Technical Memorandum No. 3.1

Statewide Quality Assurance Plan for Intelligent Transportation System Deployments

October 4, 2004
Version 3

Prepared for:

Florida Department of Transportation
Traffic Engineering and Operations Office
Intelligent Transportation Systems (ITS) Section
605 Suwannee Street, M.S. 90
Tallahassee, Florida 32399-0450
(850) 410-5600

DOCUMENT CONTROL PANEL		
File Name:	*Technical Memorandum No. 3.1: Statewide Quality Assurance Plan for Intelligent Transportation System Deployments*	
File Location:	W:\ITS Program\ITS GC\TWO31-QA Process\QCAP\Redlines\040917 TWO31 TM3-1 V3.pdf	
Deliverable Number:	3.1	
Version Number:	3	
	Name	**Date**
Created By:	Martin S. Sas	February 16, 2004
Reviewed By:	John M. Bonds	February 26, 2004
	FDOT QA Plan Review Committee	May 17, 2004
	John M. Bonds	July 7, 2004
	John M. Bonds	September 16, 2004
Modified By:	John M. Bonds	March 1, 2004
	Dave Hodges	March 2, 2004
	Martin Sas	July 29, 2004
	John M. Bonds	July 7, 2004
	Dave Hodges	July 22, 2004
	John M. Bonds	July 27, 2004
	Pamela L. Hoke	August 12, 2004
Completed By:	Pamela L. Hoke	October 4, 2004

Table of Contents

List of Appendices iv

List of Tables iv

List of Figures iv

List of Acronyms v

Definitions vi

1. Overview 1

1.1 Scope 2

1.2 Purpose 2

1.3 Quality Management References 3

1.3.1 The *Statewide Systems Engineering Management Plan* 3
1.3.2 The Florida Department of Transportation's Implementation of *Rule 940* 4
1.3.3 The *National Consensus Standard for Configuration* Management 4
1.3.4 *Quality Management Systems – Guidelines for Configuration Management* 4
1.3.5 The Family of *International Quality Management Standards* 5
1.3.6 The Florida Department of Transportation's *Quality Assurance Evaluation* 5
1.3.7 The Intelligent Transportation System Device Specifications 5
1.3.8 The Intelligent Transportation System Approved Products List 5

2. Quality Management 6

3. The Quality Management Process 9

3.1 General 10

3.2 Staffing and Responsibilities 12
3.2.1 District Intelligent Transportation System Specialist 12
3.2.2 Quality Assessment Engineer 13
3.2.3 Project Engineer 14
3.2.4 Technical Project Engineer 14

3.3 Documentation 15

3.4 Quality Assurance Processes 15

3.5 Reports Produced 16

3.6 Change Control 16
3.6.1 Noncompliance Reporting Procedures 17
3.6.2 Identification of Changes 17
3.6.2.1 Engineering Change Proposals 17

3.7 Configuration Audit 18

4. Checklists 19

List of Appendices

Appendix A – Quality Assurance Plan Template
Appendix B – Quality Assurance Checklists

List of Tables

Table of Definitions vi
Table 4.1 – Quality Assurance Checklist Implementation 21

List of Figures

Figure 3.1 – The Hub of Quality Assurance Management 10

List of Acronyms

ANSI ..... American National Standards Institute
APL ..... Approved Products List
CFP ..... Cost Feasible Plan
CM ..... Configuration Management
ECP ..... Engineering Change Proposal
ECO ..... Engineering Change Order
EIA ..... Electronic Industries Alliance
FDOT ..... Florida Department of Transportation
FHWA ..... Federal Highway Administration
FTA ..... Federal Transit Administration
GEC ..... General Engineering Consultant
IEEE ..... Institute of Electrical and Electronics Engineers
ICD ..... Interface Control Document
ISO ..... International Organization for Standardization
ITN ..... Invitation to Negotiate
ITS ..... Intelligent Transportation Systems
LRTP ..... Long Range Transportation Plan
NITSA ..... National Intelligent Transportation Systems Architecture
NTCIP ..... *National Transportation Communications for ITS Protocol*
QA ..... Quality Assurance
QC ..... Quality Control
QM ..... Quality Management
RFD ..... Request for Deviation
RFP ..... Request for Proposals
RFV ..... Request for Variance
RITSA ..... Regional Intelligent Transportation System Architecture
RTMC ..... Regional Transportation Management Center
SEMP ..... *Systems Engineering Management Plan*
SEP ..... Systems Engineering Process
TEA-21 ..... Transportation Equity Act for the 21st Century
TERL ..... Traffic Engineering Research Laboratory
USDOT ..... United States Department of Transportation

Definitions

For the purpose of this document, the definitions contained in the following table are provided to enhance understanding of the terms and processes addressed in Florida's *Statewide Quality Assurance Plan for Intelligent Transportation System Deployments*, commonly referred to as the *Statewide ITS QA Plan*.

Table of Definitions

TERM	DEFINITION
Configuration	Functional and physical characteristics of a product (or system)
Configuration Management (CM)	A management activity that applies technical and administrative direction for establishing and maintaining control of a product (or system) and its configuration information throughout its life cycle
Quality Assurance (QA)	The term "quality assurance" includes the following meanings: • All actions taken to ensure that standards and procedures are adhered to, and that delivered products or services meet performance requirements; • The planned systematic activities necessary to ensure that a component, module, or system conforms to established technical requirements; and • The policies, procedures, and systematic actions an enterprise establishes for the purpose of providing and maintaining a specified degree of confidence in data integrity and accuracy throughout the life cycle of the data, which includes input, update manipulation, and output. It includes oversight of a project quality assurance/quality control (QA/QC) plan's implementation.
Quality Assurance (QA) Milestone	A "milestone" is a measurable action, condition, or goal that marks a point of achievement on the way to solving a problem. The milestone has meaning or importance to the decision and solution of events in a process, such as with an acceptance test, the integration of dynamic message signs (DMSs) with a communication server, the quality review of design plans, etc. The schedule typically includes the timing for this event.
Quality Audit	An *audit* is the systematic, independent, and documented process used to obtain evidence and evaluate it objectively to determine the extent to which the criteria are fulfilled. *Criteria* is defined as a set of policies, procedures, or other requirements against which collected evidence, such as records, statements of fact, or other information relevant to an audit, are compared and verified.
Quality Control (QC)	The overall system of technical activities that measures the attributes and performance of a process, item, or service against defined standards to verify that they meet the stated requirements. Quality control is also referred to as "configuration control."

Table of Definitions

TERM	DEFINITION
Quality Checkpoint	A *quality checkpoint* may be considered a high-level quality *checklist.* The project quality plan provides a narrative of who will be involved; the criteria for evaluation; and who will conduct and approve the review. The quality checklist expands on the narrative by identifying all of the key items required to implement and evaluate the effectiveness of the project activities.
Quality Management (QM)	A number of interrelated processes to lead and operate an organization that are aimed at continually improving performance, management, and process effectiveness over the long term by focusing on customers while addressing the needs of all stakeholders.
Quality Review	The quality assessment and review defines what activity and/or documents will be reviewed; who will conduct the review; and what criteria will be used to determine compliance with quality objectives and stated requirements. The date a QA review is to occur is a schedule milestone. It may also be referred to as a "quality milestone."
Product Configuration Baseline	Characteristics of a product (or system) at a point in time that serves as reference for activities throughout its life cycle
Process Management	This is the collection of practices used to implement and improve quality management and process effectiveness across an organization. Process management treats the organization as a group of interrelated processes that ultimately affect quality.
Systems Approach to Management	Identifying, understanding, and managing interrelated processes as a system contributes to an organization's effectiveness and efficiency in achieving its objectives.

