MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
RADAR VEHICLE DILEMMA ZONE DETECTOR

a. Description. This work consists of furnishing and installing, or removing, a radar vehicle dilemma zone detector (RVDZD) system including up to four sensors, at an intersection as shown on the plans; furnishing and installing or removing up to four vehicle sensors at an intersection; and storage or disposal of all removed materials.

b. Materials. Furnish radar vehicle dilemma zone detection system and interface in accordance with this special provision. Furnish hardware wiring and other appurtenant materials in accordance with sections 918 and 921 of the Standard Specifications for Construction and this special provision.

1. Radar vehicle dilemma zone detector. Furnish an RVDZD from the following list.

A. Wavetronix SmartSensor Advance Extended Range.

B. Approved equal (AE). Ensure the AE is evaluated, tested, and approved per the MDOT New Traffic Signal Device Product Review Guidelines. The review time is not justification to delay the project.

2. Ensure the cable between the sensor and cabinet meets all the following specifications:

A. Has a 6-conductor cable that attaches to an 8-pin connector.

B. Furnish power and dual recommended standard (RS)-485 communication through twisted pair. RS-485 conductor nominal capacitance, conductor to conductor: less than 40 picofarad per foot (pF/ft) at 1 kilohertz (kHz). RS-485 conductor nominal conductor DC resistance: less than 16.7 ohms/1000 feet (304.8 m) at 20 °C. Cable assembly shielded with aluminum/polyester shield and tinned copper drain wire. Ensure power wires are 20 AWG while communication wires are 22 AWG and Restriction of Hazardous Substances (RoHS) compliant.

C. Ensure the cable end connector meets the *MIL-C-26482* specification and is designed to interface with the appropriate *MIL-C-26482* connector. Ensure the connector back shell is an environmentally sealed jacket, and the outer diameter (O.D.) of this jacket is within the back shell's cable O.D. range to ensure proper sealing.

D. Ensure manufacturer instructions are followed to ensure proper connection.

3. Ensure the RVDZD furnishes all the following functional capabilities:

A. Can process per vehicle range, speed, and continuous estimated time of arrival (ETA) measurements for moving vehicles on 25 simultaneous vehicles from one, up to four radar sensors.

B. Continuously detect vehicles by transmitting electromagnetic radar signals through the air. The signals bounce off vehicles in their paths and part of the signal is returned to the Radar Vehicle Advanced Detector (RVAD). Returned signal is then processed to determine the speed of the vehicle and the arrival time to the stop bar.

C. Continuously track vehicles from 50 up to 900 feet from the stop bar through the detectable area.

D. Detects vehicles in real time as they travel through the detection zone.

E. Can place new detection zones with an external computer that has RVAD software using the Ethernet or RS-485 serial ports.

F. Ensure the device stores memory in flash to prevent memory loss during power outages.

G. Continues to operate using the existing zone configurations when the operator is defining or modifying a zone pattern and not allow the new zone configuration to go into effect until the configuration is saved by the operator.

H. Is programmable by the user to save and upload any stored configurations.

4. Ensure the interface unit furnishes all the following functional capabilities:

A. Enable the user to plug an extension module into the appropriate slot without the need to rewire the interface unit.

B. Connects to the contact closure by furnished patch cable through RS-485 connectors.

C. Connects to the sensor through keyed color coded wire connectors to furnish connectivity, power, and surge protection.

D. Is available in both two and four channel configurations programmable from the contact closure and the user interface through a laptop.

E. When using the Synchronous Data Link Control (SDLC) interface unit, directly connects the 8 channels of detection per sensor directly to the controller SDLC connector.

5. Ensure the detection zones configuration furnishes all the following functional capabilities:

A. Supports up to 8 detection zones per sensor, and each detection zone can be sized to suit the site and desired vehicle detection region.

B. Can indicate vehicle presence in multiple detection zones on a single detector output channel by linking channels using “AND” or “OR” commands.

C. Allows detection zone outputs to be configurable to select simple, normal, latched, pulse, priority, extend, and delay outputs. Ensure timing parameters of pulse, extend, and delay outputs are user definable between 0.1 to 25.0 seconds.

D. Can feature directional detection zones with the ability to detect approaching or receding traffic.

E. Allows detection zone setup without site-specific information such as latitude and longitude or temporal information such as date and time.

6. Ensure the Sensor furnishes all the following operational capabilities:

A. Can mount in a standard *NEMA TS 1, TS 2, 2070 Advance Transportation Controller (ATC), 170 type detector rack*. Has interface unit to obtain power and furnish contact closure outputs or be able to obtain power and furnish contact closure through the SDLC when connected to a SDLC interface unit.

B. Can mount in a standard detector rack without the need for rack adapters or for rewiring the detector rack.

C. Can operate satisfactorily in a temperature range from -30 °F to 165 °F (-35 °C to 74 °C) and a relative humidity range from 0 percent to 95 percent, non-condensing as set forth in *NEMA* specifications.

D. Can be powered by 10 or 28 VDC.

E. Consumes less than 10 watts (W) power.

F. Includes a RS-232 port for serial communications with a remote computer. Ensure the sensor RS-232 port is multi-drop compatible with a 9-pin “D” subminiature connector on the interface unit.

G. Uses flash memory technology to enable loading modified or enhanced software through the RS-232 port without modifying the sensor hardware.

H. Includes detector output pin-out that is compatible with industry standard detector racks.

I. Can display detector outputs for each channel of detection, in real time when the system is operational, with visual cues such as LEDs on the front panel.

