

ITS CEI TRAINING: Microwave Vehicle Detection System (MVDS)

Module 2 – Phases, Documents, and Inspection

Welcome

Welcome to the Intelligent Transportation Systems Construction Engineering and Inspection Training for Microwave Vehicle Detection Systems, Module 2, Phases, Documents, and Inspection.

ITS Project – System Engineering Phases

Intelligent Transportation Systems projects consists of a number of high-level system engineering phases. For a design-build contract, the Construction Engineering Inspection, or CEI services, 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 and model, serial numbers match the installed device. The warranty dates must comply with the Contractual requirements.

Document Review – Pre-Construction

CEI personnel should verify that shop drawings are approved by the EOR, and that the product technical specification matches or exceeds FDOT Standard Specifications for Road and Bridge Construction. Many FDOT Districts have their own personnel or consultants to review shop drawings along with the CEI services. Coordination will be required.

The Concept of Operations, which is also known as the ConOps, describes high-level project requirements from the customer and stakeholder perspectives. It can also serve as a high-level functional requirements guide for the system.

The Project EOR team may create a Project System Engineering Management Plan that enables the Overall Project Manager to manage a project using systems engineering principles and methods. The Request for Proposal (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 valuable asset. The project RFP is sent to potential contractors, inviting them to submit their business proposals. A key component 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. This will be used to verify testable requirements in the contract. The CEI personnel 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, form number 750-010-02, provided by the Contractor; it includes essential device information. The Construction Engineering and Inspection personnel should review the information to ensure the submittal documents match the device, and then verify the device is listed on FDOT's Approved Product List, or APL.

The Contractor is also responsible for making sure the device is on the APL. Typical items found on the APL include: MVDS units, air terminals, surge protective device cables, and connectors.

If the Contractor submits a different model and explains the approved model is no longer available or that the submitted version is more advanced, the Construction Engineering and Inspection personnel must bring this to the attention of the Department. The EOR and the Department must be given opportunity to review the replacement model before contractor procurement.

The CEI services is responsible for making sure 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, it's foundation, and grounding and lightning protection.

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

The microwave vehicle detectors are listed on the FDOT APL in two subsections. The specifications for the microwave vehicle detector is shown under Section 660 for Vehicle Detection System.

Construction Engineering and Inspection personnel should verify the mounting height and offset of the MVDS unit and verify that the pole depth and height meet the requirements specified in the plans.

It is CEI services' responsibility to determine the Department's expectations regarding MVDS detection zone verification. This is particularly true for express lanes, reversible lanes, lanes control signals, and hard shoulder running projects where incident verification and response are critical, or where MVDS vehicle/traffic detection coverage is a performance measure that impacts the Contractors final payment.

For Design-Build projects, plans may be submitted separately by function, such as ITS, lighting, and pavement markings. These plans could be submitted by different consultants, making it important to avoid conflicts with other assets, such as landscaping, utilities, signing, lighting, sound wall and guardrail plans.

Roadway, structure, signing, landscaping, sound wall and lighting plans should be reviewed to avoid potential issues affecting the MVDS.

The following describes the document approval process for Design-Build projects. The CEI services 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.

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

Project Meetings

If required by the Contract, CEI services, 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 MVDS 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.

Material Inspection

Make sure the MVDS unit provided is the same unit that was approved in the submittal documents and that the product is on the FDOT Approved Products list. Check the FDOT APL website under the Specification, 660 – Vehicle detection system, for the approved Microwave Vehicle Detection System.

Often, the MVDS cable is custom-made to fit each installation. Be sure to verify that the cable length and the type of connectors are correct. Also, the CEI services should verify that the device was successfully tested during the factory acceptance test. This information can be found in the project documents.

Verify Surge Protective Devices are provided for both ends of all copper cables. Verify the Surge Protective Devices are the same as those approved with project submittals. Also verify that the MVDS is on the approved product list and matches the one specified in the project documents.

Pole Identification Markings per FDOT Design Standard Plans number 641-010, should be verified during the material inspection. These pictures display the different pole identification markings. FDOT Standard Specifications for Road and Bridge Construction Section 450-16 describes the handling, storage, shipping and erection of the MVDS poles. Refer to this section when working with MVDS poles.

Physical Inspection

Regarding MVDS pole installation, CEI services should verify the Pole orientation, the MVDS unit orientation, and the MVDS offset Cabinet orientation, per plans and FDOT specifications.

A great deal of analysis goes into determining the depth at which to bury a pole to conform to the appropriate standards for MVDS installation. The exact depth to sink a concrete MVDS-CCTV pole may vary from location to location based on a number of critical factors. The key is knowing the length of pole needed after accounting for the required installed height, any difference in elevation from the road surface to the pole mounting, differences in grade, soil composition, etcetera, to ensure the pole is installed at the proper depth.

Maintenance of Traffic, or MOT, standards and guidelines shall be followed at each roadside job site. The CEI team should have Florida Intermediate MOT training to verify proper maintenance of traffic at the construction site. Setback and clear zone limitations should also conform to the standards. Physical inspections should include weights, safety chain, cables, cabinets, embedment depth, offsets, plumb, concrete, conduits, grounding, lightning protection, air terminals, etc. The CEI team needs to check the proposed device has clear access and adequate space to perform maintenance. The next module will explain the MVDS pole installation stages.

End of Lesson

This concludes the Intelligent Transportation Systems Construction Engineering and Inspection Training, for Microwave Vehicle Detection Systems, Module 2, Phases, Documents, and Inspection. Please continue to the next lesson, Module 3 Installation.

Knowledge Check

1. Determine whether the following statement is TRUE or FALSE. "MVDS hardware is not subject to inspection by CEI or the Engineer of Record because all equipment on the APL is under manufacturer warranty.
 - a. True
 - b. False**

2. Which of the following best describes the meetings that must be attended by CEI, contractors, and testing staff prior to the commencement of ITS field work?
 - a. Communication Planning meeting, Town Hall meeting, and Open Forum meeting
 - b. Budget Planning meeting, Bid Committee meeting, and Construction Planning meeting
 - c. Pre-Construction Conference, Pre-Operation meeting, and Pre-Installation meeting**
 - d. Submittal meeting, Inspection meeting, and Testing meeting

3. Physical inspection in the MVDS installation phase includes physical inspection of all the following EXCEPT:
 - a. the MVDS unit to verify it is the same one that was approved in the submittal.
 - b. of the RTMC facility that is nearest to the installed MVDS unit.**
 - c. the MVDS pole, including the pole identification markings.
 - d. the installation of the MVDS on the pole, including the orientation and all components of the finished installation.