1. Overview

The Florida Department of Transportation's (FDOT) *Ten-Year ITS Cost Feasible Plan*,[1] hereinafter referred to as the *CFP*, contains a number of proposed intelligent transportation system (ITS) deployments throughout Florida and represents an investment of over $770 million dollars. It is critically important that these ITS deployments be able to exchange information and operate seamlessly together in order to achieve maximum synergy for the FDOT's investment in technology. As the *CFP* is executed, the interoperability aspect of the ITS Program is a key element of Federal Highway Administration (FHWA) *Rule 940*,[2] which became effective April 8, 2001. A standard *Statewide Quality Assurance Plan for Intelligent Transportation System Deployments* (referred to as the *Statewide ITS QA Plan*) that can be used as a checklist by District engineers will assure the interoperability of some 2,000 ITS field devices with 12 regional transportation management centers (RTMCs) and more than 500 legacy field devices.

For the purposes of this document, a deployment refers to all of the activities associated with the fielding and implementation of a project or program. Usually, the term program refers to a group of projects that constitute all of the elements of a program. For the purposes of this document, project and program are synonymous. This *Statewide ITS QA Plan* addresses, among other things, ITS interoperability though harmonization of ITS standards and specifications; standardized procedures for execution of acceptance testing; and long-term systems management through established configuration management (CM) processes,[3] an essential element of quality control (QC).

[1] Florida Department of Transportation, *Ten-Year ITS Cost Feasible Plan* (December 2003). FDOT Contract No. C-7772, Task Work Order No. 1023. Available online at http://www.dot.state.fl.us/IntelligentTransportationSystems/ITSDeployment/deployment.htm

[2] United States Department of Transportation, Federal Highway Administration, *Intelligent Transportation System Architecture and Standards* (June 1998), 23 CFR Parts 655 and 940, Pub.L.No. 105-178, 112 Stat. 457.

[3] Adapted from a letter written by Mr. Hebbani Lokesh, Federal Highway Administration, Florida Division, Traffic Operations and ITS Engineer, to the Florida Department of Transportation on or about December 2003.

1.1 Scope

The FDOT's *Statewide Systems Engineering Management Plan* (*SEMP*)[4] defines the interdisciplinary tasks and processes required throughout a system's life cycle to transform customer needs, requirements, and constraints into an ITS solution. Quality management (QM) is a critical element of the systems engineering process (SEP) that is essential to the verification and validation of system requirements. It is important to have in place standard management and administrative processes that all FDOT Districts can implement in a uniform manner to ensure project compliance with the requirements.

1.2 Purpose

The purpose of this document is to provide guidance to the FDOT Districts in the implementation of uniform QA/QC processes for the deployment of ITS programs, projects, or products. This document:

- Provides information on why a QA/QC plan is important;
- Cites applicable standards and references;
- Defines and establishes a uniform process for implementing and improving QA/QC functions statewide;
- Provides a basic template to develop and implement a workable QA/QC project plan for ITS project deployments statewide; and
- Provides QA/QC checklists to be used as a baseline for ITS project deployments statewide.

[4] Bonds, John M., Christopher S. Bausher, Robert A. Nielsen, and Martin S. Sas (PBS&J) and Troy Nguyen (Global Intergy Corporation), *Deliverable 1-7: Technical Memorandum – Draft Florida Department of Transportation Systems Engineering Management Plan, Version 1* (June 2004). FDOT Contract No. C-7772, Task Work Order No. 1011. The draft sections of this document are available online at http://floridaits.com/system_engineering.htm

1.3 Quality Management References

The guidelines presented in this document are derived from many sources, including quality management references; ITS and *National Transportation Communications for Intelligent Transportation Systems Protocol* (*NTCIP*) standards[5]; regional ITS architectures (RITSAs); and FDOT guidance and recommendations for compliance among ITS deployments in Florida. These documents include the FDOT *Statewide SEMP*; the FDOT's implementation of FHWA *Rule 940*; the American National Standards Institute (ANSI) and Electronic Industries Alliance's (EIA) standard entitled the *National Consensus Standard for Configuration Management*[6]; the International Organization for Standardization's (ISO) standard entitled *Quality Management Systems – Guidelines for Configuration Management*[7]; the *IS0 9000* family of international quality management standards[8]; the FDOT's *Quality Assurance (QA) Evaluation*[9]; the FDOT's ITS Device Specifications[10]; and the ITS Approved Products List (APL).[11]

1.3.1 The Statewide Systems Engineering Management Plan

The *Statewide SEMP* provides the guidance and necessary tools for FDOT ITS engineers to develop, deploy, and maintain an ITS project. Since the FDOT's *Statewide SEMP* is broad in nature, each project will be expected to generate its own project SEMP, including the necessary project-specific plans and processes.

---

[5] More information regarding the *NTCIP* standards is available online at http://www.ntcip.com/

[6] American National Standards Institute and Electronic Industries Alliance, *ANSI/EIA-649 – National Consensus Standard for Configuration Management* (1998), *Rev. A (Draft) 9.10* (February 2003).

[7] International Organization for Standardization, *ISO 10007: Quality Management Systems – Guidelines for Configuration Management, Revision 3* (June 2003).

[8] International Organization for Standardization, *ISO 9000: Quality Management Standards* (2000).

[9] The *Quality Assurance (QA) Evaluation* (November 2002) was produced by the Traffic Engineering Research Laboratory for the Florida Department of Transportation and is currently under revision. More information is available online at http://potentia.eng.fsu.edu/terl/areas_of_work_quality_engineering.htm

[10] The Florida Department of Transportation's current ITS Device Specifications are available online at http://floridaits.com/SSEP/index.html

[11] The ITS Approved Products List is currently under development. More information is available online at http://floridaits.com/SSEP/index.html

1.3.2 The Florida Department of Transportation's Implementation of Rule 940

On April 8, 2001, the FHWA issued *Rule 940* entitled *Intelligent Transportation System Architecture and Standards*. Concurrently, the Federal Transit Administration (FTA) issued a policy entitled the *National ITS Architecture Policy on Transit Projects*.[12] The intent of the *Rule* and *Policy* is to require procedures for implementing *Section 5206(e)* of the *Transportation Equity Act for the 21st Century* (*TEA-21*)[13] so that ITS projects conform to the *National ITS Architecture* (*NITSA*)[14] and standards, as well other ITS standards adopted by the United States Department of Transportation (USDOT).

The purpose of the FDOT's *Statewide Implementation Strategy*[15] is to recommend an approach for *Rule 940* implementation in Florida, and to develop guidelines for the integration of ITS in the planning process and the long-range transportation plan (LRTP).

1.3.3 The National Consensus Standard for Configuration Management

The *ANSI/EIA-649* standard defines CM terminology and establishes a CM process using five principal functions. It is widely used for commercial products, systems, and services; and is recognized as the *National Consensus Standard for Configuration Management*.

1.3.4 Quality Management Systems – Guidelines for Configuration Management

The *ISO 10007* standard promotes a common understanding of QM processes focusing on CM. The standard provides general guidance on the use of CM within an organization that can easily be mapped to the principles in the *EIA-649* and *ANSI/EIA-632*[16] standards, and the Institute of Electrical and Electronics Engineers' (IEEE) standard regarding the SEP.[17]

---

[12] United States Department of Transportation, Federal Transit Administration, *National ITS Architecture Policy on Transit Projects* (February 2001). *Federal Register, Vol. 66, No. 5, 1455-1459*.

[13] *Transportation Equity Act for the 21st Century* (*TEA-21*) (June 1998). Pub.L.No. 105-178, 112 Stat. 107 (1998).

[14] United States Department of Transportation, *National ITS Architecture*, *Version 5.0*. Available online at http://www.iteris.com/itsarch

[15] Quigley, Diane E. (PBS&J), *Florida's Rule 940 Statewide Implementation Strategy* (June 2002). FDOT Contract No. C-7772, Task Work Order No. 7. Available online at http://www.floridaits.com/rule_940_implementation.htm

[16] American National Standards Institute and Electronic Industries Alliance, *ANSI/EIA-632 – Standard Processes for Engineering a System* (January 1999).

[17] Institute of Electrical and Electronics Engineers, *IEEE 1220 – Application and Management of the Systems Engineering Process* (December 1998).

