Generic Procurement Specification for a

Wireless, Battery-Powered Vehicle Detection System for Presence Detection Applications using AccuSense Control

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This specification sets forth the minimum requirements for a system to detect vehicles and bicycles on a roadway by using battery-powered magnetometer and/or radar sensors that communicate their detection data by radio to a roadside communications hub before the data is relayed to a local traffic controller and, optionally, a central software system or a data server as may be desired.

1 Overview

- 1.1 - The detection system shall provide accurate roadway information as needed to support traffic signal control
- 1.2 - The Wireless Battery-Powered Vehicle Detection System shall consist of one or more of the following:
  - 1.2.1 - flush battery-powered magnetometer sensors installed in-pavement in each traffic lane for vehicle detection, designed for installation flush with pavement top surface
  - 1.2.2 - deep battery-powered magnetometer sensors installed in-pavement in each traffic lane for vehicle detection, designed for installation up to 4.25 inches below the pavement top surface
  - 1.2.3 - battery-powered radar sensors installed in-pavement in each traffic lane for vehicle detection and bicycle detection
  - 1.2.4 - AccuSense Radios mounted on the side of the roadway
  - 1.2.5 - optional wireless Repeaters (RP) mounted on the side of the roadway, serving to extend the radio range of an AccuSense Radio
  - 1.2.6 - optional external antennas to provide additional RF coverage for the RP
  - 1.2.7 - AccuSense Control cards (ASC) or AccuSense Control Module (ACM) to provide sensor information processing and support the interface between an AccuSense Radio and a standard traffic controller using contact closure signals
  - 1.2.8 - optional Extension (EX) cards to provide additional detector outputs to a traffic controller
  - 1.2.9 - optional AccuSense Connect (AC) to provide an SDLC interface to a traffic controller
  - 1.2.10 - optional AccuSense Isolator Module (AIM) to provide surge suppression and isolation, as well as providing signal conditioning to enhance the communication distance from the AccuSense Radio and the ASC or ACM
  - 1.2.11 - optional Input/Output (I/O) module is used to provide additional communication options, memory option and a battery backed real time clock
  - 1.2.12 - software to control and configure the sensors, ASC, ACM, AccuSense Radios, and RPs
  - 1.2.13 - software to store and retrieve detection data
- 1.3 - Communications between a sensor and AccuSense Radio can be direct, via a single RP, or via two RPs operating in tandem
- 1.4 - Communications between the sensors and the AccuSense Radio or RP and between the RP and AccuSense Radio or another RP shall be via radio
- 1.5 - Detection data shall be relayed from each ASC or ACM to a local traffic controller for real- time vehicle presence detection via contact closure signals or an SDLC link.

1.6 - As an option, data shall be capable of being relayed from each ASC or ACM to a central software system or central server over standard IP (Internet Protocol) networks

2 Functional Capabilities

2.1 - Each sensor shall be installed in the roadway using the following procedure

2.1.1 - For a flush sensor installed just below the roadway surface

2.1.1.1 - The roadway shall be core drilled to provide a 4” diameter hole, a minimum 2.75” / 7 cm deep

2.1.1.2 - The sensor shall be placed inside a small, clear plastic shell formed to provide a tight fit around the sensor.

2.1.1.3 - A small layer of epoxy approximately 1.25” / 3.2 cm shall be applied to the bottom of the cored hole.

2.1.1.4 - The sensor shall then be placed on top of this layer of epoxy in the correct orientation as clearly marked on the sensor

2.1.1.5 - The sensor shall be fully encapsulated with the epoxy to the lip of the cored hole

2.1.2 - For a deep sensor installed up to 4.25” from the roadway surface

2.1.2.1 - The roadway shall be core drilled to provide a 4” diameter hole, a maximum of 6.5” / 16.5 cm deep

2.1.2.2 - A small layer of epoxy approximately 1.25” / 3.2 cm shall be applied to the bottom of the cored hole.

