MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
MICROWAVE VEHICLE DETECTION SYSTEM

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 dispose of a MVDS and all required mounting hardware, power supply, cables, patch cords and jumpers.

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

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

b. Materials.

1. Functional Specifications.

A. Furnish 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 of 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. Furnish 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 can transfer 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. Each discreet lane must meet an accuracy requirement with volume having a ±5 percent tolerance, average speed having a ±10 percent tolerance, and occupancy having a ±10 percent tolerance.

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 furnish 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. Furnish a universal mounting bracket capable of pole-mounting of the MVDS. The universal mounting bracket is required to be adjustable on two axes.

D. Ensure universal mounting bracket is mounted to the pole with stainless steel bands.

E. Ensure the MDVS assembly including housing, mounting hardware, and mounting connections are capable of resisting wind loads of up to 120 mph in accordance with *LRFD Structural Supports for Highway Signs, Luminaires, and Traffic Signals, First Edition.*

F. Ensure the MVDS assembly including housing, mounting hardware, and mounting connections do not exceed a gross weight of 10 pounds and an effective projected area of 1 square foot.

4. Power, Communications, and Cable Specifications.

A. Ensure all power and communications cables have a thermoplastic jacket and are rated for outdoor use.

B. Ensure Ethernet and/or power over Ethernet cables are outdoor rated Category 5e (CAT-5e), outdoor rated Category 6 (CAT-6) or an approved equal.

C. Ensure all cabling is rated for a minimum of 300 volts (V) and possesses a temperature rating of no less than 75 °C. Ensure all cables are *UL* rated for their proposed use.

D. Conductor size. 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 DC input between 12 and 24 VDC. Automatic recovery from power failure within 15 seconds after resumption of power is required.

B. 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 has an operational temperature range of -29.2 °F to 165 °F, without performance variation.

C. All system components, while housed in their associated environmental enclosures, are to comply with *NEMA TS-2* environmental specifications.

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. Detector mounting height greater than 40 feet must be approved by the Engineer.

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. Furnish 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. Furnish a 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, power cabling, and communication cables associated with the MVDS. The equipment will remain the property of the Contractor; and

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

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

A. Document MVDS operational state. Furnish test documentation to the Engineer.

B. Remove the MVDS, mounting hardware, power supply, power cabling, and communication cables associated with the MVDS. Do not damage the ITS cabinet or associated equipment;

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

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 in a location where it is protected from theft, water, rodent, and/or, insect intrusion, and other physical damage. If the MVDS is to be reinstalled, ensure it is stored until then, otherwise notify the Engineer once the equipment has been salvaged for pickup to be arranged.

6. Install Salvaged. In accordance with the salvage test documentation, verify the MVDS has not been damaged before installation then install in accordance with 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 site.