1.3.5 The Family of International Quality Management Standards

The *ISO 9000* family is among the ISO's most widely known standards ever, and is implemented by some 610,000 organizations in 160 countries. The *ISO 9000* standards have become an international reference for QM requirements in business-to-business dealings. The *ISO 9000* family is primarily concerned with QM. This refers to what the organization does to:

- Fulfill the customer's quality requirements;
- Apply regulatory requirements, while enhancing customer satisfaction; and
- Achieve continual improvement of its performance in pursuit of these objectives.

1.3.6 The Florida Department of Transportation's Quality Assurance Evaluation

The FDOT's *Quality Assurance (QA) Evaluation*, published by the FDOT Traffic Engineering Research Laboratory (TERL), requires the manufacturer or provider of ITS equipment to identify the details of their QA/QC program prior to the FDOT's procurement and deployment of the company's products. It affords the FDOT an audit capability to verify that the procedures are implemented as documented.

1.3.7 The Intelligent Transportation System Device Specifications

The ITS Device Specifications, as referenced previously in this document, are provided to:

- Reduce the workload for the FDOT District ITS representatives;
- Foster the standardization of ITS devices, systems, and subsystems across Florida; and
- Reduce project costs for the FDOT Districts through publication of a request for proposals (RFP) that predefines the ITS devices to be used on a specific project.

The ITS Device Specifications provide the specifications and standards for all ITS devices to be deployed in Florida

1.3.8 The Intelligent Transportation System Approved Products List

When completed, the FDOT's ITS APL will be accessible through the ITS Device Specifications Web site, and will identify the ITS products that have been certified for sale and use in Florida.

2. Quality Management

Quality management includes the overall management practices and functions that determine and implement the quality policy of an agency. In this instance, the FDOT's ITS Section is responsible for the quality deployment of ITS projects and products statewide.

Quality management is a management approach that is centered on quality, based on organization-wide participation, and aimed at long-term success through customer satisfaction. An effective QM approach provides a QA program that establishes a uniform management policy and implements an effective configuration control, or CM, program. The implementation of the QA program is the employment of the QC system specified in the *Statewide ITS QA Plan*.

The organizational structures, responsibilities, procedures, processes, and resources for implementing a QA/QC system should only be as comprehensive as needed to meet the quality objectives and contractual purposes established for the program or project. The overall management of the collective body of processes, operating procedures, objectives, responsibilities, resources, and infrastructure to implement an effective quality policy is QM. To be successful, it requires the commitment and participation of everyone in the organization or agency. Quality management is a life-cycle function. It begins in the requirements definition and procurement stage, and continues through acceptance and operation.

2.1 Why are Quality Assurance and Quality Control Needed for Intelligent Transportation System Deployments?

The QA/QC process encompasses the following four areas: data integrity, accountability, documentation, and skills. It specifies the entire collection of processes and procedures through which an organization achieves fitness for use, and ensures the integrity of digital data products and conformance to project specifications by:

- Describing the controls, audits, and reviews applied to every aspect of a project's production and management tasks;
- Defining project standards; and
- Describing the work to be completed that will meet those standards.

The QA/QC process is critical in tracking all project elements, from requirements identification through deployment and final acceptance, to verify that standard quality procedures have been employed throughout the production and/or deployment process. By implementing uniform QA/QC processes for all similar ITS deployments, a QM approach emphasizes the importance of:

- Understanding and meeting requirements;
- Considering processes in terms of added value;
- Obtaining results of process performance and effectiveness;
- Continual improving the processes based on objective measurement;
- Controlling costs; and
- Mitigating risks.

It is desirable that the QA plan for a project be tailored to the requirements of that project. However, the ITS Section is responsible for policies, procedures, and QA activities. The *Statewide ITS QA Plan* should set the minimum quality standards and processes all Districts will use for ITS project deployments. Establishing these minimum quality standards and processes provides a common baseline that enables an organization to ensure and measure quality performance throughout the organization. In this case, the organization is the ITS Section, responsible for statewide ITS deployments. The components within this organization are the Districts.

The effectiveness of a QA plan and of QM is based on organization-wide acceptance of quality principles and participation in activities designed to achieve quality objectives. Every activity contributes to or detracts from quality and productivity. The definitions of process management and systems management provided below establish the philosophy for having a minimum common quality baseline within an organization.

- Process management is defined as the collection of practices used to implement and improve QM and process effectiveness across an organization. Process management treats the organization as a group of interrelated processes that ultimately affect quality; and

- The systems approach to management identifies, understands, and manages interrelated processes as a system contributes to the organization's effectiveness and efficiency in achieving its objectives.

The key to success is how both management and employees make use of a QM system to improve business and to achieve improved efficiency and better control. Using a systematic approach, objectives can be better defined; resource utilization maximized; and service standards and consistency improved. Management leadership and employee involvement is crucial for success.

The uniform implementation of and compliance with ITS standards and specifications for the deployment of ITS assets will ensure functional commonality; satisfy *NITSA* and RITSA requirements; promote cost savings; eliminate redundant functions; and promote interoperability in general.

A caution with regard to interoperability – QA/QC processes do not in and of themselves guarantee interoperability among ITS deployments. The interface control document (ICD) provides this function. The ICD defines the interface between equipment and systems that will allow them to function, or interoperate, as a system. An effective QA/QC system will identify the need for such a document, require that the Contractor(s) provide the documentation, and stipulate that the defined interface be satisfactorily demonstrated.

3. The Quality Management Process

The quality function is supported by systems thinking, which is the belief that an organization is made up of interrelated components that cannot be divided into independent parts. A quality system should encompass not only the quality of the finished product, but also the quality of the operational processes. It is therefore essential to clearly document the desired quality objectives and the processes by which the organization will achieve these objectives. The essence of these quality objectives is the organization's quality standard; and it is up to the quality system to ensure that the documented procedures, actual operation, and quality records all conform to this standard.

Generally, it is good practice for an organization to select an international quality standard as the basis of its QM process. One such standard that has been embraced by government, military, and industry in the United States over the years is the *ISO 9000* standards. The guidance for implementing the *Statewide ITS QA Plan*, as well as individual ITS deployment QA plans, is based on this quality standard. The following paragraphs provide the general format and guidance required for a QA plan. The specific requirements for each ITS deployment may be cross-referenced with the QA checklists explained in *Section 4* and provided in *Appendix B*.

For District ITS deployments, it is essential that a quality plan be established for each ITS deployment. The basic elements of the ITS deployment project's quality plan will generally follow the guidelines and procedures established in the FDOT's *Statewide SEMP* and the *Statewide ITS QA Plan*. The general processes defined in the *Plan* will not vary as a result of the procurement approach. However, the specific process a District will directly manage and control might vary. At a minimum, the District will be responsible for ensuring that a specific ITS element meets the ITS Section's configuration specifications, installation criteria, interface criteria, and performance criteria. The quality processes and methods that the ITS Section established for compliance with these elements will form the baseline for the District's tailored QA plan for an element or deployment.

The quality plan should be a document that states in a concise format the high-level policies and objectives an organization requires to achieve the desired level of quality compliance. It should also show how the organization's overall documentation of specifications is structured. This brief, concise format should also be used when developing individual ITS deployment QA plans.

3.1 General

Once an ITS deployment has been defined, the QA and CM process starts. Again, this process begins with the needs definition and continues through requirements definition; procurement; integration and testing; and final acceptance. Both the QA and CM processes are an integral part of project management, and are critical for adequately implementing and administering a QA program for ITS deployments.

Although the execution of QA and QC processes consists of many elements, nearly all of the processes needed to identify compliance with project specifications are addressed in the CM system. Since all information flows to and from the CM system, product/project integrity is maintained. As shown in Figure 3.1, the CM system essentially is "the hub of the wheel" and in reality becomes the project's information hub.