J. Provides transient voltage suppression and isolation for the sensor inputs.

K. Has two communication ports, and both ports must communicate independently and simultaneously.

7. Ensure the interface units furnish all the following operational capabilities:

A. Furnishes maximum power of 75 W at 80 °C.

B. Can mount in a standard *NEMA TS 1, TS 2, 2070 ATC, 170 cabinet*.

C. Can connect to as needed and mounts in a standard detector rack without the need for rack adapters or for rewiring the detector rack.

D. Includes detector output pin-out that is compatible with industry standard detector racks.

8. System Hardware. Ensure the RVDZD hardware consists of a radar detection sensor (RDS), a sensor back plate interface unit (SBPIU) or shelf mount interface unit (SMIU) or shelf mount SDLC interface unit; radar sensor contact closure cards as needed, mounted in a standard detector rack; a sensor mount; sensor cable and homerun cable as needed. Ensure installed RVDZD is compatible with existing solid state pre-timed or actuated traffic signal control equipment and cabinet environments. Ensure the interface units, contact closure(s) and the radar sensor(s) are from the same supplier to ensure compatibility.

9. System Software. Ensure the system software can detect vehicles in multiple lanes using only the radar image produced by the radar beam. Ensure software can allow the operator to program up to 8 detection zones per sensor by placing zones on user interface using only the user interface software. Programming sensor(s) detection zones will require the use of a laptop computer and will be connected through the interface unit via RS-232, RS-485, universal serial bus (USB) or Ethernet as allowed by the interface unit. Ensure the software is available for free download from the manufacture's website.

10. Warranty. Furnish materials with a manufacturer's 2 year warranty, transferable to the Department or the local agency responsible for the project, that the supplied materials are free from all defects in materials and workmanship. Furnish the warranty and other applicable documents from the manufacturer, and a copy of the invoice showing the date of shipment, to the Engineer prior to acceptance.

During the warranty period, the manufacturer must furnish the following services at the manufacturer's pricing and terms of sale current at the time of the order:

A. Repair with new or refurbished materials, or replace at no charge, any product containing a warranty defect, provided the product is returned to the manufacturer's factory or authorized repair site.

B. Be responsible for all costs associated with shipping products repaired or replaced under warranty.

C. Maintain an adequate inventory of parts to support maintenance and repair of RVDZD system during the warranty period.

D. Deliver parts within 45 days of placement of order.

E. Furnish technical support for the RVDZD system by manufacturer certified personnel. Ensure telephone technical support is provided within 8 hours of the time a call is made by a user. Ensure on-site technical support is also furnished as required for installation of repaired or replaced equipment.

F. Furnish sensor software updates to the Department or the local agency

responsible for the project at no additional cost.

c. Construction. Furnish and install, or remove, RVDZD system as shown on the plans or as directed by the Engineer. Ensure that the RVDZD system is installed as documented by installation materials furnished by the manufacturer. Complete this work in accordance with sections 818 and 820 of the Standard Specifications for Construction, the applicable typical signal construction detail, and this special provision. Storage and/or disposal of the removed material are included.

When RVDZD system is called for, deliver all equipment internal to the controller cabinet to the MDOT Statewide Signal shop or to the inspecting agency for setup and installation in the controller cabinet.

Install sensor(s) not less than 17 feet above the roadway, or as shown on the plans, and install each sensor offset to the traveled way on which it will detect vehicles.

Do not install the radar sensor equipment until all other signal equipment has been installed and inspected. Obtain the Engineer's approval prior to beginning radar sensor installation. Correct radar sensor installation that was completed prior to the approval of the Engineer, and which is found to be non-optimal placement of the radar sensor at no additional cost to the contract. Ensure the Engineer's approval to lower passage time in the controller to 1 second. The Engineer will not authorize extra payment or time extensions for work required to reorient or move the sensor(s).

Bond and ground all equipment per the manufacture installation specifications.

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**
Radar Vehicle Dilemma Zone Detector System	Each
Radar Vehicle Dilemma Zone Detector System, Rem	Each
Radar Vehicle Dilemma Zone Detector System, Salv	Each
Radar Vehicle Dilemma Zone Detector Sensor	Each
Radar Vehicle Dilemma Zone Detector Sensor, Rem	Each
Radar Vehicle Dilemma Zone Detector Sensor, Salv	Each

1. **Radar Vehicle Dilemma Zone Detector System** includes furnishing and installing the radar system, interface unit, contact closure hardware, cable, connectors, and other appurtenant material required to complete the work.

2. **Radar Vehicle Dilemma Zone Detector System, Rem** includes removing any previous system processor, automatic control unit, monitors, amplifiers hardware, cable, connectors, and other appurtenant material. **Radar Vehicle Dilemma Zone Detector System, Rem** also includes storing, as directed by the Engineer, or proper disposal of all removed materials.

3. **Radar Vehicle Dilemma Zone Detector System, Salv** includes reinstalling a removed radar vehicle advanced detector system at the location(s) shown on the plans.

4. **Radar Vehicle Dilemma Zone Detector Sensor** includes furnishing and installing a radar detection sensor, enclosure, mounting bracket, hardware, cable, connectors, and other appurtenant material required to complete the work.

5. **Radar Vehicle Dilemma Zone Detector Sensor, Rem** includes removing all previous detection system, enclosure, mounting bracket, hardware, cable, connectors, and other appurtenant material. **Radar Vehicle Dilemma Zone Detector Sensor, Rem** also includes storing, as directed by the Engineer, or proper disposal of all removed materials.

6. **Radar Vehicle Dilemma Zone Detector Sensor, Salv** includes reinstalling a removed radar vehicle dilemma zone detector sensor at the location(s) shown on the plans.