

Intelligent Transportation Systems Construction Engineering and Inspection Training, for Road Weather Information System

Module 2 Phases, Documents, and Inspection

Welcome

Welcome to the Intelligent Transportation Systems Construction Engineering and Inspection Training, for Road Weather Information System, Module 2 Phases, Documents, and Inspection. This training contains audio, so please adjust your speakers accordingly. This CBT contains interactive elements. An alternate version is available on the resources page. The Knowledge Check questions allow you two chances to try and answer the question correctly. To begin, select the start button or press Shift + N on your keyboard.

ITS Project – System Engineering Phases

Intelligent Transportation Systems projects consist of a number of high-level system engineering phases. For a design-build contract, the Construction Engineering and Inspection (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. The following describes some of the deliverables for each phase:

- 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
- Field Installation: Inspection of infrastructure and devices
- Device Testing: Field Acceptance Testing
- Subsystem Verification: Subsystem Testing
- System Verification: System Testing
- System Validation: 30 Day Acceptance Testing

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.

Document Review

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, model, and serial number match the installed device. The warranty dates must comply with the Contractual requirements.

Document Review – Pre-Construction

The CEI personnel should verify that the shop drawings are approved by the Engineer of Record (EOR), and that the RWIS product technical specification matches or exceeds the FDOT Developmental Specification 688.

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.

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 Project EOR team may create a PSEMP, that enables the Overall Project Manager to manage a project using systems engineering principles and methods.

The 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 Product List (APL) or the Innovative Product List (IPL).

The Contractor is also responsible for making sure that the other proposed devices are on the FDOT APL. This includes all Surge Protection Devices, or SPDs, and the Cabinet.

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

The Inspector is responsible for making sure that the devices delivered for installation are the same make, model, and firmware that was approved by the EOR, FDOT Monitor, and the Department.

The Contractor may elect to propose a RWIS cabinet that is not on the FDOT Approved Product List. The CEI personnel shall review the proposed cabinet shop drawing against FDOT Standard Specification 676.

The Contractor must supply the surge protective devices (SPDs) listed on the FDOT Approved Product List. More information on SPDs can be found in FDOT Standard Specification 620.

If the proposed sensor is not on the FDOT IPL, then its shop drawing must be reviewed against the atmospheric data, mechanical and electrical specifications in the FDOT Developmental Specification Section 688. The manufacturer must also submit environmental testing results described in the NEMA TS 2, Sections 2.2.7, 2.2.8, and 2.2.9.

The CEI personnel should verify that the RWIS is installed as shown in the project plans.

Normally, the RWIS location surveys are performed during the design process since their placement is based on hazardous weather conditions. Occasionally, a specific sensor will be deployed based on the needs of the area. For example, a visibility sensor may be placed in areas prone to fog but not in other areas.

Plans should be cross checked with other assets, such as landscaping, underground and overhead utilities, signing, lighting, sound wall, and guardrail plans, to avoid conflicts.

The RWIS is a very specialized piece of equipment, so the manufacturer's installation guide should be available during the installation of the device. Both the CEI and the Contractor must review the manufacturer's installation instructions for each of the RWIS components.

The following flowchart describes the document approval process for Design-Build projects. The CEI personnel ensures that the Design-Build Firm submits the 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.

Project Meeting

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 **System Integration** meeting may be required in certain FDOT District contracts. The purpose of this meeting is to ensure that the new RWIS unit is 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 RWIS. The Developmental Specification does not require training; however, it may be a requirement of the Contract. Training is important for the proper and safe operation of the sensors since they are a very specialized piece of equipment.

Material Inspection

The CEI personnel should verify that the SPDs that are delivered to the project are the same ones that were approved in the submittal.

Information for FDOT-approved SPDs can be found on the APL website. For the RWIS, there are 2 classes of SPDs that should be verified.

The 120 Volt or 120_240 Volt Power SPDs are installed where the AC power conductors terminate on the cabinet terminal block. These SPDs are terminated in parallel with the power conductors.

The Low Voltage Power, Control, Data and Signal Systems SPDs are typically installed on a DIN rail mount inside a cabinet. These SPDs are terminated in series between the RWIS sensor and the low voltage power supply, the terminal server, or the managed field ethernet switch.

Verify that Surge Protection Devices (SPDs) are provided for all copper cables, including the power supply, twisted pair communications, and Ethernet cables.