Figure 3.1 – The Hub of Quality Assurance Management [18]

[18] Daly, Jack, Fred J. Bahrs, and Mike Gearhart (CMstat Corporation), *Industry White Paper: Introduction to CM – What is Configuration Management?* (May 1999). Available online at http://www.cmstat.com/downloads/cmintro.pdf

Configuration management facilitates the orderly identification of product attributes. It provides control of product information and changes used to improve capabilities; correct deficiencies; improve performance, reliability, or maintainability; extend product life; or reduce cost, risk, or liability. It is a critical and essential element of QM and QA. It becomes, in essence, the hub, or heart, of QA/QC management. The QA plan identifies the quality-related operations that must be conducted to ensure that the project or deployment meets or exceeds specifications. Each plan generally includes a minimum of the following elements:

- Staffing, including roles and responsibilities, and resource estimates;
- Documentation;
- Quality assurance processes, including milestones, deliverables, reviews, change controls, testing, acceptance, etc.;
- Reports, including type, frequency, procedures, and reports of noncompliance;
- Corrective actions;
- Change control; and
- Audits.

Not all elements addressed in the QA plan template may be required for every ITS deployment. Each plan must be tailored to address a specific deployment's requirements. A general QA plan template is provided in *Appendix A*.

The following sections discuss the contents of a QA plan and provide guidance for implementing the *Statewide ITS QA Plan's* policies, as well as guidance for project-specific plans. *Sections 3.2* and *3.3* are generally applicable when addressing a quality system program from the policy and guidance level to the project-specific application. Staffing requirements must be identified at the outset when defining the *Statewide ITS QA Plan*. Documentation requirements really address two areas: District and project compliance with the policies; and the documentation required to establish a QA plan that is compliant with the *Statewide ITS QA Plan* and the required project deliverable.

Sections 3.4 through *3.7* generally pertain to project-level requirements, but as indicated previously, not all project-specific plans will contain all of the elements. *Section 3.7* is somewhat unique in that it can stand alone in the process. *Section 3.7* provides a method for evaluating compliance with the established QA policies and the implementation of those policies at the project level.

3.2 Staffing and Responsibilities

A successful QM program begins with the identification of responsibilities and authority related to the implementation and verification of the QM process. It is important for the individual with overall responsibility for the product to develop a project organization and assign QA/QC responsibility to key personnel. In most cases, the FDOT District ITS engineer or the project engineer will be responsible for developing the project organization.

The QA roles and responsibilities described in the following paragraphs have been identified as the minimum number of key personnel needed to effectively execute and monitor a project's compliance with the *Statewide ITS QA Plan*. The positions are usually implemented as four unique staff positions. However, depending on individual qualifications, the project engineer and the technical engineer functions may be performed by the same individual, provided that the individual possesses the technical qualifications for the project. Still, the evaluation of QA policy compliance may be better served by separate staff positions.

It is recommended that the ITS Section and each District add a QA engineer to their respective staffs. The ITS Section is responsible for establishing policies, procedures, and QA activities, including the establishment of a recurring statewide training program for all Central Office, and District QA engineers and staff. The Central Office ITS Administrator is responsible for ensuring that each District has designated an ITS engineer to coordinate all District ITS deployments.

The District ITS engineer will be responsible for ensuring that the District's QA plan has an ITS component that addresses the policies, procedures, and QA activities established by the *Statewide ITS QA Plan*. Other QA staff positions may be added as needed.

3.2.1 District Intelligent Transportation System Engineer

The District ITS engineer will be responsible for ensuring that the District ITS QA program and plan meet the QA requirements established by the *Statewide ITS QA Plan*. The District ITS engineer is also responsible for establishing the appropriate processes and systems to ensure compliance with the *Statewide ITS QA Plan*. The District ITS engineer has oversight responsibility to ensure that project-specific QA plans are developed in accordance with the *Statewide ITS QA Plan*; the ITS Device Specifications; and the established final acceptance criteria for the ITS product or deployment. The FDOT District ITS engineer is responsible for appointing a QA engineer or agency to assist the District in assuring QA/QC compliance for each ITS deployment.

3.2.2 Quality Assurance Engineer

Ideally, the QA engineer is an integral member of the District's quality organization and reports directly to the District ITS engineer when the ITS engineer is not also functioning as the project engineer. The District QA engineer position may fill the project QA engineer position if necessary. It is recommended that a QA engineer position be added in the District and central ITS offices. The District QA engineer is not normally assigned as a project QA engineer, but serves as the District project evaluator, or auditor. The District QA engineer has two major functions, including:

- Development of a District QA plan in accordance with the *Statewide ITS QA Plan*, including the processes, tools, and methods the District will use; and
- Audit of the implementation of and compliance with either the *Statewide ITS QA Plan* or the project QA plan.

In performing the two roles, specific responsibilities may include:

- Measuring, assessing, and reporting quality performance against project objectives for an ITS deployment;
- Determining District quality objectives;
- Approving the QA plan for an ITS deployment;
- Periodically reviewing technical program performance against quality objectives; and
- Developing remediation plans when technical quality performance is not in line with the objectives.

3.2.3 Project Engineer

The project engineer has the overall operational authority for the project and is responsible for ensuring that the implementation of the project QA program is in accordance with the *Statewide ITS QA Plan*. The project engineer is charged with delivering a system that meets quality expectations. Specific responsibilities may include:

- Determining quality objectives;
- Assigning quality objectives to subordinate system stakeholders;
- Approving a QA plan for an ITS deployment;
- Periodically reviewing project performance against quality objectives;
- Developing remediation plans when quality performance is not in line with the objectives; and
- Determining and obtaining a staff with the necessary skill sets to support the project.

3.2.4 Technical Project Engineer

The technical project engineer is accountable for delivering a system to the project engineer that meets the stated quality requirements. Specific responsibilities include:

- Determining quality objectives;
- Contributing to the program's QA plan;
- Periodically reviewing technical program performance against the quality objectives;
- Developing remediation plans when technical quality performance is not in line with the objectives; and
- Identifying the skill sets required to satisfactorily support the project and provide support to the project engineer.

3.3 Documentation

Two levels of documentation are required. The first is District and project compliance with the policies and documentation required to establish a QA plan that is compliant with the *Statewide ITS QA Plan* and applicable to the required project deliverable. In other words, the minimum quality system documentation required by the FDOT's umbrella ITS quality plan/manual that defines the organization's specifications, standards, processes, work instructions in support of these processes, and the quality records these instructions require.

The second level is project or deployment specific, and is the documentation required to ensure compliance with contract terms to meet system or project design requirements, and to control and manage system or project configuration.

The documents that define product/system design – including the acquisition program baseline, the requirements document, the system specifications, and the product baseline – are elements of the configuration items that must be tracked and changed as system or deployment requirements, hardware, or software items are changed.

3.4 Quality Assurance Processes

Each of the processes used to measure and assess quality performance on a project shall be described (i.e., methods, tools, organizational responsibilities, etc.). This includes schedule milestones and deliverables. Not all of the processes listed below may be required for each deployment and it should be left up to the QA engineer to decide which ones are applicable. Each deployment may be tailored as needed to satisfy the specifications, requirements, and deliverables for that deployment. Processes may include:

- Process reviews;
- Product reviews, such as design reviews, peer reviews, etc.;
- Requirements definition and compliance;
- Requests for change;
- Noncompliance procedures;
- Audits;
- Test monitoring;
- Trouble report analysis; and
- Final acceptance.

3.5 Reports Produced

In a project-specific QA plan, all of the reports needed to document the results of the required QA plan activities and the level of distribution should be described. Minimum reports, the recipients, and the frequencies of the reports should be specified. All of the contract deliverables and reports needed to satisfy contract terms, including the schedule milestones for the deliverables, should also be provided.

3.6 Change Control

Generally, the terms of a contract will specify that once the design requirements baseline is determined, no changes will be made to the baseline. Once a product or system baseline configuration has been established, all changes must be controlled and documented. New requirements will not be incorporated into the baseline unless submitted with an authorized formal contract amendment, or with the approval of the change control management process established for the project.

No matter how mature a product or system may be, or how experienced a contractor is, there will be changes somewhere along the way between procurement, deployment, and implementation. An effective corrective action system will minimize, if not preclude, the recurrence of such deficiencies in the future. However, it is important to note that not all changes result from errors or discrepancies. Nonetheless, the use of the term deficiency supports the argument that a change may result from a shortcoming or a perception of a shortcoming, such as a system defect, or an absent or unavailable item or interface. A change control management process may result from a number of reasons, such as:

- A perceived problem;
- Modification to meet a new requirement;
- Modification as a result of failure to perform to specification;
- A change in the scope of the contract;
- Changes in material; or
- An unanticipated physical situation that makes it imprudent or impractical to follow the terms of the contract.

