

# Intelligent Transportation Systems

## Construction Engineering and Inspection Training, for Closed-Circuit Television Cameras

### Lesson 2

Welcome to the Intelligent Transportation Systems Construction Engineering and Inspection Training, for Closed-Circuit Television Cameras, Lesson 2: Documentation.

Intelligent Transportation Systems projects consist of a number of high-level system engineering phases. For a design-build contract, the CEI personnel provides oversight for both the design and implementation phases. For a design-bid-build contract, the CEI oversees just the implementation phase.

The CEI reviews, inspects, and provides verification for each of the various phases. The Contractor's deliverable for each phase may be a document, a set of plans, the physical installation of a device, or the performance of a test.

During the design phase, the CEI reviews the Contractor's project reports, plans, and specifications. The Contractor's deliverables will include:

- Concept of Operations: Concept of Operations Plan, or ConOps
- System Requirements: Requirements Traceability Verification Matrix, or RTVM, and the Project System Engineering Management Plan, or PSEMP
- High Level Design: 90% to 100% Plans and Specifications
- Detail Design: Release for Construction Plans
- and Specifications Testing Procedures

During the implementation phase, the CEI inspects the Contractor's workmanship and witnesses the testing of the equipment. The Contractor will furnish and install the infrastructure and the devices, perform the field acceptance, subsystem, system, and 30 day acceptance tests. The inspector must read and reference the project contract to understand the conditions of final acceptance. Some Districts may require specific features and components that other Districts may not.

For an inspector, document review is the most time consuming before construction begins and during final acceptance. During the preconstruction period, it is very important to get familiar with the Contract and Request For Proposal. Other documents that require approval are based on the System Engineering process. Material approval will be granted through shop drawings.

During the final acceptance period, the Contractor will submit documents that will be utilized by the Department's Maintenance Contractor. The inspector should review these manuals, especially the Operations and Maintenance, to ensure that they are applicable to the devices that were installed. In addition, the inspector should review the warranty of each device to ensure that the make and model, serial numbers match the installed device. The warranty dates must comply with the Contractual requirements.

A Concept of Operations, also known as ConOps, describes high-level project requirements from the customer and stakeholder perspectives. This can also serve as a high-level functional requirements guide for the system. The ConOps will justify the reason behind the need for weather related information as well as specific use sensors such as pavement temperature monitors.

The Engineer of Record team may create a Project System Engineering Management Plan or PSEMP, that enables the Overall Project Manager to manage a project using systems engineering principles and methods.

The Request for Proposal, or RFP, is a vital document for any ITS Design-Build project. The project RFP solicits the proposal, which is often made through a bidding process, when FDOT is interested in the procurement of a service or asset. The project RFP is sent to potential contractors, inviting them to submit their business proposals. A key component of allowing bids to be formulated are the project requirements contained within the RFP.

The Requirements Traceability Verification Matrix, or RTVM, traces the requirements from the System Validation stage to the Concept of Operations stage in the Systems Engineering process. The CEI should have access to all the various contract-related documents. Apart from the RFP, all other documents mentioned here are live documents until the final acceptance of the project.

It is important to thoroughly review the submittal data form (750-010-02) provided by the Contractor; it includes essential device information. The CEI personnel should review the information to ensure that the submittal documents match the device and then verify that the device is listed on the FDOT Approved Products List, or APL.

The Contractor is also responsible for making sure that the proposed device is on the APL. Devices may include: CCTV camera; Camera Lowering Device; Surge Protective Device, or SPD

In addition, there are device accessories, such as mounting brackets and cables, that the Contractor would need to submit to the CEI personnel for approval.

If the contractor submits a different model and explains that the approved model is no longer available or that the submitted version is more advanced, the CEI personnel must bring this to the attention of the Department. The Engineer of Record and the Department must be given the opportunity to review a replacement model before contractor procurement. The CEI personnel are responsible for making sure that the devices delivered for installation are the same make, model and firmware that was approved by the Engineer of Record and the Department.