During the material inspection process, the CEI personnel should verify that the RWIS sensors provided are the same that were approved in the submittal. There are many parts and pieces to the various sensors so this process is more time consuming than a typical ITS device.

Pole Identification Markings are verified per FDOT Design Standard Plans Index 641-010 during the material submittal review process. The picture on the screen shows an example of a RWIS pole identification marking. Refer to FDOT Standard Specifications for Road and Bridge Construction Section 450-14 for the handling, storage, shipping and erection of a concrete pole.

RWIS Sensors

The CEI personnel shall verify that the RWIS is on the Innovative Product List or Department and FDOT Monitor approved.

The manufacturer's name, model, and serial number should be noted. This information will be entered into the Department's material tracking database known as ITS Facility Management (ITSFM). Note the type of sensors that are used at the location since each site may utilize different types of sensors.

The sensors should be visually inspected for physical defects.

The power supply should be made specifically for the sensor. Ensure that a power supply from another manufacturer is not used. For sensors that utilize Power over Ethernet (POE), a POE injector may be required for the sensor.

Some vendors may supply a special composite cable for power and communications. These cables are costly and made specific for each site.

The fixed mounting brackets should also be supplied with the sensor. Ensure that brackets from another manufacturer are not used.

Surge Protective Device

The CEI personnel shall verify that the SPD is on the APL and is the correct product for the project.

The manufacturer's name, model, and manufacture date should be noted. This information will be entered into the Department's material tracking database.

For the RWIS, SPDs must be provided for the twisted pair conductors and the power supply. For IP sensors, an ethernet cable SPD should be used. Ensure that if a POE sensor is being used, a POE SPD is used.

The specification section for the surge protection devices can be found in the FDOT Standard Specifications for Road and Bridge Construction Section 620 for Grounding and Lightning Protection.

Physical Inspection - Safety

Failure to comply with safety requirements can be costly to you as the worker who could be injured or the employer who could be fined. The OSHA requirements must be followed when performing physical inspection.

OSHA 3151 – When performing inspection duties in the field, proper personal protective equipment shall be worn. These include, but may not be limited to, a hardhat, proper foot protection and eyewear.

ANSI/ISEA 107-2004 compliant high visibility safety apparel and headwear – ANSI/ISEA 107-2004 specifies four performance classes of apparel or headwear that have different amounts of reflective and background material to enhance pedestrian worker visibility under a variety of work and traffic conditions. All compliant garments have retroreflective or retroreflective/fluorescent materials that encircle the wearer's torso.

OSHA 1910.67 Powered Platforms, Manlifts, and Vehicle-Mounted Work Platforms - A personal fall arrest or travel restraint system that meets the requirements in subpart I of this part shall be worn and attached to the boom or basket when working from an aerial lift.

OSHA 1926.501 fall protection systems. Each employee who is constructing a leading edge 6 feet (1.8 m) or more above lower levels shall be protected from falling by guardrail systems, safety net systems, or personal fall arrest systems.

OSHA 1926.503 The employer shall provide a training program for each employee who might be exposed to fall hazards.

Conclusion

This concludes the Intelligent Transportation Systems Construction Engineering and Inspection Training, for Road Weather Information System, Module 2 Phases, Documents, and Inspection. Please continue to the next lesson, Module 3 Installation.

Knowledge Check

1. A Project System Engineering Management Plan (PSEMP) is a helpful tool for the CEI to use:
 - a. and involves a competitive bidding process by FDOT when interested in procurement of a commodity, service or valuable asset from potential suppliers or contractors.
 - b. and enables the Overall Project Manager to manage a project using systems engineering principles and methods.**
 - c. and describes high-level project requirements from a customer and stakeholder perspective; this can also serve as high-level functional requirements for the system.
 - d. because it traces the requirements from the System Validation stage to the Concept of Operations stage in the Systems Engineering process.

2. Determine whether the following statement is TRUE or FALSE. "Pre-Construction activity prior to commencement of ITS field work or first-time installation of a device includes onsite training for the proper and safe operation of the device."
 - a. true**
 - b. false

3. Determine whether the following statement is TRUE or FALSE. "RWIS units should never be located in areas prone to foggy conditions."
 - a. true
 - b. false**

4. Determine whether the following statement is TRUE or FALSE. "Given the low voltage used by RWIS sensors, Surge Protection Devices (SPD) are not needed for RWIS installations."
 - a. true
 - b. false**