

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
MICROWAVE VEHICLE DETECTION SYSTEM

ITS:EG

1 of 5

APPR:MDW:JVG:04-21-20
FHWA:APPR:04-23-20

a. Description. This work consists of one or more of the following:

1. Furnish and install a Microwave Vehicle Detection System (MVDS). The MVDS is a noninvasive detection system installed above ground on the side of the road (i.e., side-fire). Its express purpose is vehicle detection and reporting of specified data by way of the ITS communication network to the designated Advanced Traffic Management System (ATMS) software. The MVDS consists of a radar detection unit pole-mount assembly; mounting hardware; UL approved power supply; lightning and surge protection; all required cable; and communications patch cords.

2. Remove and salvage a MVDS and all required mounting hardware, power supply, cables, patch cords and jumpers.

3. Install a salvaged MVDS and all required mounting hardware, power supply, cables, patch cords and jumpers.

b. Materials.

1. Functional Specifications.

A. Provide a complete side-fire mounted MVDS. The equipment includes, but is not limited to, a microwave detection unit (sensor within a weatherproof housing), i.e. the detector; composite cable required to connect the microwave detection unit to the power source and the ITS network; various control and communications equipment to be contained within an ITS equipment cabinet (cabinet paid for under a separate special provision); an Ethernet adapter appliance (if required); mounting brackets; and all ancillary equipment and/or incidental items as required to make a complete and fully operational detection system.

B. Ensure the detection process utilizes a microwave signal to accurately detect and measure vehicle classification, vehicle volume, speed, true presence (including stopped vehicles), and occupancy in all weather conditions without performance degradation.

C. Ensure the design the microwave circuitry within the MVDS utilizes active control that dynamically adjusts to compensate for temperature and aging variations in component performance.

D. No field calibration or adjustment after the initial setup is allowed. If calibration or adjustment is required after initial setup, the particular MVDS will be considered defective and must be replaced at no additional cost to the Department.

E. Ensure the MVDS unit supports Point-to-Point Protocol (PPP) and Point-to-Multi-Point Protocol (PMPP) via Ethernet communications either by a MVDS internal Ethernet port or vendor-supplied external terminal server and vendor-supplied Ethernet appliances. The MVDS is to be addressable and capable of downloading detection data when polled by the ATMS software.

F. Provide a detector capable of switching between data pushing and data polling.

G. All traffic measurements or traffic parameter data defined on the plans are to be stored in nonvolatile memory within the MVDS detector. Ensure the MVDS is capable of transferring this traffic parameter data from the detector's nonvolatile memory to the ATMS software by way of a local managed field Ethernet switch (MFES) and ITS communications network.

2. Performance Specifications. Required minimum performance of the MVDS:

A. Detection of vehicles in multiple discreet lanes within the detection zone of up to 12 discreet lanes and in both directions providing accurate, real-time presence, volume, average speed and occupancy data. Ensure detections are correctly categorized into 3 length-based classifications. Vehicle detection must occur at a range of 10 feet to 250 feet from the MVDS.

B. The reporting of classification, presence, volume, occupancy and speed data for each discreet lane of the 12 travel lane detection zones.

C. Accuracy Required. Volume (± 5 percent); average speed (± 10 percent); occupancy (± 10 percent).

3. MVDS Housing and Mounting Hardware Specifications.

A. Accomplish connectivity of the MVDS detection unit to external equipment by a composite cable and a single connector. The connector/cable must provide power to the unit and communications into the ITS cabinet.

B. Mount the MVDS detection device in a polycarbonate box meeting *NEMA 250 Type 4X* enclosure requirements with the electrical connection located at the bottom of the box.

C. Provide a universal mounting bracket capable of pole- or wall-mounting of the MVDS. The universal mounting bracket is required to be adjustable on two axes.

D. Stainless steel bands with a minimum width of 0.75 inch and 0.025 inch thickness are required to strap the universal mounting bracket to a pole. For wall/bridge mounting, 2 stainless steel expansion bolts with sufficient length and diameter to support a minimum of 40 pounds are required.

4. Power, Communications, and Cable Specifications.

A. All power and communications cables are to be a polyurethane-jacketed cable, Belden #9516, outdoor rated Category 5e (CAT-5e), outdoor rated Category 6 (CAT-6),

or an approved equal. This cable's minimum rating is 300 volts (V) with a minimum temperature rating of 140 degrees Fahrenheit (F).

B. Conductor size. American Wire Gauge (AWG) #24 or larger conductors, as recommended by the MVDS manufacturer.

5. Electrical Specifications.

A. The MVDS is to consume no more than 8 watts with a direct current (DC) input between 12 and 24V DC. Automatic recovery from power failure within 15 seconds after resumption of power is required.

