SPECIAL SPECIFICATION

6274

Microwave Vehicle Detection System

1. **Description.** Furnish and install the microwave vehicle detection (MVD) system as shown in the plans and as detailed in the Special Specifications. All equipment required to interface with the TxDOT Traffic Management Center (TMC) will be subsidiary to this pay Item.

The microwave vehicle detection system will be supplied as a complete system by a single supplier. The complete system will include:

1. Microwave vehicle detection (MVD) transmitter/receiver device.
2. Distribution system to power MVD(s) and modem(s)
3. Pole mountable cabinet for MVD equipment, fiber optic RS-232 data modem(s), power distribution, and modem(s)
4. MVD interface controls for traffic loop simulation

Provide all other materials necessary for installation of the MVD as shown on the plans.

Furnish and install MVD on existing camera poles and on Contractor-supplied new poles as highlighted on the plans.

2. **Microwave Vehicle Detection System.**

   (1) **General Requirements.**

      (A) Furnish all new equipment and component parts. All parts will be of the latest design and manufacture, be in an operable condition at the time of delivery and installation, and be of high quality workmanship.

      (B) Design to prevent reversed assembly or improper installation of connectors, fasteners, etc. Each item of equipment will be designed to protect personnel from exposure to high voltage during equipment operation, adjustments, and maintenance.

      (C) The designed Mean Time Between Failures (MTBF) of the Microwave Vehicle Detector unit, operating continuously in their application, will be 10 years or longer.

   (2) **Functional Requirements.** The MVD equipment will include a radar-based sensor that when mounted in a side-fire position, will provide volume, average speed, occupancy
and long vehicle count data for vehicles in 8 lanes simultaneously, regardless of
direction of travel.

(A) **Capabilities.** The detector will be a true presence detector, which can provide
presence, volume, lane occupancy and speed information on up to 8 discreet
detection zones. This information will be available via an RS-232 serial
communications lines directly interfacing with the fiber optic RS-232 data modem.

(B) **Transmission.** The detector will comply with the limits for a Class A digital
device, pursuant to Part 15 of the FCC rules or the appropriate Spectrum
Management Authority. The detector shall not interfere with any known
equipment.

Transmitter power will not exceed 10 milliwatts.

(C) **Area Coverage.**

The sensor’s field of view will cover an area defined by an oval shaped beam and
its maximum detection range shall be as follows:

1. Elevation Beam Width - 45 deg.
3. Range - 10 to 200 ft.

(D) **Detection Zones.**

1. The maximum number of detection zones defined will be no less than 8. The
range limits of each zone will be user defined in 7-ft. resolution.
2. Presence accuracy from overhead mount will be at least 95% in a single
detection zone.
3. Accuracy in detection and magnitude of speed will be at least 95% from the
overhead mount.
4. Presence accuracy from side-fired mount will be at least 95% in multiple
detection zones. Accuracy in detection, volume, occupancy, and magnitude of
speed will be at least 95% from a side-fired mount.
5. The detector will include surge protection in accordance with IEEE Standard
C62.41 - 1980 Category C.
6. The detector will be resistant to vibration in accordance with IEC 68-2-30 (test
Fc), NEMA TS-1 (Section 2.1.12), or approved equivalent. The detector will be
resistant to shock in accordance with IEC 68-2-27 (test Ea), NEMA TS-1 (Section
2.1.13), or approved equivalent.
(3) **Power Requirements.**

(A) The detector will operate at 10 to 30 VDC. Normal power consumption will be 8 watts or less.

(B) The equipment operation will not be affected by the transient voltages, surges and sags normally experienced on commercial power lines. It is the Contractor’s responsibility to check the local power service to determine if any special design is needed for the equipment. The extra cost, if required, will be included in the bid of this Item.

(C) Design equipment such that failure of the one unit of equipment will not cause failure of any other unit of equipment. Automatic recovery from power failure will be within 5 seconds after resumption of power. The detector must have a monitoring circuit for the transceiver that will change the output relay to the fail-safe position in the event of a component failure.

(4) **Mechanical Requirements.**

(A) The microwave vehicle presence detector will be enclosed in a rugged weatherproof enclosure and sealed to protect the unit from wind up to 90 mph, dust and airborne particles, and exposure to moisture (NEMA type 3R enclosure). The overall dimensions of the box, including fittings, will not exceed 8-in. x 10-in. x 6-in. The total weight of the microwave vehicle presence detector assembly will not exceed 5 lb.

(B) The mounting assembly will have all painted steel, stainless steel, or aluminum construction, and support a load of 20 lb. The mounting assembly will incorporate a ball-joint, or other approved mechanism that can be tilted in both axes, then locked into place, to provide the optimum area of coverage.

(C) Printed circuit boards will be coated with a clear-coat moisture and fungus resistant material (conformal coating).

(D) External connection for communications and power will be made by means of a single military style multi-pin connector, keyed to preclude improper connection.

(E) The detector will be capable of continuous operation over a temperature of –37°C (-35°F) to +74°C (165°F) and relative humidity from 0% to 95% non-condensing.

(F) All attached components of the MVD that are mounted to the pole will withstand AASHTO wind criteria for 100 mph winds with 30% gust factors.

(G) **Construction Methods.** The equipment design and construction will utilize the latest available techniques with a minimum number of parts, subassemblies, circuits, cards, and modules to maximize standardization and commonality.

