SPECIAL SPECIFICATION

1211

Microwave Vehicle Presence Detection System

1. **General.** This Item shall govern for the furnishing and installation of overhead/side-fired microwave vehicle true presence detection system as shown in the plans, as detailed in the special specifications and as directed by the Engineer. All equipment required to interface with a traffic signal controller or Local Control Unit (LCU) will be subsidiary to this pay Item.

   The sensor shall be able to hold the detection until the zone is cleared. Additionally, the sensor shall be able to tune-out stationary targets that remain within the detection zone for a minimum of 15 min.

   The sensor physical alignment and detection zones adjustments will be performed by a trained operator, with the help of a laptop computer. After the setup, there shall be no external tuning controls of any kind, which will require an operator.

   The operator shall be able to set up, monitor lane status, and retrieve data from the detector through the RS-232 serial port with any IBM compatible laptop or desktop computer. Also, the detector shall be compatible with a standard phone modem for remote data retrieval.

   All equipment and component parts furnished shall be new, be of the latest design and manufacture, and be in an operable condition at the time of delivery and installation. All parts shall be of high quality workmanship.

   The design shall be such as to prevent reversed assembly or improper installation of connectors, fasteners, etc. Each item of equipment shall be designed to protect personnel from exposure to high voltage during equipment operation, adjustments, and maintenance.

   The designed mean time between failures (mtbf) of the microwave vehicle true presence detector unit, operating continuously in their application, shall be 10 years or longer.

2. **Functional Requirements.** The Microwave Detector unit shall have Federal Communications Commission (FCC) certification. The FCC-ID number shall be displayed on an external label.

   No component shall be of such design, fabrication, nomenclature, or other identification as to prelude the purchase of said component from any wholesale electronic distributor.

   All setup, control, and diagnostic software shall be provided and run on the latest version of DOS or Window-based operating systems. Software update shall be provided free of charge during the warranty period.
The Microwave Detector unit shall be Flash upgradeable to support new ITS standards, protocols and enhancement.

(1) **Capabilities.** The detector shall be a true presence detector, which can provide presence, volume, lane occupancy and speed information on up to 8 discreet detection zones. This information shall be available to existing controllers or LCUs via contact closure pairs and to other systems via serial communications lines.

The sensor output must be directly compatible with the controller cabinet detector input. If input to a LCU is required, Contractor must provide a Dual Loop Emulation card for mounting in the isolator portion of the LCU cabinet.

(2) **Transmission.** The detector shall transmit on a frequency band of 10.525 GHz +/- 25 MHz or another approved spectral band. The detector shall 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 shall not exceed 10 milli-watts.

(3) **Area Coverage.** The sensor's field of view shall cover an area defined by an oval shaped beam and its maximum detection range shall be as follows:

- Elevation Beam Width: 45 degrees.
- Azimuth Beam Width: 15 degrees.
- Range: 10 to 200 ft.

(4) **Detection Zones.** The maximum number of detection zones defined shall be no less than 8. The range limits of each zone shall be user defined in 7-ft. resolution.

The detector shall meet overall accuracy requirements specified herein under the following environmental and installed location conditions:

- under all weather conditions normally experienced in the local area, and
- installed in overhead (forward-mounted single lane) or side-mounted (side-mounted multiple lane) position on a sign bridge and/or structure.

Presence accuracy from overhead mount shall be at least 95% in a single detection zone. Accuracy in detection and magnitude of speed shall be at least 95% from the overhead mount.

Presence accuracy from side-fired mount shall be at least 90% in multiple detection zones. Accuracy in detection, volume, occupancy, and magnitude of speed shall be at least 85% from a side-fired mount.

The detector shall include surge protection in accordance with IEEE Standard C62.41 - 1980 Category C.
The detector shall 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 shall be resistant to shock in accordance with IEC 68-2-27 (test Ea), NEMA TS-1 (Section 2.1.13), or approved equivalent.

(5) **Dual Loop Emulation Card.** The dual loop emulation card shall be compatible with, install into and draw power from either a NEMA card input file or a standard Local Control Unit (LCU) I/O rack. The LCU version shall receive inputs for up to 12 contact pairs and simulate up to 24 loop outputs (emulating up to 12 dual loop speed traps).

Calibration shall be done by modifying spacing parameters in the LCU configuration.

All inputs and outputs shall be protected by optical isolators.

3. **Power Requirements.** The detector shall operate at 12 to 24 V AC or DC, or from commercial AC power of 115 + 20 V AC @ 50-60 Hz, 80 mA. Normal power consumption shall be 8 watts or less.

The equipment operation shall 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, shall be included in the bid of this Item.

The Dual Loop Emulation card must have a monitoring circuit that will change the output relay to the fail-safe position in the event of a detector failure.