As a minimum, a standard procedure must be in place for:

- Highlighting detected anomalies;[19]
- Documenting the effects of the anomaly;
- Identifying and documenting containment and corrective actions; and
- Properly disposing of affected products, if any.

3.6.1 Noncompliance Reporting Procedures

In writing a project-specific QA plan, be sure to describe the steps, including the level of management involved, to be performed in resolving noncompliance issues for contractor actions and product or system deficiencies. Resolution of noncompliance issues may result in change control actions or affect contract terms.

3.6.2 Identification of Changes

Changes may include changes to hardware, maintenance procedures, processes, operations, documents, computer software, or inventory limits, as well as temporary modifications. Document and follow the guidelines established in the project CM plan for identification of changes and for remedial action.

3.6.2.1 Engineering Change Proposals

To assure that a change is both necessary and adds value, it is important to establish criteria for initiating change requests, requests for variance (RFVs), or requests for deviation (RFDs). Technical, budgetary, and scheduling problems must be detected and diagnosed as early as possible to determine their impacts and to determine if an engineering change proposal (ECP) is warranted. Document and follow the guidelines established in the project CM plan for implementing an ECP. Refer to the *Statewide SEMP, Section 4.3.10.4.4* for a description of deviations and waivers.

[19] An anomaly is an unexpected response from the system. Some anomalies may be normal once it is understood what caused them.

3.7 Configuration Audit

An organization needs a mechanism that can be used to check whether its operations are complying with all standards defined to meet its stated objectives. For the purpose of evaluating the quality program, this may be accomplished by a quality audit. These audits must be conducted regularly to ensure that the organization has documented standards or specifications, and that actual implementation of the quality system is in full conformance with the quality system documentation at all times.

An audit is the systematic, independent, and documented process for obtaining evidence and evaluating it objectively to determine the extent to which the criteria are fulfilled. Where criteria is defined as a "set of policies, procedures, or other requirements against which collected evidence (records, statements of fact or other information relevant to the audit) are compared and verified."

There are two quality audit levels. One is conducted periodically by the ITS Section to determine if the Districts have an ITS deployment QA plan that reflects the policies, procedures, and QA activities established by the *Statewide ITS QA Plan*, including the development of project-specific QA plans. This audit may be conducted internally by ITS Section staff or a general engineering consultant (GEC) staff representative. An external consultant may also be hired to conduct the audit.

The second audit is one that evaluates an individual project's compliance with the requirements in the *Statewide ITS QA Plan* and how it has been adapted to specific project requirements. A project's quality audit may be conducted internally or externally to the project. When done internally, the auditor is usually assigned to the project team and reports to the project engineer (i.e., manager). With this type of internal audit, the auditor may encounter influence from the project engineer when discrepancies are found with the project QA plan's compliance, or with management activities affecting the project.

The quality audit may also be conducted externally by ITS Section staff, a GEC staff representative, or a hired external consultant. An external audit will typically provide an objective report that is not influenced by the project engineer, and may be used as a realistic measure of compliance with District and ITS Section policies, procedures, and QA activities.

Using the audit plan or a checklist of items, such as procedures, equipment setups, quality records, measurements, etc., as a basis for conducting the audit, the auditor proceeds by asking questions, reviewing documents, checking records against specifications, making measurements, etc., to ensure that all the audit items have adequate documentation and are implemented in accordance with the documentation.

4. Checklists

Checklists are tools that can be used to assist the Districts and the ITS Section in determining whether ITS deployments are being executed uniformly throughout Florida, and whether they are compliant with applicable ITS standards, specifications, and QA measures. Checklists may also be used as tools to assist in the performance of quality audits.

The foundation elements for developing checklists are derived from applicable sections of the ITS and quality references listed in *Section 1*. Compliance with all or portions of these references will depend on individual ITS product or deployment project. These references include the:

- Regional ITS architectures;
- *Rule 940*;
- *NTCIP* standards;
- ITS Device Standards;
- ITS APL;
- SunGuide[SM] software;
- *Statewide SEMP*;
- Quality management plan; and
- Intelligent transportation system CM plan.

The QA/QC process begins with requirements identification, and continues through RFP[20] announcement, procurement, integration, and final acceptance to verify that standard quality procedures have been employed throughout the production or deployment process.

Once a QA plan has been developed for an ITS deployment, the QA checklist forms provided in *Appendix B* may be used as a common baseline to implement the QA policies established by the ITS Section, and to track project compliance with all product or system functions and performance requirements.

[20] The process can also apply to an invitation to negotiate (ITN) or other FDOT procurement mechanism.

The checklists provided in *Appendix B* should be used as a common starting point for all project engineers, QA engineers, and other QA personnel to:

- Evaluate the effectiveness of the project monitoring process;
- Use when planning or reviewing the QA activities for a project (i.e., for software acquisition, CM, change control, etc.);
- Ensure appropriate items have been included for an effective QA assessment of the activities being monitored; and
- Consider when checking the work of a project engineer and project team.

The checklists provided are not meant to be all encompassing, nor are they applicable to all ITS deployments or products. Variances between similar ITS deployments will be minimal, yet the checklists serve as a baseline for implementing a consistent QA program throughout Florida.

Table 4.1 provides general guidelines for ownership and utilization of the checklists within the statewide QA organization. The TERL's *Quality Assurance (QA) Evaluation* is included in Table 4.1, since its use can be a valuable tool for the project engineer as well as the QA engineer.

Table 4.1 – Quality Assurance Checklist Implementation

Checklist	Who	When Used/How Often
Project Monitoring	• District QA Engineer • Project Engineer • Independent Auditor	• When the QA program is established • At the start of a project • Periodically during a project, where frequency depends on project length
Configuration Management	• District QA Engineer • Project Engineer	• When the QA program is established • At the start of a project
Change Management	• District QA Engineer • Project Engineer • Technical Engineer	• When the QA program is established • At the start of a project • For each change request
Post-Project Review	• District QA Engineer • Project Engineer • Independent Auditor	• At a project's mid-point review • At the end of a project
Quality Assurance Software Acquisition	• District QA Engineer • Technical Engineer • Independent Auditor	• When the QA program is established • At the start of a project
TERL's *Quality Assurance Evaluation*	• District QA Engineer • Project Engineer • Technical Engineer	• When new equipment is fielded • When improvements to existing equipment are to be fielded • When there are device complaints and defect issues between the FDOT and manufacturers

The checklists for ITS deployments should be basically the same for each District. There may have to be additional items to accommodate variances between the Districts; however, establishing common processes, checklists, and measures provides a common baseline that will permit the ITS Section to measure quality compliance and performance for all similar ITS project deployments throughout Florida.

Appendix A

Quality Assurance Plan Template

Introduction

Purpose – Identify an ITS deployment's quality-related objectives, describe how achievement of these objectives will be measured, and describe the quality-related processes that will be used to assure that the objectives are achieved.

Scope – Provide the objectives, measures, and processes that pertain to the program.

Background – Describe the project to provide the context for the QA plan.

References – Cite applicable reference material used in developing the plan.

Quality Checkpoints – Describe in detail the QA processes to be used and when they will be used. For each checkpoint, provide a high-level overview of who will be involved, the evaluation criteria to be used, and who will review/approve the results.

Staffing

Roles and Responsibilities – Identify the overall responsibilities of the QA team and the project team, as well as their individual responsibilities at the various quality checkpoints.

Required Skills – Identify the knowledge, skills, and experience necessary to perform QA activities.

Reviews

Methodologies and Standards – Identify the methodologies to be used and the standards to be applied to the project and product QA.

Quality Assessments and Reviews – Describe the review processes that will be used to verify the quality of project work processes and project work products. Include details on assessments or reviews, when they will be conducted, who will conduct them, the scope of the reviews, success criteria, QA reporting formats, and review processes.

