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

1. Furnish, install, integrate, and test 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.

   A. Furnish, install, integrate and test all equipment and components necessary to provide full and complete ITS functionality in all respects, without additional expense to the Department.

   B. The payment process, including partial payment, is governed by section 109 of the Standard Specifications for Construction.

   C. This detection system uses a Federal Communications Commission (FCC) certified, but non-site-licensed, low-power microwave radar beam technology to measure vehicle presence, volume, occupancy, and speed. The system is to transmit data via serial and Ethernet communication protocols and must be compatible with the ITS network.

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. The detection process must utilize 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. The microwave circuitry within the MVDS must be designed utilizing 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 is considered defective and must be replaced at no additional cost to the Department.

E. The MVDS unit must support 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 within the plans are to be stored in nonvolatile memory within the MVDS detector. The MVDS must be capable of transferring this traffic parameter data from the detector’s nonvolatile memory to the ATMS software by way of the 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 10 discreet lanes and in both directions providing accurate, real-time presence, volume, average speed and occupancy data. Detections must be correctly categorized into 3 length-based classifications. True 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 10 travel lane detection zones.

C. Accuracy Required. Volume (±5 percent); average speed (±10 percent); occupancy (±10 percent); and classification data under nominal traffic conditions and in all weather conditions over a range of 10 feet to 250 feet from the MVDS; must perform accurately without cleaning or maintenance.

3. MVDS Housing and Mounting Hardware Specifications.

A. Accomplish MVDS detection unit to external equipment connectivity by a composite cable and a single connector. The connector/cable must provide power to the unit and allows the generation of contact closure via output pairs for interface with traffic controller inputs, if required.
B. The MVDS detection device is to be mounted in a NEMA 4X polycarbonate box 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 thick 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 is required. If the stainless steel bands are installed on galvanized poles, the Contractor is to place non-conductive material approved by the Engineer between the band and the pole.

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 volt with a minimum temperature rating of 140 degrees 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 24 volts DC (VDC). The equipment must be designed such that the failures of the equipment do not cause the failure of any other unit of equipment. Automatic recovery from power failure within 15 seconds after resumption of power is required.

B. FCC certification of the detector is required. The FCC’s identification number must be displayed on an external label. Transmission frequency band of 24.125 gigahertz (GHz), using the K band, or another approved spectral band is required. FCC’s 2001 Code of Federal Regulations (CFR), Title 47 - Telecommunication, Volume 2, Part 15, Radio Frequency Devices compliance is required.

C. Internal lightning suppression and electrical isolation is required.


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

B. The MVDS’s operation must not be affected by a minimum vibration range of 0.5 grams to 30 Hz and a shock ratio of 5 grams for 10 millisecond half sine waves.

C. An operational temperature range of -29.2 degrees F to 165 degrees F, without performance variation, is required of the MVDS.
D. All system components, while housed in their associated environmental enclosures, are to comply with *NEMA TS-2* environmental specifications. The housing must be capable of wind loads of up to 120 miles per hour (MPH) sustained.

c. **Construction.**

1. **General Requirements.**

   A. Prior to submitting shop drawings, a pre-construction 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. The detector is to be mounted level from side to side. Software and a laptop computer are to be furnished by the Contractor and 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, the detector is to be mounted and aimed 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. Shop drawings that detail the complete detector and all other components to be supplied and constructed are to be submitted to the Engineer for approval. These drawings detail the exact location and placement of system components and include installation details for the required cables. All cabling is to be installed 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. **Testing.**

   A. **General.**

      (1) Notify the Engineer a minimum of 10 working days prior to the proposed installed MVDS site test date.

      (2) The Engineer or designee will witness such tests.
(3) Furnish all equipment, appliances and labor necessary to test the installed MVDS and the network communication device.

B. Site Inspection.

(1) All control cabinet components will be inspected for their proper installation and cable termination.

(2) Apply power to the components and verify that they are functioning as anticipated.

(3) Verify that physical construction has been completed as specified herein, within the plan set, and/or in the contract.

C. Detector Test.

(1) A radar gun is required for the verification and calibration of speed detection. Manufacturer recommended procedures for calibration are to be followed.

(2) Each installed MVDS’s volume counts and speed measurements are to be verified utilizing the MVDS vendor-supplied test software running on a laptop connected locally to the detector communication port. Compare the counts from the detector to visual counts or counts from permanent or temporary traffic detection devices of known accuracy. Compare the speed measured by the detector to the speeds measured by the radar gun. Confirm that the accuracy is within the range required by this special provision.

4. Manufacturer Warranty. The MVDS system, consisting of the microwave detection sensor, network interface devices, and all cabling must carry a manufacturer’s warranty of 2 years from the date of final acceptance. Software updates are to be provided free of charge during the warranty period.

5. Remove and Salvage. If MVDS remove 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. Inform the Transportation Operations Center (TOC) and the Engineer a minimum of 7 days in advance of the decommissioning of 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 sections c.1 and c.3 in this special provision and the MVDS test requirements in the Special Provision for System Integration and Testing.

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

<table>
<thead>
<tr>
<th>Pay Item</th>
<th>Pay Unit</th>
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</thead>
<tbody>
<tr>
<td>Microwave Vehicle Detection System</td>
<td>Each</td>
</tr>
<tr>
<td>Microwave Vehicle Detection System, Rem and Salv</td>
<td>Each</td>
</tr>
<tr>
<td>Microwave Vehicle Detection System, Install Salv</td>
<td>Each</td>
</tr>
</tbody>
</table>

**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.