DESCRIPTION:

Under these items the contractor shall furnish and install a wireless, battery-powered magnetometer vehicle detection system as shown in the contract documents or where directed by the Engineer.

The wireless, battery-powered magnetometer vehicle detection system shall consist of the following equipment:

- Battery-powered sensors installed in-pavement in each traffic lane as indicated in the Contract Documents
- System radios (including repeaters, if required) that communicate wirelessly with the sensors and provide detection information to the processing unit.
- A base station unit capable of interpreting the information provided by the sensors. Software to control and configure the detectors, base station units and access points.
- A SDLC interface to provide a communication interface between a base station unit and a standard 2070 controller.

Communications between the detectors and the access point shall be via radio. When only one access point is used, it shall be hard-wired to the base station. When two access points are used in one site, the access point with the weakest signal shall be hard-wired to the base station, except when the cable routing distance is greater than 950 ft. For traffic signal applications, detection data shall be relayed from each sensor to a local 2070 controller for real-time vehicle presence detection using SDLC interfaces. If a network interfaced base station unit is specified in the contract documents, data shall be broadcast from each base station unit to a central software system or central server over standard TCP/IP (Internet Protocol) networks. NYSDOT shall provide the contractor with network configuration information necessary for the configuration of each networked base station unit.

MATERIALS:

PAVEMENT SENSOR

- All detector components shall be contained within a single housing. The sensor housing shall conform to NEMA Type 6P and IEC IP68 standards.
- Detectors should communicate at an Ultra High Frequency, increasing the range and battery life of the sensor device.
- The detector housing shall be capable of being installed in a 4.5” diameter hole.
- The detector components shall be fully encapsulated within clamshell housing to prevent moisture from degrading the components.
- The detector shall operate at temperatures from -35° F to +176° F.
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- A detector shall be battery-powered with a minimum lifetime of eight (8) years when the detector is configured for, and operating under normal traffic conditions.
- Each detector shall detect a vehicle by magnetometer detection by measuring changes in the earth’s magnetic field near the sensor as caused by a stopped or passing vehicle. The sensor shall have a three (3) axis magnetometer with dual sensors in the Z-axis to improve capture accuracy.
- The detector shall be capable of operating in three (3) detection modes: count, presence and speed.
- The detector shall be capable of wirelessly accepting software and firmware upgrades.
- In the event of a detector lock, “memory on”, each detector shall automatically recalibrate.
- Each detector shall transmit its detection data within 150ms of a detected event.
- Each detector shall automatically re-transmit a detected event if no acknowledgement is received from the base station unit. Each detector may stop retransmission after 8 attempts.
- After losing radio contact because of stopped vehicles over or near the detector, each detector shall be capable of re-establishing the radio link with its supporting access point or receiver in less than 2 seconds.
- Each detector shall transmit a unique identifying code and shall respond within 100 seconds when the base station unit is powered on.
- When no base station unit is present or powered on, the detector shall not be required to detect vehicles.
- Each detector in an installation shall be capable of being individually configured with its own sensitivity level. A single detector shall be capable of being configured with a sensitivity level that approximates the detection zone of a standard 6’ x 6’ inductive loop.
  - Each detector shall be capable of being configured with relatively higher or lower sensitivity levels as may be required to detect bicycles or motorcycles.
  - Each pavement sensor is only required to be capable of reporting vehicle presence.
  - Up to two detectors properly configured shall be capable of detecting motorcycles in a standard traffic lane and bicycles in a designated bicycle lane.
- The detector shall be supplied with sufficient two part epoxy resin to secure and cover the sensor inside the cored hole in the pavement where it will be installed.

BASE STATION UNITS

- The base station shall be capable of being installed in shelf mount within the cabinet.
- The base station shall be capable of being installed in card mount within the cabinet.
- Each base station unit shall be capable of operation at temperatures from -35°F to +176°F.
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- The base station unit shall include, or make available via the Internet at no extra charge, an interface specification or application programming interface that will allow for retrieval of traffic data from the base station unit over a TCP/IP Ethernet connection.
- The base station unit shall consist of, at a minimum, the base station, SDLC interface, software, and all ancillary equipment needed for a complete installation.

ACCESS POINTS

- The access points shall operate at temperatures from -35° F to +176° F.
- The access points shall be FCC Part 15 compliant and shall not interfere with public safety radio bands or other radio services.
- A detection access point shall be no larger than 8” H x 8” W x 8”D. The access point shall not weigh more than 4 pounds (1.8 kg).
- All access point components shall be contained within a single housing. The access point housing shall conform to NEMA Type 4X and IEC IP67 standards.
- The access point shall support communications with at least 48 sensors.
- The access point shall reliably communicate with all in-pavement detectors within 500 feet, without the use of repeaters.
- Additional range may be provided through the use of repeaters. If repeaters are required, all repeater components shall be included in this item, including poles, foundations, mounting hardware, and any other items required for a complete installation. There is no separate payment for repeater equipment.
- The access point shall be able to support up to three (3) radios directly connected to it.
- The access point shall be able to communicate with the base station with a fixed cable, a wireless connection or both simultaneously.
- The access point shall also be able to accept RF splitters being used on up to two (2) of the connected radios to allow for up to five (5) radios per access point.
- Each access point shall include all antennas, mounting devices, cabling, surge protection and RF splitters, needed to a complete installation. There is no separate payment for this equipment.
- Each access point must be supplied with any electrical isolation equipment necessary for protection from electrical surges in the power supply. There is no separate payment for this equipment.
- Each access point must be supplied with any cabling necessary for its operation. There is no separate payment for this equipment.
- The access point shall be capable of accepting firmware upgrades.
- The radio links between each sensor and each access point shall conform to the following requirements:
  - The physical layer of the radio links between each sensor and access point shall conform to published standards.
The center frequencies, bandwidths, and transmit power levels of the radio links shall allow operation in an unlicensed frequency band for Detector Wireless links.