Quality Assurance Milestones – Identify the QA deliverables and the timelines associated with those deliverables. For each checkpoint, include information such as checkpoint name; lead QA resource; QA deliverable; and planned start and end dates.

Resource Estimates – Include an estimate of the resources required to perform QA activities, such as the number of staff required, hours of effort, direct expenses, etc.

Contractor Controls – If using contracted QA resources, include a section that describes the controls and processes in place for monitoring the contractors' work product and deliverables against agreed-to timelines and levels of quality.

Corrective Action

Process – Provide a high-level description of planned procedures to track and resolve problems or issues identified in project processes detected in QA reviews.

Product – Provide a high-level description of planned procedures to track and resolve problems or defects identified in project products detected in QA reviews.

Preventive Measures – Describe any processes or measures put in place to prevent detection of errors or problems in QA activities. Reviewing lessons learned from prior projects may provide a valuable starting point.

Appendix B

Quality Assurance Checklists

(Refer to Table 4.1 for information on who should use these checklists.)

State of Florida
Department of Transportation

QUALITY ASSURANCE EVALUATION SURVEY

Traffic Engineering and Operations Office
Traffic Engineering Research Laboratory (TERL)
October 2004
(This survey replaces previous survey dated November 2002)

Table of Contents

Section 1: General Information
- 1.1 Purpose and Scope
- 1.2 Manufacturer Information
- 1.3 Manufacturer Documentation and Information

Section 2: Manufacturing Process Video Requirements

Section 3: Quality System Questions
- 3.1 Management Responsibilities
- 3.2 Design Control
- 3.3 Purchasing
- 3.4 Product Identification and Traceability
- 3.5 Process Control
- 3.6 Inspection and Testing
- 3.7 Controlling Measuring and Test equipment
- 3.8 Controlling Nonconforming Products
- 3.9 Corrective and Preventative Action

Section 4: Statement of Authenticity

Contact Information
Direct all questions or comments concerning this document to the following:
FDOT – TERL, 2612 Springhill Road, Tallahassee, Florida 32305
Qualification Program Manager: Jeffrey M. Morgan - jeffrey.morgan@dot.state.fl.us
Phone: (850) 414-5254, Fax: (850) 487-0011
Office web site: http://www.dot.state.fl.us/trafficoperations
Lab web site: http://potentia.eng.fsu.edu/terl/index.htm

Section 1: General Information

1.1 Purpose and Scope

To obtain listing on the Florida Department of Transportation's Approved Product List (APL), the submitting manufacturer must show evidence of a successful quality control and assurance program. This is done by satisfactorily completing this evaluation survey which verifies that the Florida DOT's Minimum Quality Standards are met. Once qualified, the manufacturer is then added to the FDOT APL Vendor Qualification List at: http://www.dot.state.fl.us/trafficoperations/apl_vendor_qualification.htm

The purpose of this survey is to request information regarding a manufacturer's quality assurance (QA) program. The documentation and responses provided herein will be used to perform an audit of the manufacturer's QA program. In addition to this quality survey, manufacturers may be required to:

1. Allow an on-site audit of their facilities.
2. Conduct a teleconference meeting with a TERL QA evaluator.
3. Present information on their QA program at the TERL facility.

The primary goals of the QA evaluation program survey are to:

1. Improve the quality of approved devices used in the field.
2. Redirect the responsibility of maintaining quality standards to the manufacturers.
3. Reduce the frequency of complaints and issues associated with defective devices.

1.2 Manufacturer Information

Please complete the following information about your company.

COMPANY NAME: DATE:

TYPE OF PRODUCT PROVIDED:

PHYSICAL ADDRESS WHERE PRODUCT IS MANUFACTURED:

PHONE NUMBER: COMPANY WEB SITE:
E-MAIL ADDRESS:

NUMBER OF YEARS COMPANY HAS MANUFACTURERED PRODUCT UNDER CURRENT NAME:

PRESENT NUMBER OF EMPLOYEES: ENGINEERING:

MANUFACTURING:

QUALITY ASSURANCE:

OTHER:

TOTAL:

1.3 Manufacturer Documentation and Information

The following checklist describes the required documents and information needed to perform the QA evaluation. Each item listed below must be provided or your submittal may be returned.

☐	a. A copy of the manufacturer's quality assurance/control manual.
☐	b. An organization chart showing the functional responsibilities of all key quality assurance positions in the company, including the names and positions of the people authorized to resolve quality problems.
☐	c. A videotape and documentation describing your manufacturing process, capabilities and experience. Please refer to section 2 for a description of the video requirements.
☐	d. List principal customers over the past two years that you have supplied product similar to that provided to TERL.
☐	e. List companies that have performed a quality audit and source inspection at your facilities. Include the month and year of inspection and results.
☐	f. List organizations that regard your company as a preferred supplier.
☐	g. Provide your approved vendor list or list of principal vendor facilities you have used over the past year as a source of material, processes, or services. Include vendors you currently approve for such services.
☐	h. List all industry certifications and National Quality Standards (NQS) met. Provide a copy of registration and the latest assessment audit report. Include registrar's name and registration number, if applicable.

Section 2: Manufacturing Process Video Requirements

Provide a 25-35 minute video of the manufacturing process used to produce the submitted product. The video must be in VHS or DVD format. This video does not have to be of high-grade professional quality, but must be of adequate audio and video quality that it can be easily viewed and understood. A transcript may be required. Produce this video as a virtual tour of your manufacturing process for the device in question. This video should also be used as a supplement in answering questions throughout this QA evaluation survey. Use this video to demonstrate that your documented quality system is being implemented. The following list describes the minimum requirements for the video. Each area below must be addressed or your submittal may be returned.

1. A real-time video **during a typical workday** of your:
    a. Manufacturing plant;
    b. Plant equipment, machinery, and special tooling;
    c. Support/ test equipment;
    d. Manufacturing work and quality assurance testing in progress.
2. A description of the process and documents that will provide and maintain your quality system.
    a. When and how corrective action reports are generated?
    b. What documentation accompanies the product throughout the manufacturing cycle?
3. A description of the inspection and tests necessary to ensure conformance with FDOT specifications.
    a. Show and discuss the laboratories and equipment used to perform these inspections. If performed, include a detailed description of statistical sampling and testing required by the quality system.
4. Interviews with quality control personnel and discussions concerning:
    a. Qualifications, and
    b. Job functions.

Section 3: Quality System Questions

Instructions: A response **must** be provided for all questions. Each response is evaluated on one or more of the following factors:

1) The written explanation of your system.

2) Proof of documented procedures. These procedures should be referenced in your written explanation of the system.

3) Proof of the procedure's implementation (e.g. filled out corrective action reports, meeting minutes, etc.). This evidence must also be referenced in your written explanation of the system.

Each question below is followed by a check list of required information. Please check off each item indicating that you have provided this information. ALL CHECKBOXES MUST BE CHECKED OFF. Failure to provide any of these requirements may results in a failing grade.

3.1 Management Responsibilities	
a) Who is responsible for ensuring that the quality policy is understood throughout all levels of the organization? Include names and position descriptions.	☐ Written Explanation ☐ Referenced Documents
b) How does your organization ensure that the quality policy is understood throughout all levels of the organization? Provide evidence that demonstrates this.	☐ Written Explanation ☐ Referenced Documents ☐ Evidence of Implementation
c) Describe the positions and number of internal personnel responsible for performing quality program reviews/audits. In doing so, please address the following: 1) How often are these reviews/audits performed? 2) Provide records of your last two internal reviews/audits?	☐ Written Explanation ☐ Referenced Documents ☐ Evidence of Implementation
3.2 Design Control	
a) Who is responsible for the planning of each design and development activity? Include names and position descriptions.	☐ Written Explanation ☐ Referenced Documents

