designed enforcement areas, remotely from their moving patrol cars using Mobile Enforcement Readers (MER) or from their motorcycles using hand-held enforcement devices in conjunction with the beacons

Sub System Name	Sub System Number	Requirement Number	Functional Requirement Label	Functional Requirement Description
roadside enforcement sub system	400	227	System Enforcement Approach	Tolling Zone Beacon: The lane controller, which is located at the tolling zone, shall initiate a signal every time a tag read occurs when a transponder equipped vehicle traverses the tolling zone. The beacon shall illuminate each time a tag is read and it is determined to be a valid SunPass™ transaction. This verification shall be made automatically by the lane controller by linking the transponder to the SunPass™ account and confirming that it is an account in good standing

Sub System Name	Sub System Number	Requirement Number	Functional Requirement Label	Functional Requirement Description
roadside enforcement sub system	400	228	System Enforcement Approach	Mobile Enforcement Reader: The MER is a SunPass™ antenna mounted on enforcement agency patrol cars allowing an officer to determine whether passing vehicles are equipped with a transponder that is in good standing. The officers can either park on the shoulder of the road or be traveling along the corridor and query whether passing vehicles are equipped with a valid transponder or not by touching the screen of a Personal Digital Assistant (PDA) device which triggers an RF read signal. The MER antenna shall then attempt to detect a SunPass™ on-board device and, if it does detect a tag, compares the antenna ID number against the tag status file that is resident on the MER to determine whether or not the transponder is linked to a good SunPass™ account. A MER shall permit I4 Ultimate Managed Lanes enforcement activities by enforcement agency officers while traveling at highway speeds. Once the officer determines that a potential violator has been detected, he/she would pursue the suspected violator and

Sub System Name	Sub System Number	Requirement Number	Functional Requirement Label	Functional Requirement Description
				request that the driver pull over.
roadside enforcement sub system	400	229	System Enforcement Approach	The PDA devices that are used in combination with the MER are a different type of unit than shall be integrated into the hand-held enforcement device

Sub System Name	Sub System Number	Requirement Number	Functional Requirement Label	Functional Requirement Description
roadside enforcement sub system	400	230	Enforcement System Primary Requirements	The FTE Tolls Back Office system accepts the tag status and customer data from the toll zone controller and is responsible for passing on this information to other components of the enforcement subsystem. Tag status information is transmitted to the lane controllers in each tolling zone on a periodic basis. Both tag status and customer descriptive data shall be downloaded to the MER's PDA device and the hand-held device over a high-speed connection
roadside enforcement sub system	400	231	Enforcement System Primary Requirements	As described previously, the lane controller shall be responsible for the monitoring and control of all equipment deployed at the tolling zones and for the transmission of SunPass™ transactions to the FTE Tolls Back Office system. For the enforcement subsystem, the lane controller, through the SunPass™ reader, shall determine whether a read is valid and illuminate the beacon light if the read is good

Sub System Name	Sub System Number	Requirement Number	Functional Requirement Label	Functional Requirement Description
roadside enforcement sub system	400	232	Enforcement System Primary Requirements	The MER shall determine whether passing vehicles are equipped with a transponder that is in good standing. The Officers can either park on the shoulder of the road or be traveling along the corridor and query whether passing vehicles are equipped with a valid transponder or not by touching the screen of a Personal Digital Assistant (PDA) device which triggers an RF read signal
roadside enforcement sub system	400	233	Enforcement System Primary Requirements	Hand-Held Device: This unit shall allow the enforcement agency officer to obtain account status information by waving the transponder across the top of the hand-held device. This will allow enforcement agency motorcycle officers to enforce the I4 Ultimate Managed Lanes
roadside enforcement sub system	400	234	Mobile Enforcement Reader	The MER shall be able to read a transponder and determine whether it is in good standing or not.
roadside enforcement sub system	400	235	Mobile Enforcement Reader	The MER shall be able to read on-board transponders, at highway speeds, at distances of up to 75 feet

Sub System Name	Sub System Number	Requirement Number	Functional Requirement Label	Functional Requirement Description
roadside enforcement sub system	400	236	Mobile Enforcement Reader	The MER shall operate in compliance with the SunPass™ Dedicated Short Range Communications (DSRC) specifications, protocol and operating parameters
roadside enforcement sub system	400	237	Mobile Enforcement Reader	The MER shall detect on-board transponders within the operating requirements that are used by the SunPass™ readers and antennas that are installed at the I4 Ultimate Managed Lanes tolling zones
roadside enforcement sub system	400	238	MER Equipment Requirements	The MER shall be weather proof, hardened for use outside and suitable for use by enforcement agency enforcement cars
roadside enforcement sub system	400	239	MER Equipment Requirements	The PDA display screen shall be visible under all lighting conditions
roadside enforcement sub system	400	240	MER Equipment Requirements	Power to the MER antenna and reader shall be provided by the enforcement agency vehicle's power source to ensure continuous use
roadside enforcement sub system	400	241	Handheld	The hand held device shall be able to read a transponder and determine whether it is a linked