The Contractor must provide an ITS field cabinet on the FDOT Approved Product List. The reference for the ITS field cabinets is FDOT Standard Specification 676. The FDOT Standard Drawings 641-020 and 649-020 show cabinets that are ground mounted as well as pole mounted. These Standard Drawings also provide information about the pole, its foundation, and grounding and lightning protection. The Contractor must supply the surge protective devices listed on the FDOT Approved Products List. More information on SPDs can be found in FDOT Standard Specification 620.

The Camera Lowering Devices are also listed on the FDOT APL. Standard Drawing 659-020 shows a detailed drawing of a camera lowering device as well as a fixed mount camera. The specifications for the camera lowering device is shown under Section 641 for Prestressed Concrete Poles. The Contractor must provide a CCTV camera listed on the FDOT Approved Products List. The APL categorizes the cameras as dome, external positioner, or thermal hybrid. FDOT Standard Specification 682 provides further information for these cameras.

The CEI personnel should verify that the Closed-Circuit Television camera coverage and the view specified in the project plans are met, particularly for Design-Build projects. It is the CEI personnel's responsibility to determine the Department's expectation regarding CCTV camera coverage requirements; this is particularly true for Express Lanes, Reversible Lanes, and Shoulder Use

projects where incident verification and response are critical, or where camera coverage is a performance measure that impacts the Contractors' final payment.

Often, CCTV camera site surveys are performed during the design process to give the Engineer of Record, or EOR, and the client representative views of the proposed camera locations. Bucket trucks are staged at the proposed locations so that the actual views at the required elevation can be evaluated. For Design-Build projects, plans may be submitted separately by discipline (ITS, Lighting, pavement markings, etc.). Landscaping, utilities, signing, lighting, sound wall, and guardrail plans should be reviewed to avoid conflicts with the ITS plans.

Lighting plans should be reviewed to verify potential illumination issues affecting nighttime camera operations. In addition, in most cases, the electrical power service of the lighting circuit is different from the power service of an ITS network. Therefore, the plans should show two power services.

The following flowchart describes the document approval process for Design-Build projects. The CEI personnel ensures that the Design-Build Firm submits the Engineer of Record, or EOR, approved documentation to the Department. The Department and CEI reviews and approves or rejects the document. If the documentation is not approved, then it will be returned to the Design-Build Firm with comments and recommendations.

Here you can see the documentation approval process for a Design-Bid-Build project. The process begins with the Contractor developing the document and then submitting it to the Department. The Department and CEI personnel reviews the document. If the document is rejected, then it will be returned to the Contractor with comments and recommendations.

If required by the Contract, CEI personnel, Contractors, and testing staff shall participate in the following meetings prior to commencement of ITS field work:

A **Pre-Installation** meeting with those closest to the work is a good opportunity to review and discuss specific responsibilities, project documents, such as plans, Technical Special Provisions, submittals, device inspection checklist and testing/acceptance requirements.

A **Pre-Integration** meeting may be required in certain FDOT District contracts. The purpose of this meeting is to ensure that the new cameras are properly added to the existing FDOT network without disrupting operations. Coordination between the Traffic Management Center Operations Manager, District ITS Network Administrator, and the Contractor must occur to provide a seamless integration of the new devices.

**On-site training**, often provided by the manufacturer, may be required by the Contract for personnel involved with installation, operation and maintenance of the camera lowering device. The FDOT Standard Drawing 659-020 states that the lowering device manufacturer shall provide an on-site inspection and operator instruction and certification. This ensures the product is assembled correctly and that all necessary persons are trained in the proper and safe operation of the system. Before erecting the first pole, the contractor must contact the lowering device supplier and schedule a manufacturer's representative to be on-site.

This concludes the Intelligent Transportation Systems Construction Engineering and Inspection Training, for Closed-Circuit Television Cameras, Lesson 2: Documentation.

Please continue to Lesson 3: Inspection.