(H) All electronic components will comply with Special Specification, “Electronic Components”.
(I) All external screws, nuts, and locking washers will be stainless steel; no self-tapping screws will be used unless specifically approved by the Engineer.

(J) All parts will be made of corrosion resistant material, such as plastic, stainless steel, anodized aluminum or brass.

(K) All materials used in construction will be protected from fungus growth and moisture deterioration.

(L) Dissimilar metals will be separated by an inert dielectric material.

3. **Mechanical Requirements.**

   (1) The equipment will be modular in design such that it can be easily replaced in the field.

   (2) Clearly identify with name, model number, serial number and any other pertinent information required to facilitate equipment maintenance.

   (3) Printed circuit boards will be coated with a clear-coat moisture and fungus resistant material (conformal coating).

   (4) External connection for communications and power will be made by means of a single military style multi-pin connector, keyed to preclude improper connection.

   (5) **Construction Methods.** The equipment design and construction will utilize the latest available techniques with a minimum number of parts, subassemblies, circuits, cards, and modules to maximize standardization and commonality.

   (6) All electronic components will comply with Special Specification, “Electronic Components”.

   (7) All external screws, nuts, and locking washers will be stainless steel; no self-tapping screws will be used unless specifically approved by the Engineer.

   (8) All parts will be made of corrosion resistant material, such as plastic, stainless steel, anodized aluminum or brass.

   (9) All materials used in construction will be protected from fungus growth and moisture deterioration.

   (10) Dissimilar metals will be separated by an inert dielectric material.

4. **Installation.** Installation will include:

   1. Furnish and install MVD equipment on as shown on the plans and per the MVD manufacturer installation requirements.

   2. Obtain Engineer’s approval for the final location of the MVD prior to construction.

   3. Configure the MVD for optimal results for each lane of traffic.

   4. Ensure that all holes and entries made to DMS or camera poles and NEMA enclosures are made watertight.
5. Wire, ground, and bond equipment in accordance with Section 250-86 of the NEC.

6. Furnish and install terminal blocks, field wiring, and service equipment (when applicable) needed to provide power to the MVD equipment.

7. Furnish and install power line surge protectors in the cabinet that conform to the following requirements (EDCO SHA 1210 or equivalent):
   1. Peak surge current occurrences: 20 minimum.
   2. Peak surge current for an 8 x 20 microsecond wave shape: 20,000 amperes.
   3. Clamp voltage at 20,000 amperes: 280 volts.
   4. Response to surge: Voltage shall never exceed 280 volts during any portion of the surge.
   5. Maximum continuous operating current at 120 VAC, 60 Hz: 10 amperes
   6. Temperature range: -40ºF (-40ºC) to 162º F (+72ºC).

5. **Documentation Requirements.** Documentation requirements will be in accordance with the Special Specification, “Testing, Training, Documentation, Final Acceptance and Warranty”.

6. **Testing.** In addition to the testing requirements listed elsewhere in these Special Provisions, the Contractor will perform the accuracy and subsystem tests prior to acceptance of the MVD system:

   (1) **24-Hour Volume Test.** The volume test will be conducted using the MVD over a 24-hour period for each direction. Volume data will be obtained for each direction using tube counts, or similar Engineer approved method, over the same 24-hour period. Prepare a table that compares volume information obtained by the MVD versus volume information obtained via the tube counts in one-hour periods. Include in the table, the total difference in vehicles and % difference for each period.

   Any locations that exceed ± 5% difference between the tube count and the MVD count for 2 or more periods, or exceed ± 10% for any period will be reconfigured and retested.

   (2) **Individual Lane Volume Test.** For each MVD location, volume data collected by the MVD assembly for the farthest lane (from the MVD sensor) in each direction will be compared to volume obtained from a hand-count or other Engineer approved method over a 15 minute period during normal traffic conditions. Should this test yield greater than a ± 5% difference between the MVD collected data and the manual count data, then the MVD will be reconfigured and retested.

   (3) **Individual Lane Speed Test.** For each MVD location, average speed data collected by the MVD assembly for the furthest lane (from the MVD sensor) in each direction will be compared to an average of speeds collected using a calibrated radar gun or other Engineer approved method over a 15 min. period during normal traffic conditions. Should this test yield greater than a ± 10% difference between the MVD collected speed data and the manually collected speed data, then the MVD will be reconfigured and re-tested.
(4) Perform subsystem tests for each MVD in accordance with the MVD manufacturer’s testing requirements. The testing will include the following:

1. On-site testing using an agency furnished laptop computer with MVD Vendor furnished test software, run the build-in-test features of the MVD assembly.
2. Demonstrate that all data collected by the MVD is properly communicated to the TMC.
3. The MVD assembly fully recovers automatically from loss of power.

7. **Training.** Training will be in accordance with the Special Specification, “Testing, Training, Documentation, Final Acceptance and Warranty”.

8. **Warranty.** Warranty will be in accordance with the Special Specification, “Testing, Training, Documentation, Final Acceptance and Warranty”

9. **Measurement.** These Items will be measured as each unit furnished, installed, made fully operational and tested in accordance with these Special Specifications or as directed by the Engineer.

10. **Payment.** The work performed and material furnished in accordance with this Item and measured as provided under “Measurement” will be paid for at the unit price bid for “Microwave Vehicle Detection System”. This price will include all equipment described under this Item with all cables and connectors, all documentation and testing; and will include the cost of furnishing all labor, materials, training, warranty, equipment, and incidentals necessary to complete the work.