ITS CEI TRAINING: Microwave Vehicle Detection System (MVDS)

Module 1 – Overview

Welcome

Welcome to the Intelligent Transportation Systems Construction Engineering and Inspection Training for Microwave Vehicle Detection Systems, Module 1, Overview.

Purpose

This training was developed to show Construction Engineering and Inspection firms what a Microwave Vehicle Detection System, or MVDS is, what it does, how it is commonly used on transportation projects, and how to ensure that the contractors have provided an approved and properly configured device.

You will be able to apply this training based on differing conditions in the field. However, not all FDOT ITS projects will deploy the same devices or systems. The MVDS required will be based on District conditions, project requirements, and FDOT specifications.

This training will also cover terminology, standards, basic inspection procedures, documentation that is needed before final acceptance, testing, and other requirements that are relevant to Microwave Vehicle Detection Systems as well as what to look for to make sure MVDS units are acceptable and properly installed on FDOT projects.

These are different types of FDOT-approved MVDS devices. These devices can be found on the FDOT Approved Product List, or APL. A link to the FDOT APL is located on the Resources page of this training. Here is a Microwave Vehicle Detection System unit and mounting brackets, and some of the various in-cabinet equipment used in the system. This is an MVDS mounted on a CCTV pole the top square-shaped item on the right side of the pole is the MVDS unit, and the rounded item on the left side of the pole is the weather head which facilitates cable egress with the pole without water intrusion.

Other Industry Specifications

This list identifies various standards used for Microwave Vehicle Detection Systems:

- NTCIP – National Transportation Communication for ITS Protocol
- NEMA – National Electrical Manufacturer Association
- NFPA 70 – National Electrical Code
- NESC – National Electric Safety Code
- NFPA 780 - Standard for the Installation of Lightning Protection Systems
- UL Standards – 96 & 96A Lightning Protection
- 1449 Standard for Surge Protective Devices

Microwave Vehicle Detection Systems are described in the FDOT Standard Specification for Road and Bridge Construction, section 660-2.1.2.3.

The Standard Specification book states: “Ensure the serial interface and connector conforms to TIA-232 standards.

MVDS shall be Federal Communications Commission (FCC) certified with the FCC identification number displayed on the unit with an external label.”

The CEI personnel is responsible for verifying that the MVDS to be installed is on FDOT’s Approved Product List.

The NEMA specification relates to how MVDS outputs shall meet NEMA TS2-2003, section 6.5.2.26. The National Electric Code shall be followed when installing the MVDS. Various UL standards also come into play as noted on the list.

What It Does and Why We Use It

An Microwave Vehicle Detection System is a traffic data detection system that collects roadway information including lane presence, volume, occupancy, and speed data. To accomplish this, the MVDS uses a radar signal for vehicle detection. This involves transmitting, receiving, and analyzing an FCC-certified, low-power microwave radar signal specifically designated for vehicle detection. Once the system collects that data, it is sent to the Regional Transportation Management Center or RTMC. At the RTMC, the data is analyzed to provide traffic information to the travelling public.

The Microwave Vehicle Detection System is used by the Regional Transportation Management Centers to detect traffic on various freeways and city streets. The MVDS is used to observe all types of vehicular traffic such as cars, trucks and buses. The Microwave Vehicle Detection System is also used for automatic incident detection. Additionally, the MVDS can send alerts when traffic slows below a set “miles per hour” threshold for a specific duration of time.

The alert notifies the RTMC operator to look at the closed-circuit television camera feed showing the location near the MVDS unit, so the operator can view the roadway and see why traffic has slowed. Cameras are used for incident verification after the RTMC operators have received notification from the MVDS unit that traffic has slowed or stopped. The Microwave Vehicle Detection System is mainly used to observe current traffic conditions. Unlike CCTV traffic footage data, MVDS traffic data is saved and archived. All MVDS units are being monitored at the same time.

MVDS units are used at traffic signal locations to aid in signal operations and ramp metering. MVDS units used on ramps can detect wrong-way traffic or aid in vehicle detection. The MVDS data feed can provide the real-time traffic status and the archived traffic data can be used for trend analysis, crash reports, and average daily traffic volumes.

Types Of MVDS

Microwave Vehicle Detection System equipment comes in different shapes and sizes. MVDS units are usually mounted on poles but can sometimes be installed on other structures.

These pictures show single radar MVDS examples of varying shapes and sizes. This MVDS is an example of a dual radar MVDS.

Dual Antenna radar operates at different frequencies. Using two signals, Dual MVDS can determine vehicle travel direction.

MVDS for Stop Bar Detection

Microwave Vehicle Detection Systems are also used for stop bar detection at vehicle-activated signalized intersections.

Some MVDS deployments may use a matrix of multiple radars for two-dimensional coverage. MVDS stop bar detection typically tracks vehicles through a 90-degree field of view that extends out past 100 feet.

Some such systems can be configured to support real-time data collection on moving and stopped vehicles, for up to 10 lanes, including intersections with curved lanes, islands, and medians. The MVDS, in this role, has displayed robust performance in changing temperature, light, and weather conditions.