2.1.2.3 - The sensor shall then be placed on top of this layer of epoxy in the correct orientation as clearly marked on the sensor

2.1.2.4 - The sensor shall be fully encapsulated with the epoxy

2.2 - Each radar sensor shall be installed in the roadway using the following procedure

2.2.1 - For a sensor installed just below the roadway surface

2.2.1.1 - The roadway shall be core drilled to provide a 4” diameter hole, a maximum 3.0” / 7.6 cm deep

2.2.1.2 - A small layer of epoxy approximately 1.25” / 3.2 cm shall be applied to the bottom of the cored hole.

2.2.1.3 - The sensor shall then be placed on top of this layer of epoxy in the correct orientation as clearly marked on the sensor. The sensor case shall maintain the proper installation depth relative to the top of the roadway

2.2.1.4 - The sensor shall be fully encapsulated with the epoxy to the lip of the cored hole

2.3 - Each magnetometer sensor shall detect a vehicle by measuring changes in the earth’s magnetic field near the sensor as caused by a stopped or passing vehicle (i.e., magnetometer-type detection)

2.3.1 - The sensor shall sample the earth’s magnetic field at a rate of 128 Hz

2.3.2 - The sensor shall communicate time-stamped ON and OFF vehicle detection events

2.3.3 - Each sensor shall automatically recalibrate in the event of a detector lock.

2.4 - Each radar sensor shall detect a vehicle by measuring the time delta and the intensity of the reflected energy return from the self-initiated radar pulse field near the sensor as caused by a stopped vehicle)
- 2.4.1 - The sensor shall sample the radar pulse and reflected energy at a user selectable rate of 1 to 8 Hz
- 2.4.2 - The sensor shall communicate time-stamped ON and OFF vehicle detection events
- 2.4.3 - Each sensor shall automatically recalibrate in the event of a detector lock

2.5 - Each sensor shall communicate by radio to a nearby AccuSense Radio or RP
- 2.5.1 - Each sensor shall transmit its detection data within 150 msec of a detected event
- 2.5.2 - Each sensor shall automatically re-transmit a detected event if no acknowledgement is received from the ASC or ACM
- 2.5.3 - Each sensor shall transmit a unique identifying code
- 2.5.4 - Each sensor shall respond within 100 seconds when the ASC or ACM is powered on and transmitting
- 2.5.5 - When no AccuSense Radio or RP is present or powered on and transmitting, the sensors are not required to detect vehicles

2.6 - The radio links between each sensor and AccuSense Radio or RP and between each RP and AccuSense Radio or each RP and RP shall conform to the following:
- 2.6.1 - The physical layer of the radio links (i.e., the over-the-air data rate(s), modulation type(s), forward error correction, bit interleaving, channel coding, and other aspects of the transmitted signal) shall conform to published standards (e.g., IEEE, ITU-T, etc.)
- 2.6.2 - The center frequencies, bandwidths, and transmit power levels of the radio links shall allow operation in an unlicensed frequency band
- 2.6.3 - Frequency channels shall be employed by the sensors, AccuSense Radios, and RPs to avoid interference with other devices operating in the unlicensed band
  - 2.6.3.1 - Frequency channels shall be user-configurable
  - 2.6.3.2 - At least 16 frequency channels shall be supported
- 2.6.4 - The link budget (i.e., transmit power plus transmit antenna gain plus receive antenna gain minus receive sensitivity, where receive sensitivity shall assume a 1% packet error rate) for all radio links shall be 93 dB or greater
- 2.6.5 - The maximum distance between a sensor installed in the roadway and an AccuSense Radio or an RP with a clear line-of-sight between devices shall be:
  - 2.6.5.1 - At least 150 feet / 45 meters for an AccuSense Radio or RP installed 20 feet / 6 meters above the roadway
  - 2.6.5.2 - At least 100 feet / 30 meters for an AccuSense Radio or RP installed 16 feet / 5 meters above the roadway
- 2.6.6 - The maximum distance between an AccuSense Radio and an RP or between an RP and another RP shall be at least 1,000 feet / 305 meters when both units are installed 20 feet / 6 meters above the roadway and with a clear line-of- sight between devices
- 2.6.7 - Maximum wireless distances shall be based on the following:
  - 2.6.7.1 - AccuSense Radio or Repeater front of the housing shall be aimed directly at the device (AccuSense Radio, RP or Sensor) it is communicating with.