Sub System Name	Sub System Number	Requirement Number	Functional Requirement Label	Functional Requirement Description
system			Enforcement Device	to a SunPass™ account that is in good standing;
roadside enforcement sub system	400	242	Handheld Enforcement Device	The hand held device shall operate within the SunPass™ DSRC protocol and operating standards
roadside enforcement sub system	400	243	Hand Held Equipment Requirements	The hand held device shall be small enough in size, weather proof, hardened for use outside and suitable for use by a enforcement agency motorcycle officer
roadside enforcement sub system	400	244	Enforcement Use of Personal Digital Assistant Devices	PDA's shall be used in support of both the MER and hand held enforcement devices.
roadside enforcement sub system	400	245	Enforcement Use of Personal Digital Assistant Devices	The PDA shall provide enforcement agency officers with readily accessible information on transponder identification numbers and related customer descriptive information
roadside enforcement sub system	400	246	Enforcement Use of Personal Digital Assistant Devices	The PDA shall also receive tag status downloads on, at least, a daily basis

Sub System Name	Sub System Number	Requirement Number	Functional Requirement Label	Functional Requirement Description
roadside enforcement sub system	400	247	Enforcement Use of Personal Digital Assistant Devices	The PDA shall receive tag status file data which includes the daily updated list of the valid and invalid transponders recognized by the FTE Tolls Back Office. This data shall be downloaded when the PDA is connected to the FTE Tolls Back Office system Wide Area Network (WAN
roadside enforcement sub system	400	248	Enforcement Use of Personal Digital Assistant Devices	The PDA shall receive tag status updates periodically throughout the day. This data shall be downloaded to the PDA over a secure, high-speed wireless communications connection
roadside enforcement sub system	400	249	Enforcement Use of Personal Digital Assistant Devices	The PDA will contain software to compare a transponder's identification with the tag status file and determine if the transponder is linked to an account in good standing
roadside enforcement sub system	400	250	Enforcement Use of Personal Digital Assistant Devices	The PDA shall display information in an intuitive format that requires minimal interaction on the part of the user
roadside enforcement sub system	400	251	PDA Equipment Requirements	The PDA shall be small in size, weather proof, hardened for use outside and suitable for use by

Sub System Name	Sub System Number	Requirement Number	Functional Requirement Label	Functional Requirement Description
				enforcement agency motorcycle officers.
roadside enforcement sub system	400	252	PDA Equipment Requirements	The PDA display screen shall be visible under all lighting conditions
roadside enforcement sub system	400	253	PDA Equipment Requirements	The PDA shall be able to receive data over a secure, high-speed, wireless WAN connection
roadside enforcement sub system	400	254	PDA Equipment Requirements	A rechargeable battery shall power the PDA that allows use for up to 12 hours of continuous use
FTE Tolls Back Office	100	255	FTE Tolls Back Office Customer Service Center	The existing FTE Tolls Back Office shall be slightly modified, by FTE Tolls Back Office's back office provider, to include I4 Ultimate Managed Lanes functionality
FTE Tolls Back Office	100	256	FTE Tolls Back Office Customer Service Center	The current business rules, procedures and practices of the FTE Tolls Back Office shall remain the same, but some changes will be necessary to accommodate the new I4 Ultimate Managed Lanes customers. One area in which changes will be required is to modify the FTE Tolls Back Office SunPass™ account statements to include I4

Sub System Name	Sub System Number	Requirement Number	Functional Requirement Label	Functional Requirement Description
				Ultimate Managed Lanes trips.
FTE Tolls Back Office	100	257	FTE Tolls Back Office Customer Service Center	Other changes are required to integrate the I4 Ultimate Managed Lanes operation into their back office processing, including agency codes, file names, etc.
FTE Tolls Back Office	100	258	FTE Tolls Back Office Customer Service Center	When accessing customer accounts, Customer Service Representatives (CSRs) shall be able to view I4 Ultimate Managed Lanes transactions as well as account information
FTE Tolls Back Office	100	259	FTE Tolls Back Office Customer Service Center	Current FTE Tolls Back Office SunPass™ customer statements shall be modified to include actual I4 Ultimate Managed Lanes trips that are made