(1) **Wiring.** All wiring shall meet the requirements of the National Electric Code. All wires shall be cut to proper length before assembly. No wire shall be doubled back to take up slack. Wires shall be neatly laced into cable with nylon lacing or plastic straps. Cables shall be secured with clamps. Service loops shall be provided at all connections.

(2) **Transient Suppression.** All DC relays, solenoids and holding coils shall have diodes or other protective devices across the coils for transient suppression.

(3) **Power Service Protection.** The equipment shall contain readily accessible, manually resettable or replaceable circuit protection devices (such as circuit breakers or fuses) for equipment and power source protection.

Circuit breakers or fuses shall be provided and sized such that no wire, component, connector, PC board or assembly shall be subjected to sustained current in excess of their respective design limits upon the failure of any single circuit element of wiring.

(4) **Fail Safe Provision.** The equipment shall be designed such that the failures of the equipment shall not cause the failure of any other unit of equipment. Automatic recovery from power failure shall be within 5 sec. after resumption of power.

(5) **Connectors and Harnesses.** All external connections shall be made by means of connectors. The connectors shall be keyed to preclude improper hookups. All wires to and from the connectors shall be color coded and/or appropriately marked.
Connecting harnesses of appropriate length and terminated with matching connectors shall be provided for interconnection with the communications system equipment.

Patch fibers with mixed connectors shall be uniquely color coded for easy identification.

All pins and mating connectors shall be plated with not less than 20 microns of gold. Connectors utilizing solder type connections shall have each soldered connection covered by a piece of heat shrink tubing securely shrunk to insure that it protects the connection.

All assemblies shall be clearly identified with name, model number, serial number and any other pertinent information required to facilitate equipment maintenance.

4. **Mechanical Requirements.** The equipment shall be modular in design such that it can be easily replaced in the field.

   The unit shall be clearly identified with name, model number, serial number and any other pertinent information required to facilitate equipment maintenance.

   The microwave radar detector shall 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 enclosure sealing shall not use silicone gels or any other material that will deteriorate under prolonged exposed to ultraviolet rays. The overall dimensions of the box, including fittings, shall not exceed 8 in. x 10 in. x 6 in. The total weight of the microwave radar detector assembly shall not exceed 5 lb.

   The sensor shall be furnished with bracket or band designed to mount directly to a pole or overhead mast-arm or other structure. The mounting assembly shall have all painted steel, stainless steel, or aluminum construction, and shall support a load of 20 lb. The mounting assembly shall incorporate a ball-joint, or other approved mechanism that can be tilted in both axis, then locked into place, to provide the optimum area of coverage.

   The sensor shall be provided with an RS-232 interface port for with required setup, control and diagnostic software, when required.

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

   External connection for telecommunications and power shall be made by means of a single military style multi-pin connector, keyed to preclude improper connection.

5. **Environmental Requirements.** The Detector shall be capable of continuous operation over a temperature range of –35°F (-37°C) to +165°F (+74°C) and a humidity range of 0% to 95% (non-condensing).

6. **Experience Requirements.** The Contractor or designated subcontractors involved in the installation and testing of the Microwave Vehicle Presence Detection System shall, as a minimum, meet the following requirements:
Three years experience in the installation of Microwave Vehicle Presence Detection equipment.

Two installed Microwave Vehicle Presence Detection systems where systems have been in continuously satisfactory operation for at least 1 year. The Contractor shall submit as proof, photographs or other supporting documents, and the names, addresses and telephone numbers of the operating personnel who can be contacted regarding the system.

The Contractor will be responsible for providing necessary documentation of subcontractor qualifications pursuant to contract award.

7. **Technical Assistance.** The Contractor shall ensure that a manufacturer's technical representative is available on site to assist the Contractor's technical personnel at each installation site and with Microwave Vehicle Presence Detection System equipment installation and communication system configuration.

The initial powering up of the Microwave Vehicle Presence detection equipment shall not be executed without the permission of the manufacturer's representative.

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

All electronic components shall comply with Special Specification, "Electronic Components".

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

All parts shall be made of corrosion resistant material, such as plastic, stainless steel, anodized aluminum or brass.

All materials used in construction shall be protected from fungus growth and moisture deterioration.

Dissimilar metals shall be separated by an inert dielectric material.


10. **Testing.** The manufacturer shall test all microwave units to ensure compliance to all FCC and Department specifications.

The manufacturer shall be required to supply a medical statement as to the safety of the unit to the general public (example: Pacemakers, etc.).

Testing shall be in accordance with the Special Specification, "Testing, Training, Documentation, Final Acceptance and Warranty", Article 2. and Article 5.


13. **Measurement.** This Item will be measured as each unit complete in place.

14. **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 prices bid for each "Microwave Vehicle Presence Detector" or "Dual Loop Emulation Card": These prices shall include all equipment described under this Item with all cables and connectors, mounting assemblies, all documentation and testing; and shall include the cost of furnishing all labor, materials, training, warranty, equipment, and incidentals necessary to complete the work.