2.6.7.2 - Deviations from the centerline of the front of the AccuSense Radio or RP shall reduce the effective distance of communication

2.7 - Each installation of the Wireless Battery-Powered Vehicle Detection System shall consist of one or more sensors installed in each traffic lane where presence detection is required. Magnetometer sensors should avoiding sources of magnetic noise such as underground power cables, overhead high tension power cables, light rail or subway tracks, and power generation stations and sub-stations

2.7.1 - The sensors shall be located as specified by the intersection plans, with each sensor's supporting AccuSense Radio or RP installed no farther than the maximum range indicated in Section 2.6.5

2.8 - Each magnetometer sensor in an installation shall be capable of being individually configured with its own sensitivity level

2.8.1 - A single magnetometer sensor shall be capable of being configured with a sensitivity level that approximates the detection zone of a standard 6' x 6' / 1.8m x 1.8m inductive loop

2.8.2 - Each sensor shall be capable of being configured with relatively higher or lower sensitivity levels as may be required to detect bicycles, motorcycles, or light rail

2.8.3 - As an option as directed by the plans, up to two sensors properly configured shall be capable of detecting

2.8.3.1 - motorcycles in a standard traffic lane

2.8.3.2 - bicycles in a designated bicycle lane

2.9 - Each radar sensor in an installation shall be capable of being individually configured with its own range level

2.9.1 - A single radar sensor shall be capable of being configured with a maximum range level for vehicles that approximates 10 feet/3.0 meters deep by 12 feet/3.6 meters wide with the bicycle detection zone being smaller. The radar sensor shall be at located at the edge of the zone, centered on the 12 feet/3.6 meter width side.

2.9.2 - At least 3 User selectable ranges within the above defined detection area shall be available

2.9.2.1 - 4 foot/1.2 meter radius

2.9.2.2 - 6 foot/1.8 meter radius

2.9.2.3 - 8 foot/2.4 meter radius

2.9.2.4 - 10 foot/3.0 meter radius

2.10 - An ASC or ACM shall support the relay of sensor detection data through several interfaces as required by the application

2.10.1 - Detection data shall be communicated to a standard roadside traffic controller via Contact Closure Interface cards capable of being installed in standard contact closure input shelves, where the following controller types shall be supported:

2.10.1.1 - Type 170

2.10.1.2 - Type 2070 and ATC

2.10.1.3 - NEMA TS1

2.10.1.4 - NEMA TS2

2.10.2 - Detection data shall be communicated to a NEMA TS2 controller over an SDLC link via the AC installed in the controller cabinet.
2.10.3 - As an option, detection data shall be communicated over TCP/IP via an integrated 10Base-T Ethernet interface
2.10.4 - The ASC or ACM shall be capable of simultaneously communicating detection data via a contact closure interface, via a SDLC link, the Ethernet interface, or a cellular data modem interface

2.11 - Each sensor, ASC, ACM, AccuSense Radio, and RP shall be capable of accepting software and firmware upgrades

2.12 - The Wireless Battery-Powered Vehicle Detection System shall provide software operating on conventional notebook/portable PCs
2.12.1 - To support configuration of a sensor, including archiving and recovery
2.12.2 - To support configuration of an ASC, including archiving and recovery
2.12.3 - To support configuration of an ACM, including archiving and recovery
2.12.4 - To support configuration of an RP, including archiving and recovery
2.12.5 - To support firmware update of a sensor
2.12.6 - To support software update of an ASC, ACM, and AccuSense Radio
2.12.7 - To support firmware update of an RP