b) Describe the general procedure used for design and development of a product. Include the following: 1) How is design input requirements related to the product identified and documented? 2) How are design outputs documented and reviewed? 3) Describe the role quality management plays in product design reviews. 4) Provide copies of documents generated from such activities.	☐ Written Explanation ☐ Referenced Documents ☐ Evidence of Implementation
c) Who is authorized to identify the need for design changes and who is authorized to review and approve design changes? Include names and position descriptions.	☐ Written Explanation ☐ Referenced Documents ☐ Evidence of Implementation
3.3 Purchasing	
a) Provide the documents that describe the type and extent of control exercised by your company over subcontractors?	☐ Written Explanation ☐ Referenced Documents
b) What requirements are used to evaluate and select subcontractors? Are subcontractors required to meet any quality standards? Provide this documentation.	☐ Written Explanation ☐ Referenced Documents
c) Do you have a "Vendor Rating System"? If so, please explain the system and show where it is defined. In explaining, be sure to address the following: 1) Do different evaluation/selection criteria apply for different types of subcontractors? 2) What are the qualifications of the auditor evaluating the subcontractor? 3) How can a subcontractor become disqualified?	☐ Written Explanation ☐ Referenced Documents ☐ Evidence of Implementation
d) Do you have an "Approved Supplier List"? If so, provide the list and state who is in charge of maintaining and updating the list? Include names and position descriptions.	☐ Written Explanation ☐ Referenced Documents ☐ Evidence of Implementation
3.4 Product Identification and Traceability	
a) Describe how product identification and traceability are maintained throughout production, delivery, and installation? In explaining, be sure to address the following: 1) Are parts, lot, or batch numbers used? How are these number assigned? 2) Provide examples (e.g. pictures, labels) of where the product I.D. and traceability information is marked on the finished product. **Note: The Florida DOT requires all product approved to be identified by manufacturer name, part number and date of manufacture.**	☐ Written Explanation ☐ Referenced Documents ☐ Evidence of Implementation

3.5 Process Control	
a) How are production processes that affect quality identified and planned? Who is responsible for identifying and planning these processes? Include names and position descriptions.	☐ Written Explanation ☐ Referenced Documents
b) What statistical techniques are used to monitor and verify process capability and stability? Estimate the number of processes statistically monitored in your system. Provide examples of control charting if used.	☐ Written Explanation ☐ Referenced Documents ☐ Evidence of Implementation
c) Has top management received statistical training? In answering this question, please address the following: 1) What statistical training has top management received? 2) Does your company have SPC specialists available? If so, provide their contact information. 3) Has anyone within your company received six-sigma training? If so, provide their contact information.	☐ Written Explanation ☐ Evidence of Implementation
3.6 Inspection and Testing	
a) Describe your receiving inspection and testing procedures. In doing so, address the following: 1) What statistical sampling technique is used (e.g. 100% testing, random testing, etc.)? 2) How are damaged goods handled? 3) What data is maintained to provide feedback to your purchasing procedures?	☐ Written Explanation ☐ Referenced Documents ☐ Evidence of Implementation
b) Who is authorized to perform in-process and final inspection testing? Include names and position descriptions.	☐ Written Explanation ☐ Referenced Documents
c) Provide the documentation that provides information regarding what products require in-process inspections and testing and the procedures for conducting these inspections and tests.	☐ Written Explanation ☐ Referenced Documents ☐ Evidence of Implementation
d) Describe the procedure when a product fails in-process or final inspection. In doing so, please address the following: 1) How are inspection and testing results recorded? 2) Provide examples of these records showing whether the product passed or failed inspections and identify the inspector.	☐ Written Explanation ☐ Referenced Documents ☐ Evidence of Implementation

3.7 Controlling Measuring and Test equipment	
a) Describe the procedures used for inspection and calibration of tools, gauges, and test equipment. In doing so, address the following: 1) Who ensures that measuring and test equipment is calibrated and adjusted at predetermined intervals? Include names and position descriptions. 2) How are uncalibrated or outdated items identified and/or stored? 3) How are tools, gauges, and test equipment that require regular re-calibration recalled?	☐ Written Explanation ☐ Referenced Documents ☐ Evidence of Implementation
b) What certifications of calibration are on file? Provide a copy of the last two certificates.	☐ Written Explanation ☐ Referenced Documents ☐ Evidence of Implementation
3.8 Controlling Nonconforming Products	
a) What formal organization procedures are established for the segregation of discrepant material? Where are these procedures defined?	☐ Written Explanation ☐ Referenced Documents ☐ Evidence of Implementation
b) What formal company procedures are established for the identification and/or marking of discrepant material? Provide examples (e.g. pictures, labels) of the identification and/or marking of discrepant material.	☐ Written Explanation ☐ Referenced Documents ☐ Evidence of Implementation
3.9 Corrective and Preventative Action	
a) Describe the procedures for implementing corrective action. In doing so, address the following: 1) What triggers corrective action? 2) Who is responsible for investigating the causes of nonconformities and recording the results of the investigation? Include names and position descriptions. 3) How do records indicate the nature of deficiencies and the positive corrective action taken? Provide an example copy of these records.	☐ Written Explanation ☐ Referenced Documents ☐ Evidence of Implementation
b) Describe the procedures for implementing preventative action. In doing so, address the following: 1) Who is responsible for determining and implementing the necessary steps to deal with problems requiring preventive action? Include names and position descriptions. 2) How is the effectiveness of the preventative action measured?	☐ Written Explanation ☐ Referenced Documents ☐ Evidence of Implementation
c) Describe the procedure for handling customer complaints and reports of product nonconformities.	☐ Written Explanation ☐ Referenced Documents ☐ Evidence of Implementation

Section 4: Statement of Authenticity

The FDOT will not consider any manufacturer for qualification until this form is completed and signed by an authorized official of the device vendor/manufacturer and received at the address on the first page of this survey.

I have read this application and attest that the information submitted within and attached for qualification evaluation is true and correct.

Signed:	
Printed Name:	
E-mail:	
Position:	
Date Signed:	
Company:	
Address:	

Project Monitoring Checklist [21]

Intended Use of This Checklist	For a project team, a project engineer/manager, or District QA engineer to evaluate the effectiveness of the project monitoring process. The checklist contains items to consider when checking the work of a project engineer/manager and project team in monitoring the project according to its plan.

Step	☑	Items to be Considered
1	☐	Has the project plan been approved and the work started as planned?
2	☐	Has the project been staffed to the level projected?
3	☐	Are the key elements being monitored (at least weekly) to ensure that their progress is in accordance with their plan? Items that may be included: • Tasks starting and ending as planned; • Deliverables with the content and quality level required; • Level of effort as planned; • Milestones being met when planned; • Critical computer resources as planned; • Risk management progress; • Issues and action item resolution measures; and • Measures to handle key project issues.
4	☐	Is a change management activity being used to process changes?
5	☐	Are action items being followed and tracked to closure?
6	☐	Have periodic progress reports been sent to the team and project engineer/manager?
7	☐	Has the project been monitoring for and reporting potential risks?
8	☐	Has the quality engineer been reviewing project work products and activities, and identifying any exceptions to the project plan and/or organization processes?
9	☐	Have the deviations (as identified by the quality engineer) been reviewed, discussed, and resolved with the project team and project engineer/manager?
10	☐	Have the items that were not resolved been submitted to management?
11	☐	Have the items to be placed under CM been reviewed by the appropriate organizations?
12	☐	Have all the items that were planned to be under configuration control been placed under configuration control?
13	☐	Have the states of the various baselines been communicated to the appropriate people?
14	☐	*Other?*

[21] This checklist was produced by TeraQuest Metrics, Inc., for the State of Texas Department of Information Resources and has been adapted for use by the Florida Department of Transportation.

Configuration Management Checklist [22]

Intended Use of This Checklist	For a project team, project engineer/manager, configuration manager, or District QA engineer to use when planning or reviewing the configuration management (CM) activities for a project. The checklist helps ensure that the appropriate items have been included for effective CM.