Sub System Name	Sub System Number	Requirement Number	Functional Requirement Label	Functional Requirement Description
Tolling Communications Network	1000	260	Tolling Zones to FTE Tolls Back Office	Due to the distances between the Tolling Zones and the FTE Tolls Back Office system and the relatively high costs associated with adding new underground infrastructure, the communication links between the Tolling Zones and the FTE Tolls Back Office system shall utilize existing FDOT fiber, leased data communication services or a wireless communication network solution.
Tolling Communications Network	1000	261	Tolling Zones to FTE Tolls Back Office	These communication links shall provide a minimum 1.5Mbps data rate and shall have a high level of availability (99.999%).
Tolling Communications Network	1000	262	Tolling Zone to Tolling Zone	Tolling Zone to Tolling Zone communication shall be used to provide a redundant or backup communications path to the Tolling Data Center should the primary communications path fail
Tolling Communications Network	1000	263	Intra Tolling Zone	Intra Tolling communications is defined as the communications between the lane controller and the local field devices within the Tolling Zone. This includes the VDS, SunPass™ antenna and reader, DMS and CCTV cameras

Sub System Name	Sub System Number	Requirement Number	Functional Requirement Label	Functional Requirement Description
Tolling Communications Network	1000	264	Intra Tolling Zone	The coverage for any intra-TZ communications infrastructure is 0.5 mile per tolling zone
Tolling Communications Network	1000	265	Intra Tolling Zone	Secure point to point wireless communication links shall be used. For non-line-of-sight situations, repeaters shall be used
Tolling Communications Network	1000	266	Intra Tolling Zone	Where civil work is being undertaken within a Tolling Zone and it is practical to install underground infrastructure, or where conduit will be installed to provide electrical service to field devices, twisted pair cabling shall be used for low data rate applications and fiber optic cabling shall be used for high data rate applications
Tolling Communications Network	1000	267	FTE Tolls Back Office to Enforcement Devices	Communications between the FTE Tolls Back Office system and enforcement devices, including the MERs and the hand-held devices, shall utilize a secure, high-speed data connection to the PDA over a cellular data network
Tolling Communications Network	1000	268	FTE Tolls Back Office to Enforcement	The cellular data communications network shall provide uninterrupted coverage over the entire

Sub System Name	Sub System Number	Requirement Number	Functional Requirement Label	Functional Requirement Description
			Devices	length of the project.
Tolling Communications Network	1000	269	FTE Tolls Back Office to Enforcement Devices	The cellular data communications network shall provide a minimum data rate of 128kbps
Tolling Communications Network	1000	270	FTE Tolls Back Office to Enforcement Devices	The communication link between the enforcement device and the FTE Tolls Back Office system shall utilize Virtual Private Network (VPN) tunneling to establish a secure and encrypted connection

Appendix M: Communications Management Plan

1 Introduction

The purpose of the Communications Management Plan is to define the communication requirements for the project and how information will be distributed. The Communications Management Plan defines the following:

- What information will be communicated—to include the level of detail and format
- How the information will be communicated—in meetings, email, telephone, web portal, etc.
- When information will be distributed—the frequency of project communications both formal and informal
- Who is responsible for communicating project information
- Communication requirements for all project stakeholders
- What resources the project allocates for communication
- How any sensitive or confidential information is communicated and who must authorize this
- How changes in communication or the communication process are managed
- The flow of project communications
- Any constraints, internal or external, which affect project communications
- Any standard templates, formats, or documents the project must use for communicating
- An escalation process for resolving any communication-based conflicts or issues

This Communications Management Plan sets the communications framework for this project. It will serve as a guide for communications throughout the life of the project and will be updated as communication needs change. This plan identifies and defines the roles of persons involved in this project. It also includes a communications matrix which maps the communication requirements of this project. An in-depth guide for conducting meetings details the communications rules and how the meetings will be conducted, ensuring successful meetings. A project team directory is included to provide contact information for all stakeholders directly involved in the project.

2 Communications Management Approach

The Project Manager will take a proactive role in ensuring effective communications on this project. The communications requirements are documented in the Communications Matrix presented in this document. The Communications Matrix will be used as the guide for what information to communicate, who is to do the communicating, when to communicate it and to whom to communicate.

As with most project plans, updates or changes may be required as the project progresses or changes are approved. Changes or updates may be required due to changes in personnel, scope, budget, or other reasons. Additionally, updates may be required as the project matures and additional requirements are needed. The project manager is responsible for managing all proposed and approved changes to the communications management plan. Once the change is approved, the project manager will update the plan and supporting

documentation and will distribute the updates to the project team and all stakeholders. This methodology is consistent with the project's Change Management Plan and ensures that all project stakeholders remain aware and informed of any changes to communications management.

3 Communications Management Constraints

All project communication activities will occur within the project's approved budget, schedule, and resource allocations. The project manager is responsible for ensuring that communication activities are performed by the project team and without external resources which will result in exceeding the authorized budget. Communication activities will occur in accordance with the frequencies detailed in the Communication Matrix in order to ensure the project adheres to schedule constraints. Any deviation of these timelines may result in excessive costs or schedule delays and must be approved by the project sponsor.

FDOT D5 organizational policy states that where applicable, standardized formats and templates must be used for all formal project communications. The details of these policy requirements are provided in the section titled "Standardization of Communication" in this document.