3 AccuSense Sensor Hardware

3.1 - All sensor components shall be contained within a single housing
3.1.1 - The sensor housing shall conform to NEMA Type 6P and IEC IP68 standards
3.1.2 - The sensor components shall be fully encapsulated within the housing to prevent moisture from degrading the components
3.1.3 - The flush sensor housing shall be capable of being installed in a 4- inch / 10-cm diameter hole with a minimum 2.75 inches / 7 cm deep, 6.5 inches / 16.5 cm deep for the deep magnetometer sensors and 3 inches / 7.6 cm deep for the radar based sensors

3.2 - A sensor shall operate at temperatures from -37 ˚F /-38.3 ˚C to +176 ˚F / +80 ˚C

3.3 - A magnetometer sensor shall be battery-powered with an average lifetime of ten (10) years when the sensor is configured for and operating under normal traffic conditions using default settings. The radar based sensor shall be battery-powered with an average lifetime of eight (8) years when the sensor is configured for and operating under normal traffic conditions using default settings.

3.4 - Three configurations of sensors shall be available from the manufacturer.
3.4.1 - The first magnetometer sensor type shall provide all sensor functions, including data collection functions, available in both flush and deep configurations
3.4.2 - The second magnetometer type shall support presence detection only, available in both flush and deep configurations
3.4.3 - The third radar based type shall support presence detection only of stopped vehicles
3.4.4 - The drawings and/or plans shall dictate the sensor type required.

4 Serial Port Protocol (AccuSense Radio) Hardware
- 4.1 - An AccuSense Radio shall support at least 48 sensors with a 0.125 second latency
- 4.2 - An AccuSense Radio shall operate at temperatures from -37 ˚F / -38.3 ˚C to +176 ˚F / +80 ˚C
- 4.3 - All AccuSense Radio components shall be contained within a single housing
  - 4.3.1 - The AccuSense Radio housing shall conform to NEMA Type 4X and IEC IP67 standards
  - 4.3.2 - An AccuSense Radio shall be no larger than 4.7” H x 3.5” W x 2.4” D / 12 cm H x 9 cm W x 6 cm D
  - 4.3.3 - An AccuSense Radio shall weigh no more than 2 pounds / 0.9 kg
- 4.4 - The AccuSense Radio shall communicate to the ASC or ACM utilizing a standard CAT5e or higher Ethernet cable
- 4.5 - The AccuSense Radio shall have a weatherproof Ethernet connector on the bottom
  - 4.5.1 - The Ethernet connector shall be shipped with a cover firmly attached to provide protection form the elements prior to cable connection
  - 4.5.2 - The weatherproof connector shall not require any specialized tools for installation

5 Repeater (RP) Hardware
- 5.1 - An RP communicating directly to an AccuSense Radio shall support at least 20 sensors
- 5.2 - An RP communicating to an AccuSense Radio via an intermediate RP (i.e., tandem operation) shall support at least 12 sensors
- 5.3 - An RP shall be battery-powered with 7 year average battery life based on typical use and standard (125 msec) latency
- 5.4 - The RP battery shall not have user replaceable batteries.
- 5.5 - An RP shall operate at temperatures from -37 ˚F /-38.3 ˚C to +176 ˚F / +80 ˚C
- 5.6 - All RP components shall be contained within a suitable housing
  - 5.6.1 - The RP housing shall conform to NEMA Type 4X and IEC IP67 standards
  - 5.6.2 - An RP shall be no larger than 8” H x 6.5” W x 5.5” D / 20 cm H x 16.5 cm W x 14 cm D
  - 5.6.3 - An RP shall weigh no more than 4 pounds / 2 kg
- 5.7 - As an option, the RP shall be configured for an additional antenna.
  - 5.7.1 - Option 1
    - 5.7.1.1 - The Antenna housing shall conform to NEMA Type 4X and IEC IP67 standards
    - 5.7.1.2 - The Antenna shall be no larger than 5.7” H x 3.5” W x 4.8” D / 15 cm H x 9 cm W x 13 cm D
    - 5.7.1.3 - The Antenna shall weigh no more than 1 pounds / 0.5 kg
    - 5.7.1.4 - The RF Node and Performance shall be identical to the RF Node and Performance of the RP
  - 5.7.2 - Option 2
    - 5.7.2.1 - The Antenna housing shall be rated for outdoor applications
    - 5.7.2.2 - The Antenna shall be no larger than 9.5” H x 9.5” W x 4.4” D / 24.1 cm H x 24.1 cm W x 11.1 cm D