Like other side-fired and angular fired MVDS, stop bar MVDS must be installed as per the manufacturer guidelines.

Device Mounting Location

These are important considerations when determining MVDS locations. We will consider explanations for each item on the list.

Lane Coverage – Sensor mounting locations should be selected so that all monitored lanes are within 10 to 200 feet or use the distance suggested by the manufacturer, running parallel to each other. If more lanes need to be simultaneously monitored than what is recommended by the device manufacturer, multiple sensors should be used.

Parallel Lanes – When the sensor is used to collect both mainline and ramp data, the pole position should be selected so that the on and off ramp lanes run parallel with the mainline. If lanes are not parallel, installation of multiple MVDS units should be considered to achieve the sensor manufacturer’s recommended side-to-side angle requirement.

Sensors on the Same Pole – When multiple sensors are mounted on the same pole, they will not be subject to interference if they are configured to operate using different Radio Frequency or “RF” channels and are separated vertically by a few feet. The higher sensor would typically be used for the lanes furthest from the pole to minimize occlusion.

Sensors on Opposing Poles – MVDS units facing each other on opposing poles should operate on different Radio Frequency or “RF” channels and be separated by a manufacturer-recommended lateral offset, if possible.

Line of Sight – The MVDS may be designed to work accurately in the presence of barriers, but in general, an alternate mounting location that would avoid any type of structural occlusion is preferred. Avoid occlusion by trees, signs, and other roadside structures.

Neighboring Structures or Parallel Walls – It is also preferred that sensor locations have a manufacturer recommended lateral separation distance from overhead signs, bridges, overpasses, tunnels, parallel walls and parallel-parked vehicles to avoid multiple reflection paths.

Arterial Locations – Sensor sites on arterials or other roadway segments with regulated stop lines should be selected at mid-block positions to increase the accuracy by increasing line of sight to stop-and-go vehicles.

Freeway Locations – The number of MVDS locations along a single roadway and the distance between MVDS units should be selected to achieve adequate levels of statistical confidence. Permanent MVDS stations, which are selected to cover interstate, principal arterials and other national and state highways, are used to establish seasonal adjustment factors for count data from temporary collection sites.

Mounting Height – The mounting height should be based upon the offset from the lanes of interest. For each offset, mount the MVDS unit per manufacturer recommendations for the minimum, maximum and recommended range of mounting heights for MVDS units.

Mounting Offset – The minimum recommended offset from the near edge of the first lane of interest is provided by the manufacturer.

Cable Lengths – Make sure that you have sufficient homerun and sensor cabling. Cable runs as long as 600 feet operating 24 volts of direct current or VDC and RS-485 communications are acceptable. For longer connections, alternate wired and wireless options should be considered.

End of Lesson

This concludes the Intelligent Transportation Systems Construction Engineering and Inspection Training, for Microwave Vehicle Detection Systems, Module 1 Overview. Please continue to the next lesson, Module 2 Phase, Documents, and Inspection.

Knowledge Check

1. In the context of this FDOT training module, MVDS is an acronym standing for:
    a. Multipoint Video Distribution System
    b. Modular Vault Dry Store
    c. Microwave Vehicle Detection System
    d. Minimum Variance Distortion Suppression

2. In the context of this FDOT training module, NEMA is an acronym standing for:
    a. National Electrical Manufacturers Association
    b. National Emergency Management Alliance
    c. Notice of Electronic Monitoring Act
    d. Network Expansion Multicore Autoresponder

3. Which of the following best describes how Microwave Vehicle Detection Systems work?
    a. MVDS units transmit, receive, and analyze high-power infrared radiation and ranging signals to detect wildlife hazards near roadways.
    b. MVDS units detect and record basic weather data that is transmitted directly to Dynamic Message Signs (DMS) to benefit the traveling public.
    c. MVDS units are designed to detect and neutralize electrical power surges that occur over Intelligent Transportation Systems (ITS) power lines.
    d. MVDS units transmit, receive, and analyze low-power microwave radar signals to detect vehicles and make this information available for various safety applications.

4. Determine whether the following statement is TRUE or FALSE. “All Microwave Vehicle Detection Systems utilize a single radar unit and a single antenna.”
    a. True
    b. False

5. Which of the following best represents considerations in determining MVDS mounting locations?
    a. **Lane coverage, other sensors on the same pole, line of sight, mounting height and offset**
    b. Light quality, air quality, vehicle types, number of passengers per vehicle
    c. Mounting offset, ethernet connectivity, distance from nearest RTMC, elevation above sea level
    d. Cable lengths, thickness of pavement, toll amount per axle, size of nearest urban area

6. Determine whether the following statement is TRUE or FALSE. “The actual mounting height for MVDS units should be based upon the offset from the lanes of interest.”
    a. **True**
    b. False

7. Determine whether the following statement is TRUE or FALSE. “The maximum mounting height for MVDS units varies among different MVDS unit manufacturers.”
    a. **True**
    b. False

8. Determine whether the following statement is TRUE or FALSE. “MVDS can also be used to detect the presence of vehicles at intersection stop bars.”
    a. **True**
    b. False