MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
WIRELESS VEHICLE DETECTION SYSTEM

SIG:EMS 1 of 6 APPR:HLO:EMS:03-19-26
FHWA:APPR:04-06-26

a. Description. This work consists of completing one or more of the following work types at locations shown on the plans:

1. Furnishing and installing a wireless vehicle detection system (VDS) including serial port protocol (SPP) radios, Flex Modules and Isolator Module.

2. Furnishing and installing a repeater (RP).

3. Furnishing and installing a vehicle sensor node (VSN).

4. Removing and disposing of an existing wireless VDS.

5. Removing, storing, and reinstalling an existing wireless VDS.

6. Removing and disposing of an existing RP.

7. Removing, storing, and reinstalling an existing RP.

8. Removing and disposing of an existing VSN.

9. Removing, storing, and reinstalling an existing VSN.

As applicable, this work includes removal or installation of mounting brackets, hardware, cable, connectors, grounding, sensors and orange epoxy and any other material required to ensure a complete removal or installation, as specified for a location.

b. Materials. Furnish materials, as directed by the Engineer, necessary to provide a complete and operating job. Furnish materials in accordance with sections 918 and 921 of the Standard Specifications for Construction and this special provision.

1. Vehicle Detection System (VDS).

A. Furnish a VDS from the following list.

(1) Sensys Flex System.

(2) 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 for delaying the project.

B. A complete VDS consists of:

(1) Flex Connect

(2) Flex Control

(3) Flex Isolator Module

(4) Mounting hardware

(5) The quantity of SPP radios as specified on the plans including *NEMA 4X type* enclosure with mounting bracket and hardware and Category 5e (CAT 5e) 600 volt (V) rated cable from the SSP to the Isolator Module; and

(6) Any associated cable, connectors, and hardware necessary to complete the work.

C. Furnish a VDS that:

(1) Detects and counts vehicles using battery powered magnetometers utilizing wireless communications to transmit detection information;

(2) Furnishes vehicle counts per lane, lane occupancy, vehicle speed (when more than one VSN is installed per lane), and vehicle classification (when one or more VSN is installed per lane); and

(3) Allows the time intervals for the above measurements to be user selectable from 30 seconds to 24 hours.

D. Furnish an SPP radio that:

(1) Consists of a 2.4 gigahertz (Ghz) Master transceiver powered via CAT 5e cable;

(2) Includes 600 V rated CAT 5e cable from the SPP to the Isolator Module;

(3) Includes an enclosure with mounting bracket, and associated hardware;

(4) Transmits detection information to a 170, 2070 or *NEMA type* controller in real-time;

(5) Operates on 48 VDC at 3-watt power or via non-isolated external 10 to 15 VDC at 2-watt power;

(6) Operates in an ambient temperature range of -37 °F to +176 °F (-38 °C to +80 °C);

(7) Furnishes 1500 V isolation and 5 kilovolt (kV) surge protection;

(8) Is housed in a plastic enclosure, no larger than 12 inches high, 8 inches wide, and 4 inches deep, meeting *NEMA 4X* and *International Protection Rating (IP67) standards*.

2. Vehicle Sensor Node (VSN).

A. A complete VSN consists of:

(1) A magnetometer,

(2) A microprocessor,

(3) A wireless transceiver,

(4) A battery, and

(5) Orange epoxy for securing the node in the pavement.

B. Furnish a VSN that:

(1) Is 3.1 inches high, 2.2 inches in diameter;

(2) Operates in an ambient temperature range of -40 °F to +176 °F (-40 °C to +80 °C);

(3) Operates on battery power for an expected 10 years under normal traffic conditions;

(4) Detects a vehicle by measuring a change in the earth's magnetic field and transmits the detected information within 125 milliseconds (ms) of receiving the detected vehicle;

(5) Can be programmed with a unique identifying code and transmits this code and detector information via a wireless radio communication method;

(6) Automatically recalibrates in the event of a detector timeout;

(7) Responds within 100 seconds after the VDS is powered up.

(8) Provide VSN with an enclosure that allows the sensor to be removed, replaced, or repositioned.

(9) Ensure VSN enclosure is 3.5 inches high, 3.1 inches in diameter.

3. Wireless Repeater (RP).

A. A complete RP consists of:

(1) A battery operated transceiver;

(2) A battery with a minimum 8-year life; and

(3) An enclosure with mounting bracket and associated hardware.

B. Furnish an RP that:

(1) Is housed in a plastic enclosure, no larger than 12 inches high, 8 inches wide, and 4 inches deep, meeting *International Protection Rating (IP67) standards*;

(2) Extends the effective communication range of the VSN to the SPP up to 2000 feet with external long-range antenna; and

(3) Operates in an ambient temperature range of -40 °F to +176 °F (-40 °C to +80 °C).