FDOT D5 organizational policy also states that only the District Secretary of Transportation or higher level employee may authorize the distribution of confidential information. The FDT D5 project manager is responsible for ensuring that approval is requested and obtained prior to the distribution of any confidential information regarding this project.

4 Stakeholder Communication Requirements

As part of identifying all project stakeholders, the project manager will communicate with each stakeholder in order to determine their preferred frequency and method of communication. This feedback will be maintained by the project manager in the project's Stakeholder Register. Standard project communications will occur in accordance with the Communication Matrix; however, depending on the identified stakeholder communication requirements, individual communication is acceptable and within the constraints outlined for this project.

In addition to identifying communication preferences, stakeholder communication requirements must identify the project's communication channels and ensure that stakeholders have access to these channels. If project information is communicated via secure means or through internal company resources, all stakeholders, internal and external, must have the necessary access to receive project communications.

Once all stakeholders have been identified and communication requirements are established, the project team will maintain this information in the project's Stakeholder

Register and use this, along with the project communication matrix as the basis for all communications.

5 Roles

5.1 Project Sponsor – FDOT D5 District Secretary of Transportation

The project sponsor is the champion of the project and has authorized the project by signing the project charter. This person is responsible for the funding of the project and is ultimately responsible for its success. Since the Project Sponsor is at the executive level communications should be presented in summary format unless the Project Sponsor requests more detailed communications.

5.2 Program Manager – FDOT D5

The Program Manager oversees the project at the portfolio level and owns most of the resources assigned to the project. The Program Manager is responsible for overall program costs and profitability as such they require more detailed communications than the Project Sponsor.

5.3 Key Stakeholders – FTE, FDOT Central Office, FHWA, Selected Concessionaire (Integrator)

Stakeholders include all individuals and organizations who are impacted by the project. For this project we are defining a subset of the stakeholders as Key Stakeholders. These are the stakeholders with whom we need to communicate with and are not included in the other roles defined in this section. The Key Stakeholders includes executive management with an interest in the project and key users identified for participation in the project.

5.4 Change Control Board

The Change Control Board is a designated group which reviews technical specifications and authorizes changes within the organizations infrastructure. Technical design documents, user impact analysis and implementation strategies are typical of the types of communication this group requires.

5.5 Customer

The customer for this project is FDOT D5 As the customer who will be accepting the final deliverable of this project they will be informed of the project status including potential impacts to the schedule for the final deliverable or the product itself.

5.6 Project Manager

The Project Manager has overall responsibility for the execution of the project. The Project Manager manages day to day resources, provides project guidance and monitors and reports on the projects metrics as defined in the Project Management Plan. As the person responsible for the execution of the project, the Project Manager is the primary

communicator for the project distributing information according to this Communications Management Plan.

5.7 Project Team

The Project Team is comprised of all persons who have a role performing work on the project. The project team needs to have a clear understanding of the work to be completed and the framework in which the project is to be executed. Since the Project Team is responsible for completing the work for the project they played a key role in creating the Project Plan including defining its schedule and work packages. The Project Team requires a detailed level of communications which is achieved through day to day interactions with the Project Manager and other team members along with weekly team meetings.

5.8 Steering Committee

The Steering Committee includes management representing the departments which make up the organization. The Steering Committee provides strategic oversight for changes which impact the overall organization. The purpose of the Steering Committee is to ensure that changes within the organization are effected in such a way that it benefits the organization as a whole. The Steering Committee requires communication on matters which will change the scope of the project and its deliverables.

5.9 Technical Lead

The Technical Lead is a person on the Project Team who is designated to be responsible for ensuring that all technical aspects of the project are addressed and that the project is implemented in a technically sound manner. The Technical Lead is responsible for all technical designs, overseeing the implementation of the designs and developing as-build documentation. The Technical Lead requires close communications with the Project Manager and the Project Team.

6 Project Team Directory

The following table presents contact information for all persons identified in this communications management plan. The email addresses and phone numbers in table 2 will be used to communicate with these people.

Role	Name	Title	Organization/ Department	Email	Phone
Project Sponsor					
Program Manager					
Project Manager					
Project Stakeholders					
Customer					
Project Team					
Technical Lead					

Table 2: Communications Directory

6.1 Communication Methods and Technologies

The project team will determine, in accordance with FDOT D5 organizational policy, the communication methods and technologies based on several factors to include: stakeholder communication requirements, available technologies (internal and external), and organizational policies and standards.

The Integrator will as part of the RFP requirements, be directed to provide FDOT D5 with a SharePoint (or functionally equivalent) platform within the PMO which all projects use to provide updates, archive various reports, and conduct project communications. This platform enables senior management, as well as stakeholders with compatible technology, to access project data and communications at any point in time. SharePoint also provides the ability for stakeholders and project team members to collaborate on project work and communication.