Step	☑	Items to Consider
1	☐	Is there a CM plan for the development effort? Does it include the following: • Roles and responsibilities for CM; • Configuration identification activities; • Software build activities; • Change control activities; • Status accounting activities; • Audit activities; • Reporting and review activities; and • How to integrate changes to items outside the project's control that affect the items in the project, and vice versa?
2	☐	Is there someone to perform the CM activities?
3	☐	Are sufficient tools and funding allocated for performing the CM activities?
4	☐	Are all configuration items identified and documented?
5	☐	Is there a CM library of software baselines?
6	☐	Are software builds being done according to plan and schedule, using the baseline library?
7	☐	Are changes to baselines controlled?
8	☐	Are baseline audits planned and conducted?
9	☐	Is a documented change control process being followed that supports the following: • Documenting a requested change; • Reviewing a requested change by a change control board; • Examining the impact to the project if a change is approved; • Modifying project plans to incorporate any approved change; and • Tracking a change request from submission to completion?
10	☐	Is there a functioning change control board, with joint representation of supplier, acquirer, and customer (as appropriate)?
11	☐	Are standard reports on CM activities prepared and made available?
12	☐	Are CM activities reviewed with the project engineer/manager?
13	☐	Do QA personnel review CM activities and results?
14	☐	Are measures made to determine the status of CM activities?
15	☐	Are issues of interface control between internal components and outside components being identified and addressed?
16	☐	*Other?*

[22] This checklist was produced by TeraQuest Metrics, Inc., for the State of Texas Department of Information Resources and has been adapted for use by the Florida Department of Transportation.

Change Management Checklist [23]

Intended Use of This Checklist	For a project team, a project engineer/manager, District QA engineer, or technical engineer to evaluate the effectiveness of a project's change management process and how to revise specific plans. The checklist contains items to consider for documenting change requests, handling them with a change process, and ensuring approved changes are included in the project deliverables.

Step	☑	Items to be Considered
1	☐	Has a request (i.e., requirement, change, problem, defect, or other change) been filed by a member of the project team or by a stakeholder?
2	☐	Has the change request been documented?
3	☐	Has the change request been prioritized?
4	☐	Has an approach been identified to handle the change?
5	☐	Has a workaround been identified if the change is not implemented?
6	☐	Has it been acknowledged that the change applies to this project?
7	☐	Has an independent team or member (not the originator) reviewed the change request to determine whether it is worth evaluation for action?
8	☐	Has an estimate been developed of project effort, cost, schedule, and resources?
9	☐	Have the estimates been evaluated and authorized by a change control board or other authority?
10	☐	Have the results of the above evaluation been communicated to the requestor?
11	☐	If the change was denied, has the requester been notified?
***The following steps are to be considered* only if *authorization was given for the consideration of the change* (Block 9 above is checked).**		
1	☐	Has the change been incorporated into the project work plan?
2	☐	Does the incorporation of the change require an adjustment of resources?
2a	☐	Have the required resource adjustments been made?
3	☐	Does the incorporation of the change require an adjustment to the schedule?
3a	☐	Has the schedule been adjusted?
4	☐	Have the changes in the plan been communicated and commitments established?
5	☐	Has the work been performed to address the change?
6	☐	Has the work been reviewed with all effected parties?
7	☐	Have the associated verification activities been performed to ensure correctness?
8	☐	Have revisions been placed under configuration control?
9	☐	Have the change request records been updated to document the changes made?
10	☐	Has the change control board been notified that the change has been completed?
11	☐	Have the change request records been updated to reflect completion status?
12	☐	Has the requestor been informed of the final status?
13	☐	*Other?*

[23] This checklist was produced by TeraQuest Metrics, Inc., for the State of Texas Department of Information Resources and has been adapted for use by the Florida Department of Transportation.

Post-Project Review Preparation Checklist [24]

Intended Use of This Checklist	For a project team, a project engineer/manager, or District QA engineer to evaluate the effectiveness of a post-review preparation. The checklist contains items to consider when checking that a project team has a good plan for a post-project review.

Step	☑	Items to be Considered
1	☐	Is a post-project review needed?
2	☐	Are participants available and have they been invited to the meeting?
3	☐	Have the review activities been identified? Items to consider: • Kickoff meeting to describe the process; • Survey for each person to complete (may be tailored for individual projects); • Post-project review session to discuss results; • Report circulated for comment/correction; and • Report archived in process assets library.
4	☐	Has information as to how the review will be conducted been distributed to the participants?
5	☐	Are all participants in agreement on the approach being taken?
6	☐	Have relevant sources of information been identified? Items for consideration should include: • Initial budget/final cost; • Initial staffing estimates and profiles/actual staffing profiles; • Initial effort estimates/final effort values; • Initial product size estimates/final values; • Initial milestones and schedules/final values; • Number of requirement changes; • Rework statistic; • Product quality targets/actual values; • Initial risk list/final results of risk management; and • Any other relevant measures of risk management.
7	☐	Have various templates for gathering post-project information been reviewed and one selected for use in this review?
8	☐	Has information been identified that should be gathered from project participants? Candidate items could include: • Success rating by team, management, customers; • Key things that were done right on the project; • Key things that were done wrong and should be changed; • Risks that were not detected and became problems; and • Risks for which mitigation actions were ineffective.
9	☐	Has a survey been developed and distributed to participants, with notice of when to complete, to have information included in post-project review session?

[24] This checklist was produced by TeraQuest Metrics, Inc., for the State of Texas Department of Information Resources and has been adapted for use by the Florida Department of Transportation.

Step	☑	Items to be Considered
10	☐	Has a summary form been developed for analyzing data from a survey?
11	☐	Has the entire project history data been gathered and reviewed for completeness and accuracy?
12	☐	Is the data in a format ready for storage in the project history database?
13	☐	Has a summary report been generated in all survey areas that can be summarized?
14	☐	Have lists been built for those items that require discussion or consensus?
15	☐	Has suspect data been reviewed with the provider and consensus reached?
16	☐	Has the agenda for the post-project review session been developed and distributed to participants? Possible items to include are: • Review of the summary information gathered thus far; • Facilitated discussion of things done right and a group ranking of the most important recommendations for how to ensure continuation in future projects; • Facilitated discussions of things done wrong and a group ranking of the most important; • Brainstorm causes of these problems and how to ensure they don't happen again; and • Review of risk management effectiveness, what was missed, brainstorm factors to include, and ways to adapt mitigation.

Quality Assurance Checklist [25]

Intended Use of This Checklist	For a project team, a software acquisition manager, technical engineer, or District QA engineer to use when planning or reviewing the QA activities for a software acquisition effort. The checklist helps ensure that the appropriate items have been included for effective software QA.

Step	☑	Items to Consider
1	☐	Is there a QA plan for the development effort? [This could be a separate document or part of the overall development plan.] Items to include: • Defined roles and responsibilities for QA; • Minimum documentation requirements for the product; • Standards, conventions, and processes for use in development of the product; • Quality assurance role in preparing and reviewing the project's development plan, standards, and procedures; • Measures for tracking project progress and product quality; • Planned work product reviews, along with roles and responsibilities; • Process reviews for examining the conformance of software engineering activities to the plan; • Functional configuration audit to ensure that the delivered product matches requirements; • Physical configuration audit to ensure that all deliverables are consistent and ready for delivery at the end of the project; • In-process audits to ensure consistency between work products of the different phases of the project life cycle; • Timing and content of planned management reviews have been identified; • Provision for post-project review; • Plan for testing of the product; • Process described for handling defects discovered during product development; and • Is there a plan for quality records collection, maintenance, and retention?
2	☐	Are adequate resources and funding provided for performing the activities?
3	☐	Are members of the QA group trained to perform their QA activities?
4	☐	Are members of the software project oriented to the roles, responsibility, authority, and value of the QA group?
5	☐	Is the project performing QA activities according to the plan?
6	☐	Are deviations from the project plan being communicated to the project engineer?
7	☐	Are deviations from its plan being effectively addressed by the project?
8	☐	Is management being notified of deviations that are not being addressed?
9	☐	Are periodic reports of QA activities provided to the project?
10	☐	Are measures of QA status gathered and reported?

[25] This checklist was produced by TeraQuest Metrics, Inc., for the State of Texas Department of Information Resources and has been adapted for use by the Florida Department of Transportation.

Step	☑	Items to Consider
11	☐	Do project QA personnel review the supplier QA activities on a regular basis?
12	☐	Is there some group who periodically reviews the activities and work products of the QA group?
13	☐	*Other?*