B. Federal Communications Commission (FCC) certification of the detector is required. Ensure the FCC's identification number is displayed on an external label. Transmission frequency band of 24.125 gigahertz (GHz), using the K band, or another approved spectral band is required. Compliance with 47 CFR Part 15 is required.

C. Internal lightning suppression and electrical isolation is required.

6. Environmental Specifications.

A. All materials are required to be corrosion resistant and approved by the Engineer.

B. Ensure the MVDS's operation is not affected by a minimum vibration of 16.087 feet per second squared (ft/s^2) at 30 Hertz and a shock ratio of 160.87 ft/s^2 for 10 millisecond half sine waves.

C. Ensure the MVDS has an operational temperature range of -29.2 degrees F to 165 degrees F, without performance variation.

D. All system components, while housed in their associated environmental enclosures, are to comply with *NEMA TS-2* environmental specifications. Ensure the housing is capable of wind loads of up to 120 miles per hour (mph) sustained from any direction required by *ASCE 7*.

c. Construction.

1. General Requirements.

A. Prior to submitting shop drawings, a preconstruction site survey is to be conducted by a factory-trained and certified representative. The site survey is designed to identify the exact location and details for each detection station. The site survey report is to be submitted to the Engineer for approval, including specific location and detail information.

B. Mount detection units in a side-fired configuration. Mount the detector level from side to side. Furnish a laptop computer and software to be used for zone calibration. Detector height and downward pitch angle are to be in accordance with the manufacturer recommendations for the roadway, median width, and number of lanes being detected at each site.

C. All detection zones are to be contained within the specified elevation angle as

suggested by the manufacturer.

D. When installing the detector near metal structures, such as buildings, bridges, or sign supports, mount and aim the detector so the detection zone is not under and does not pass through the structure to avoid distortion and reflection.

E. All wires are to be cut to their proper length before assembly. No doubled-back wire/cable to take up slack is allowed.

2. Required Documentation.

A. Submit shop drawings that detail the complete detector and all other components to be supplied and constructed to the Engineer for approval. Ensure these drawings detail the exact location and placement of system components and include installation details for the required cables. Install all cabling in accordance with manufacturer recommendations.

B. Provide a training and maintenance manual for the MVDS, including detailed specifications and information regarding the inventory of installed assemblies by location and corresponding serial number.

3. Warranty. Provide MVDS with a standard manufacturer's warranty, transferable to MDOT. The MVDS must carry a warranty (parts, software and labor) of 2 years from the date of shipment with at least 1 year of warranty remaining at the start of burn-in. MVDS ancillary components must carry a manufacturer's warranty of 1 year from the date of shipment. Furnish warranty and other applicable documents from the manufacturer, and a copy of the invoice showing the date of shipment, to the Engineer prior to final written acceptance.

4. Remove. If MVDS removal is specified in the contract, the following procedures apply:

A. Do not damage the ITS cabinet or associated equipment.

B. Remove the MVDS, mounting hardware, power supply, and power cabling associated with the MVDS. Disconnect all communication cables from the MVDS. The equipment will remain the property of the Contractor.

C. Notify the Transportation Operations Center (TOC) and the Engineer a minimum of 7 days in advance of decommissioning the MVDS hardware.

5. Remove and Salvage. If MVDS removal and salvage is specified in the contract, the following procedures apply:

A. Do not damage the ITS cabinet or associated equipment.

B. Remove the MVDS, mounting hardware, power supply, and power cabling associated with the MVDS. Disconnect all communication cables from the MVDS and leave them in place unless otherwise directed by the Engineer.

C. Notify the Transportation Operations Center (TOC) and the Engineer a minimum of 7 days in advance of decommissioning the MVDS hardware.

D. Salvage the MVDS, including mounting hardware, power supply, surge protectors (if any) and cabling, as directed by the Engineer. The salvaged equipment is to be stored at a location free of moisture, and rodent/insect intrusion. If the MVDS is to be reinstalled it must be stored until then, otherwise notify the Engineer once the equipment has been salvaged for pickup to be arranged.

6. Install Salvaged. If a salvaged MVDS is to be installed at a location specified in the contract, follow the procedures detailed in section c of this special provision.

d. Measurement and Payment. The completed work, as described, will be measured and paid for at the contract unit price using the following pay items:

Pay Item	Pay Unit
Microwave Vehicle Detection System	Each
Microwave Vehicle Detection System, Rem.....	Each
Microwave Vehicle Detection System, Rem and Salv	Each
Microwave Vehicle Detection System, Install Salv	Each

Microwave Vehicle Detection System consists of a radar detection unit pole or truss mount assembly, pole or truss mounting hardware, UL approved power supply, lightning and surge protection, all required cable, communications patch cords, and any and all ancillary items required for a fully operational MVDS remote site installation.