For stakeholders who do not have the ability to access SharePoint, a web site will also be established for the project. Access to the website will be controlled with a username and password. Any stakeholders identified who are not able to access SharePoint will be issued a unique username and password in order to access the web site. The project manager is responsible for ensuring all project communications and documentation are copied to the web site and that the content mirrors what is contained on the SharePoint platform.

FDOT D5 maintains software licenses for MS Project software. All project teams are responsible for developing, maintaining, and communicating schedules using this software. PERT Charts are the preferred format for communicating schedules to stakeholders. The project schedule will be maintained on both the SharePoint platform and the project website.

All project communication and documentation, in addition to being maintained on the SharePoint platform and project website, will be archived on the internal FDOT D5 shared drive which resides in the PMO program directory. Organizational naming conventions for files and folder will be applied to all archived work.

Communications Matrix

Table 3: Communications Requirements.

Communication Type	Objective of Communication	Medium	Frequency	Audience	Owner	Deliverable	Format
Kickoff Meeting	Introduce the project team and the project. Review project objectives and management approach.	Face to Face	Once	Project Sponsor Project Team Stakeholders	Project Manager	Agenda Meeting Minutes	Soft copy archived on project SharePoint site and project web site
Project Team Meetings	Review status of the project with the team.	Face to Face Conference Call	Weekly	Project Team	Project Manager	Agenda Meeting Minutes Project schedule	Soft copy archived on project SharePoint site and project web site
Technical Design Meetings	Discuss and develop technical design solutions for the project.	Face to Face	As Needed	Project Technical Staff	Technical Lead	Agenda Meeting Minutes	Soft copy archived on project SharePoint site and project web site
Monthly Project Status Meetings	Report on the status of the project to management.	Face to Face Conference Call	Monthly	PMO	Project Manager	Slide updates Project schedule	Soft copy archived on project SharePoint site and project web site

Communication Type	Objective of Communication	Medium	Frequency	Audience	Owner	Deliverable	Format
Project Status Reports	Report the status of the project including activities, progress, costs and issues.	Email	Monthly	Project Sponsor Project Team Stakeholders PMO	Project Manager	Project Status Report Project schedule	Soft copy archived on project SharePoint site and project web site

7 Communication Flowchart

The communication flowchart below was created to aid in project communication. This flowchart provides a framework for the project team to follow for this project. However, there may be occasions or situations which fall outside of the communication flowchart where additional clarification is necessary. In these situations the Project Manager is responsible for discussing the communication with the Project Sponsor and making a determination on how to proceed.

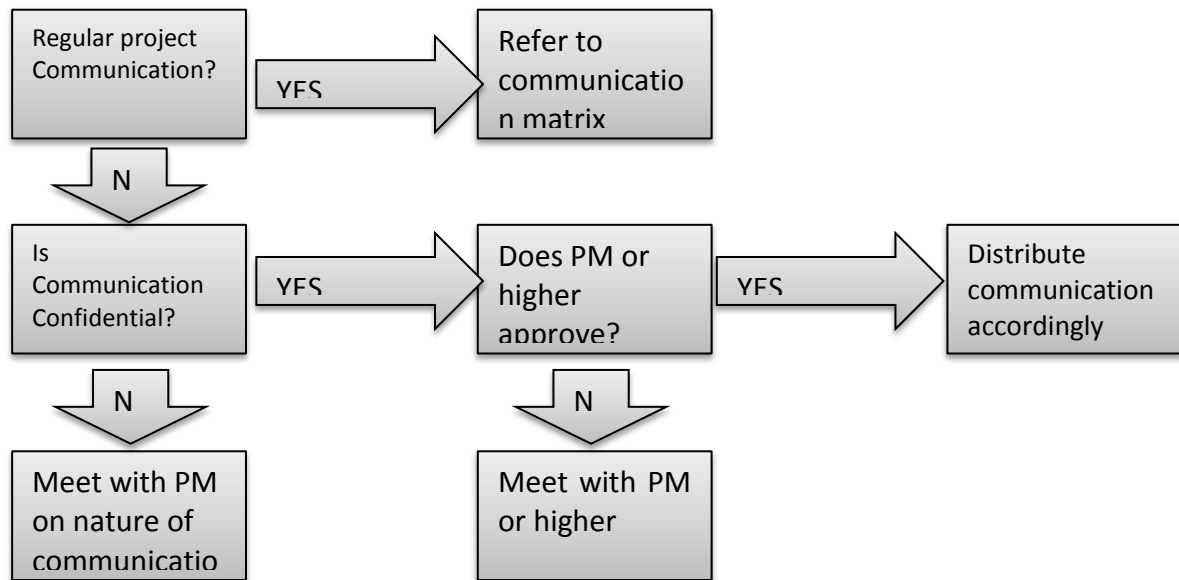


Figure 14: communications Flow Chart

8 Guidelines for Meetings

8.1 Meeting Agenda

Meeting Agenda will be distributed 5 business days in advance of the meeting. The Agenda should identify the presenter for each topic along with a time limit for that topic. The first item in the agenda should be a review of action items from the previous meeting.