4. Wireless Communication. Furnish a VDS, RP, or VSN that operates in the unlicensed Industrial, Scientific, and Medical (ISM) 2.4 GHz band. Ensure the SPP and VSN operate in any one of the 16 channels available in the band. Furnish two-way communication between the SPP and VSN to ensure integrity over the RP interface. Furnish a VSN that uses a Time Division Multiple Access (TDMA) protocol wherein each sensor is assigned a time slot during which it transmits and receives one or more data packets. Ensure all system components are synchronized to the same time reference sourced by the VDS.

5. Software. Furnish a VDS that can accept software and firmware upgrades. Furnish software required to configure the VSN, SPP and RP units and store and retrieve the detection data. Ensure the VSN and RP are reconfigurable by a user over the wireless communication interface.

6. Warranty. Furnish materials with a manufacturer's 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.

c. Construction. Complete the work in accordance with sections 818 and 820 of the Standard Specifications for Construction, as shown on the plans, and as directed by the Engineer. Remove, store, and dispose of material in accordance with section 204 of the Standard Specifications for Construction.

1. Installation. When installing new equipment is specified, furnish, and install the VDS, RP or VSN as shown on the plans. Installation includes Flex Connect, Flex Control, Flex Isolator Module, mounting brackets, hardware, cable, connectors, grounding, sensors, and other appurtenances required for a complete system.

Install the VSN in a 3⅛ inch diameter by 3½ inch deep hole, cored in the pavement in the traffic lane as shown on the plans, or as directed by the Engineer. Encapsulate the VSN with orange epoxy and apply within temperature range as per manufacturer's specification.

Install the SPP and RP within range of the sensors and as shown on the plans, or as directed by the Engineer.

2. Removal. When removal is specified, remove the existing VDS, VSN or RP units, associated enclosures, mounting brackets, hardware, and other appurtenances required for a complete removal. Dispose of removed materials.

3. Salvage. When salvage is specified, remove the existing VDS, VSN, or RP units, associated enclosures, mounting brackets, hardware, and other appurtenances required for a complete removal, store salvaged materials in a protected and clean environment, and re-install the materials. Complete reinstallation in accordance with subsection c.1 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
Wireless Vehicle Detection System	Each
Wireless Vehicle Sensor Node	Each
Wireless Repeater	Each
Wireless Vehicle Detection System, Rem	Each
Wireless Vehicle Sensor Node, Rem	Each
Wireless Repeater, Rem	Each
Wireless Vehicle Detection System, Salv	Each
Wireless Repeater, Salv	Each
Wireless Vehicle Sensor Node, Salv	Each

1. **Wireless Vehicle Detection System** includes installing a wireless vehicle detection system including the SPP radios, the Flex Connect, Flex Control, and Flex Isolator Module. The work includes all mounting brackets, hardware, cable, connectors, grounding, and all appurtenant material required to complete the work.

2. **Wireless Vehicle Sensor Node** includes installing a wireless vehicle sensor node including the sensors, orange epoxy, and all appurtenant material required to complete the work.

3. **Wireless Repeater** includes installing a wireless repeater including the RP, mounting brackets, hardware, and all appurtenant material required to complete the work.

4. **Wireless Vehicle Detection System, Rem** includes removing a wireless vehicle detection system including the SPP radios, the master interface Access Point Controller Card (APCC), the extension (EX) cards, the Isolator Module, or any Flex components, including Flex Connect, Flex Control, and the Flex Isolator Module. The work includes removing all mounting brackets, hardware, cable, connectors, grounding, and all appurtenant material required to complete the work. **Wireless Vehicle Detection System, Rem** also includes storage or disposal of removed material.

5. **Wireless Vehicle Sensor Node, Rem** includes:

   A. Remove a wireless vehicle sensor node including the sensor, epoxy, and all appurtenant material required to complete the work;

   B. Storage and/or disposal of removed material;

   C. Filling the old hole with black epoxy;

6. **Wireless Repeater, Rem** includes removing a wireless repeater including the RP, mounting brackets, hardware, and all appurtenant material required to complete the work. **Wireless Repeater, Rem** also includes storage or disposal of removed material.

7. **Wireless Vehicle Detection System, Salv** includes removing a wireless vehicle

detection system including the SPP radios, the master interface APCC card, the EX cards, and the Isolator Module or any Flex components, including Flex Connect, Flex Control, and the Flex Isolator Module. The work includes removing all mounting brackets, hardware, cable, connectors, grounding, and all appurtenant material required to complete the work. **Wireless Vehicle Detection System, Salv** also includes storage and reinstallation on the project;

8. **Wireless Repeater, Salv** includes removing a wireless repeater including the RP, mounting brackets, hardware, and all appurtenant material required to complete the work. **Wireless Repeater, Salv** also includes storage and reinstallation on the project;

9. **Wireless Vehicle Sensor Node, Salv** includes:

A. Removing a wireless vehicle sensor node including the sensor, epoxy, and all appurtenant material required to complete the work;

B. Storage and reinstallation on the project;

C. Core drilling a new 4 inch by 2¼ inch diameter hole or 3½ inch by 3⅛ inch diameter hole as shown on manufacturer's specification, as shown on the plans, or as directed by the Engineer, and encapsulating the VSN with orange epoxy; and

D. Filling the old hole with black epoxy.