- Frequency channels shall be employed by the sensors and system radio to avoid interference with other devices operating in the unlicensed band. The frequency channels shall be user-configurable and at least 16 frequency channels shall be supported.

### VEHICLE DETECTION APPLICATIONS

This application uses the wireless magnetometer system as vehicle detection for signalized intersection control, as well as other applications where the wireless magnetometer system data is being subsequently processed or communicated by a 2070 controller. These applications require the card mount form factor.

- Detection data shall be communicated to a standard roadside 2070 controller via a base station unit expansion card capable of being installed in standard 33X input file assemblies, with a SDLC cable.
- If expansion cards are to be installed within the detector input rack of the cabinet. The cards shall have a minimum of four (4) optically isolated outputs per card.
- Rack mount processing units shall include an Ethernet interface for communicating directly via a wired TCP/IP network. This shall include a minimum 3 foot (1 meter) long EIA/TIA 568B RJ45 terminated category 6 network cable.
- The base station unit shall be capable of simultaneously communicating detection data via the contact closure interface and Ethernet interface.
- Contact closure card shall operate at Temperatures from -35 F to +176 F.
- Each installed contact closure card shall provide an additional minimum of 4 channels of detection data to the input file and 2070 controller.
- Each contact closure card shall be configurable to provide contact closure signals in either presence or pulse mode.
- The contact closure card front panel shall provide status LEDs to monitor detection channel status, line quality and fault monitor.
- The contact closure card front panel shall provide means to select and configure presence or pulse mode, delay timing and extension timing.
- Contact closure cards shall be powered from input file assembly rack or detector rack, not from controller back panel.
- Contact closure cards shall be surge protected to GR-1089 standards.
- Contact closure cards shall operate in humidity up to 95% (non-condensing).
CONSTRUCTION DETAILS:

- All construction shall conform to Section 680-3.01 of the Standard Specifications.
- The contractor shall not damage the components of the wireless vehicle detection system during construction.
- The contractor shall ensure that the wireless vehicle detection system operates according to manufacturer specification during all phases and sub-phases of construction.
- All equipment shall become the property of NYSDOT upon project completion.

PAVEMENT SENSORS

- The roadway shall be core drilled to provide a 4.5” diameter hole at the location and to the depth indicated in the contract plans or as directed by the Engineer. All debris from the drilling process shall be removed cored hole to provide a clean surface to mount the sensor.
- A layer of two part epoxy shall be applied to cover the bottom of the hole. The detector, within a protective shell (if offered by the manufacture), shall then be placed on top of this layer in the correct orientation as marked on the detector. The upper edge of the sensor should be a minimum distance of 3/8” from the road surface. The detector shall then be fully encapsulated with the two part epoxy to the lip of the cored hole. The depth of detector placement and distance to the access point shall not exceed the link tolerances specified by the manufacturer for consistent, accurate reception of detector data at the base station unit.
- All detector protection, such as clamshell covers and two part epoxy resin necessary for operation of the access points shall be included in the item for the access point. There is no separate payment for this equipment.

BASE STATION UNITS

- Rack mounted base station units, and if required by the contract documents, additional Contact Closure cards, shall be inserted into the input file assembly for the site. Specific ordering of cards and associated detection contact closures may be stipulated in the contract documents or as directed by the engineer.
- Shelf mounted base station units shall be placed on an equipment shelf provided within the cabinet at the site.
- Shelf mounted units in cabinets provided with standard 120V 60Hz line electricity shall be connected to power using a standard power receptacle provided within the cabinet unless otherwise directed by the contract documents or the engineer.
- Shelf mounted units in cabinets provided with 12VDC electricity shall be connected to power according to manufacturer instructions, unless otherwise directed by the contract documents or the engineer.
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- Ethernet communications cables shall be connected to network interfaces as shown in the contract documents or as directed by the engineer.
- All cabling and electrical isolation necessary for operation of the base station unit shall be included in the item for the base station unit. There is no separate payment for this equipment.

ACCESS POINTS (RADIOS)

- System access points are to be installed according to the contract documents and subject to the following stipulations;
  - Access points shall be placed within a clear line-of-sight to the detectors, the unit in question is intended to receive traffic data from.
  - The height of placement of access points and distance to the detectors shall not exceed the link tolerances specified by the manufacturer for consistent, accurate reception of detector data at the base station unit.
- All cabling and electrical isolation (such as surge protection for the Ethernet cable) necessary for operation of the access points shall be included in the item for the access point. There is no separate payment for this equipment.
- If repeaters or additional equipment are required to provide constant communications with detectors, they shall be included within these items with no separate payment required. Any additional equipment shall be installed as shown on Contract Documents or as ordered by the Engineer.

METHOD OF MEASUREMENT:

This work will be measured by the number of successfully installed radios, detectors, processing units, or contact closure cards installed as part of the wireless, battery-powered magnetometer vehicle detection system, per site, as defined by the contract documents and the Engineer.

BASIS OF PAYMENT:

The unit price bid for furnishing and installing each item shall include the cost of furnishing all labor, materials, equipment, tools and all necessary tests to satisfactorily complete the work in accordance with the contract documents.