8.2 Meeting Minutes

Meeting minutes will be distributed within 2 business days following the meeting. Meeting minutes will include the status of all items from the agenda along with new action items and the Parking Lot list.

8.3 Action Items

Action Items are recorded in both the meeting agenda and minutes. Action items will include both the action item along with the owner of the action item. Meetings will start with a review of the status of all action items from previous meetings and end with a review of all new action items resulting from the meeting. The review of the new action items will include identifying the owner for each action item.

8.4 Meeting Chair Person

The Chair Person is responsible for distributing the meeting agenda, facilitating the meeting and distributing the meeting minutes. The Chair Person will ensure that the meeting starts and ends on time and that all presenters adhere to their allocated time frames.

8.5 Note Taker

The Note Taker is responsible for documenting the status of all meeting items, maintaining a Parking Lot item list and taking notes of anything else of importance during the meeting. The Note Taker will give a copy of their notes to the Chair Person at the end of the meeting as the Chair Person will use the notes to create the Meeting Minutes.

8.6 Time Keeper

The Time Keeper is responsible for helping the facilitator adhere to the time limits set in the meeting agenda. The Time Keeper will let the presenter know when they are approaching the end of their allocated time. Typically a quick hand signal to the presenter indicating how many minutes remain for the topic is sufficient.

8.7 Parking Lot

The Parking Lot is a tool used by the facilitator to record and defer items which aren't on the meeting agenda; however, merit further discussion at a later time or through another forum.

A parking lot record should identify an owner for the item as that person will be responsible for ensuring follow-up. The Parking Lot list is to be included in the meeting minutes.

9 Communication Standards

For this project, FDOT D5 will utilize standard organizational formats and templates for all formal project communications. Formal project communications are detailed in the project's communication matrix and include:

9.1 Kickoff Meeting

Project team will utilize FDOT D5 standard templates for meeting agenda and meeting minutes. Additionally, any slides presented will use the FDOT D5 standard slideshow template.

9.2 Project Team Meetings

Project team will utilize FDOT D5 standard templates for meeting agenda and meeting minutes. Additionally, any slides presented will use the FDOT D5 standard slideshow template.

9.3 Technical Design Meetings

Project team will utilize FDOT D5 standard templates for meeting agenda and meeting minutes. Additionally, any slides presented will use the FDOT D5 standard slideshow template.

9.4 Monthly Project Status Meetings

Project team will utilize FDOT D5 standard templates for meeting agenda and meeting minutes. Additionally, any slides presented will use the FDOT D5 standard slideshow template.

9.5 Project Status Reports

Project team will utilize FDOT D5 standard templates for meeting agenda and meeting minutes. Additionally the standard project status report document, available on the share drive, will be used to provide project status.

Informal project communications should be professional and effective but there is no standard template or format that must be used.

10 Communication Escalation Process

Efficient and timely communication is the key to successful project completion. As such, it is imperative that any disputes, conflicts, or discrepancies regarding project communications are resolved in a way that is conducive to maintaining the project schedule, ensuring the correct communications are distributed, and preventing any ongoing difficulties. In order to ensure projects stay on schedule and issues are resolved, FDOT D5 will use its standard escalation model to provide a framework for escalating communication issues. Table 4 below defines the priority levels, decision authorities, and timeframes for resolution.

Priority	Definition	Decision Authority	Timeframe for Resolution
Priority 1	Major impact to project or business operations. If not resolved quickly there will be a significant adverse impact to revenue and/or schedule.	District Secretary of Transportation or higher	Within 4 hours
Priority 2	Medium impact to project or business operations which may result in some adverse impact to revenue and/or schedule.	Project Sponsor	Within one business day
Priority 3	Slight impact which may cause some minor scheduling difficulties with the project but no impact to business operations or revenue.	Project Manager	Within two business days
Priority 4	Insignificant impact to project but there may be a better solution.	Project Manager	Work continues and any recommendations are submitted via the project change control process

Table 4: Communications Escalation Process

Any communication including sensitive and/or confidential information will require escalation to District Secretary level or higher for approval prior to external distribution.

Appendix N: Procurement Management Plan

1 Introduction

The purpose of the Procurement Management Plan is to define the procurement requirements for the I-4 Managed Lanes Project and how it will be managed from developing procurement documentation through contract closure. The Procurement Management Plan defines the following:

- Items to be procured with justification statements and timelines
- Type of contract to be used
- Risks associated with procurement management
- How procurement risks will be mitigated through contract performance metrics, insurance, or other means
- Determining costs and if/how they're used as evaluation criteria
- Any standardized procurement templates or documents to be used
- How multiple suppliers will be managed if applicable
- Contract approval process
- Decision criteria
- Establishing contract deliverables and deadlines
- How procurement and contracts are coordinated with project scope, budget, and schedule
- Any constraints pertaining to procurement
- Direction to sellers on baseline requirements such as contract schedules and work breakdown structures (WBSs)
- Integrator Management
- Identification of any prequalified sellers if applicable
- Performance metrics for procurement activities

This Procurement Management Plan sets the procurement framework for this project. It will serve as a guide for managing procurement throughout the life of the I-4 Managed Lanes Project and will be updated as acquisition needs change. This plan identifies and defines the items to be procured, the types of contracts to be used in support of this project, the contract approval process, and decision criteria. The importance of coordinating procurement activities, establishing firm contract deliverables, and metrics in measuring procurement activities is included. Other items included in the procurement management plan include: procurement risks and procurement risk management considerations; how costs will be determined; how standard procurement documentation will be used; and procurement constraints.

2 Procurement Management Approach

The FDOT D5 FDOT D5 Project Manager will provide oversight and management for all procurement activities under this project. The FDOT D5 Project Manager will work with the I-4 Managed Lanes Project team to identify all items to be procured for the successful completion of the I-4 Managed Lanes Project. The Project Management Office (PMO) will then review the procurement list prior to submitting it to the contracts and purchasing department. The contracts and purchasing department will review the procurement items,

determine whether it is advantageous to make or buy the items, and begin the Integrator selection, purchasing and the contracting process.

3 Procurement Definition

The following procurement items and/or services have been determined to be essential for project completion and success. The following list of items/services, justification, and timeline are pending PMO review for submission to the contracts and purchasing department:

ID	Item/Service	Justification	Needed By
A	Electronic toll collection and pricing system		
B	ITS		

In addition to the above list of procurement items, the following individuals are authorized to approve purchases for the I-4 Managed Lanes Project team:

Name	Role

4 Type of Contract to be used

All items and services to be procured for this project will be solicited under the auspices of a Public Private Partnership agreement that will be competitively bid as a public procurement. The project team will work with the contracts and purchasing department to define and RFP for the procurement of the services. The contracts and purchasing department will then solicit bids from various concessionaires in order to procure the items within the required time frame and at a reasonable cost under the firm fixed price contract once the concessionaire is selected. This contract will be awarded with an xx year concession term with agreed availability payments..

5 Procurement Risks

All procurement activities carry some potential for risk which must be managed to ensure project success. While all risks will be managed in accordance with the I-4 Managed Lanes Project's risk management plan, there are specific risks which pertain specifically to procurement which must be considered:

- Unrealistic schedule and cost expectations for concessionaires
- Construction capacity capabilities of concessionaires
- Conflicts with current contracts and Integrator relationships
- Configuration management for upgrades and improvements of purchased technology
- Potential delays in shipping and impacts on cost and schedule
- Questionable past performance for Integrators
- Potential that final product does not meet required specifications

These risks are not all-inclusive and the standard risk management process of identifying, documenting, analyzing, mitigating, and managing risks will be used.

6 Procurement Risk Management

As previously stated, project risks will be managed in accordance with the I-4 Managed Lanes Project's risk management plan. However, for risks related specifically to procurement, there must be additional consideration and involvement. Project procurement efforts involve external organizations and potentially affect current and future business relationships as well as internal supply chain and Integrator management operations. Because of the sensitivity of these relationships and operations the I-4 Managed Lanes Project team will include the I-4 Managed Lanes Project sponsor and a designated representative from the contracting department in all project meetings and status reviews.

Additionally, any decisions regarding procurement actions must be approved by the I-4 Managed Lanes Project sponsor before implementation. Any issues concerning procurement actions or any newly identified risks will immediately be communicated to the I-4 Managed Lanes Project's contracting department point of contact as well as the I-4 Managed Lanes Project sponsor.

7 Cost Determination

For this project we will issue a Request for Proposal (RFP) in order to solicit proposals from concessionaire teams which describe how they will meet our requirements and the cost of doing so. All proposals will include Integrator support for items in the RFP as well as the base and out-year costs. The Integrators will outline how the work will be accomplished, who will perform the work, Integrators' experience in providing these goods, customer testimonials, backgrounds and resumes of employees performing the work, and a line-item breakdown of all costs involved. Additionally, the Integrators will be required to submit work breakdown structures (WBSs) and work schedules to show their

understanding of the work to be performed and their ability to meet the I-4 Managed Lanes Project schedule.

All information must be included in each proposal as the proposals will be used as the foundation of our selection criteria. Proposals which omit solicited information or contain incomplete information will be discarded from consideration.

8 Standardized Procurement Documentation

The procurement management process consists of many steps as well as ongoing management of all procurement activities and contracts. In this dynamic and sensitive environment, our goal must be to simplify procurement management by all necessary means in order to facilitate successful completion of our contracts and project. To aid in simplifying these tasks, we will use standard documentation for all steps of the procurement management process. These standard documents have been developed and revised over a period of many years in an effort to continually improve procurement efforts. They provide adequate levels of detail which allows for easier comparison of proposals, more accurate pricing, more detailed responses, and more effective management of contracts and Integrators.

The PMO maintains a repository on the company's shared drive which contains standard project management and procurement documentation that will be used for this project. The following standard documents will be used for project procurement activities:

Standard Request for Proposal Template to include:

- Background
- Proposal process and timelines
- Proposal guidelines
- Proposal formats and media
- Source selection criteria
- Pricing forms
- Statement of work
- Terms and Conditions
- Internal source selection evaluation forms
- Non-disclosure agreement
- Letter of intent
- Firm fixed price contract
- Procurement audit form
- Procurement performance evaluation form
- Lessons learned form

9 Procurement Constraints

There are several constraints that must be considered as part of the I-4 Managed Lanes Project's procurement management plan. These constraints will be included in the RFP and communicated to all Integrators in order to determine their ability to operate within these constraints. These constraints apply to several areas which include schedule, cost, scope, resources, and technology:

9.1 Schedule:

Project schedule is not flexible and the procurement activities, contract administration, and contract fulfillment must be completed within the established project schedule.

9.2 Cost:

Project budget has contingency and management reserves built in; however, these reserves may not be applied to procurement activities. Reserves are only to be used in the event of an approved change in project scope or at management's discretion.

9.3 Scope:

All procurement activities and contract awards must support the approved project scope statement. Any procurement activities or contract awards which specify work which is not in direct support of the I-4 Managed Lanes Project's scope statement will be considered out of scope and disapproved.

9.4 Resources:

All procurement activities must be performed and managed with current personnel. No additional personnel will be hired or re-allocated to support the procurement activities on this project.

9.5 Technology:

Parts specifications have already been determined and will be included in the statement of work as part of the RFP. While proposals may include suggested alternative material or manufacturing processes, parts specifications must match those provided in the statement of work exactly.

10 Contract Approval Process

The first step in the contract approval process is to determine what items or services will require procurement from outside Integrators. This will be determined by conducting a cost analysis on products or services which can be provided internally and compared with purchase prices from Integrators. Once cost analyses are complete and the list of items and services to be procured externally is finalized, the purchasing and contracts department will send out solicitations to outside Integrators. Once solicitations are complete and proposals have been received by all Integrators the approval process begins. The first step of this

process is to conduct a review of all Integrator proposals to determine which meet the criteria established by the I-4 Managed Lanes Project team and the purchasing and contracts department. Purchases less than the Project Manager's spending limit only require the approval of the FDOT D5 Project Manager; whereas, purchases greater than the Project Manager's spending limit must be approved by the Contract Review Board. For these larger purchases the contract review board will meet to determine which contract will be accepted. The Contract Review Board consists of representatives from the I-4 Managed Lanes Project team, purchasing and contracts department, finance, and the PMO.

11 Decision Criteria

The criteria for the selection and award of procurement contracts under this project will be based on the following decision criteria:

- Ability of the Integrator to provide all items by the required delivery date
- Quality
- Cost
- Expected delivery date
- Comparison of outsourced cost versus in-sourcing
- Past performance

These criteria will be measured by the contracts review board and/or the FDOT D5 Project Manager. The ultimate decision will be made based on these criteria as well as available resources.

12 Integrator Management

The FDOT D5 Project Manager is ultimately responsible for managing Integrators. In order to ensure the timely delivery and high quality of products from Integrators the FDOT D5 Project Manager, or his/her designee will meet weekly with the contract and purchasing department and each Integrator to discuss the progress for each procured item. The meetings can be in person or by teleconference. The purpose of these meetings will be to review all documented specifications for each product as well as to review the quality test findings. This forum will provide an opportunity to review each item's development or the service provided in order to ensure it complies with the requirements established in the I-4 Managed Lanes Project specifications. It also serves as an opportunity to ask questions or modify contracts or requirements ahead of time in order to prevent delays in delivery and schedule. The FDOT D5 Project Manager will be responsible for scheduling this meeting on a weekly basis until all items are delivered and are determined to be acceptable.

13 Performance Metrics for Procurement Activities

While the purchasing and contracts department has their own internal metrics for procurement, the following metrics are established for Integrator performance for this project's procurement activities. Each metric is rated on a 1-3 scale as indicated below:

Integrator	Product Quality	On Time Delivery	Documentation Quality	Development Costs	Development Time	Cost per Unit	Transactional Efficiency
Integrator #1							
Integrator #2							

1 – Unsatisfactory

2 – Acceptable

3 - Exceptional

In addition to rating each Integrator, actual values will be noted in order to build a past-performance data base for selecting Integrators for future procurement activities.