5.7.2.3 - The Antenna shall weigh no more than 2.2 pounds / 1 kg
5.7.2.4 - The RF Node and Performance
5.7.2.4.1 The Antenna shall have 14dBi of gain
5.7.2.4.2 THE RF Node shall have 30 degrees of coverage both horizontally and vertically
5.7.2.4.3 The maximum distance between this antenna and a sensor installed with a clear line-of-sight between devices shall be at least 150 feet / 45 meters for an antenna installed 20 feet / 6 meters above the roadway and at least 100 feet / 30 meters for an antenna installed 16 feet / 5 meters above the roadway
5.7.2.4.4 The maximum distance between an antenna and an AccuSense Radio or between an antenna and another RP shall be at least 2,000 feet / 610 meters when both units are installed 20 feet / 6 meters above the roadway and with a clear line-of-sight between devices

6 AccuSense Control Card (ASC) Hardware
6.1 - Each ASC shall be capable of communicating with at least 2 AccuSense Radio modules
6.2 - Optional Extension (EX) cards shall provide additional contact closures (user configurable form 1 to 4 outputs each)
6.3 - Optional AC shall provide SDLC interface to NEMA TS2 controllers.
6.4 - The ASC shall provide all the higher level processing and interface functions of the system
6.5 - Each ASC shall provide detector data as contact closure signals to the traffic controller
6.5.1 - An ASC shall directly plug in to standard 170/2070 input files or NEMA detector racks
6.5.2 - One or more EX cards shall provide up to 256 channels of detection data from a single ASC's supported sensors, where each channel comprises an optically isolated contact closure relay and, if configured for TS2 operation, an additional contact closure relay to indicate the channel status
6.6 - Each ASC and EX card shall be configurable
6.6.1 - A card shall provide contact closure signals in either presence or pulse mode
6.6.2 - A card shall provide up to 31 seconds of delay timing
6.6.3 - A card shall provide up to 7.5 seconds of extension (carryover) timing
6.7 - The ASC and EX card front panel shall provide status LEDs to monitor:
6.7.1 - Detection channel status
6.7.2 - Line Quality
6.7.3 - Fault Monitor
6.8 - The ASC and EX card shall be configurable via software to provide:
6.8.1 - Presence or pulse mode
6.8.2 - Delay timing
6.8.3 - Extension timing
6.9 - An ASC or EX card shall be powered by the traffic controller backplane via an 11- 26 VDC input.

6.10 - An ASC shall support the following external interfaces
- 6.10.1 - Ethernet
- 6.10.2 - USB

6.11 - Power Consumption for an ASC (without optional cellular interfaces) operating in a low power mode shall be under 750 milli-watts. In other modes (including optional cellular modem), the power shall be under 3.5 watts.

6.12 - An EX card shall be surge protected to GR-1089 standards

6.13 - An ASC and EX card shall operate at temperatures from -37 ˚F / -38.3 ˚C to +176 ˚F / +80 ˚C

6.14 - An ASC and EX card shall operate in humidity up to 95% (non-condensing)

7 Input/Output (I/O) Module

7.1 - An I/O module shall expand the capabilities of an ASC by adding
- 7.1.1 - SD Memory Card Slot
- 7.1.2 - Battery backed up real time clock
- 7.1.3 - As an option, RS232 port for serial communications
- 7.1.4 - As an option, detection data shall be communicated as IP data over GSM-based cellular data services via a GPRS cellular modem
- 7.1.5 - As an option, detection data shall be communicated as IP data over CDMA-based cellular data services via a 1xRTT cellular modem

7.2 - The I/O module shall be physically mounted to the ASC and shall be the same width. The combined ASC with I/O module shall be the width of a standard 2 slot wide detector amplifier.

8 AccuSense Control Module (ACM) Module Hardware

8.1 - Each ACM module shall be capable of communicating with at least 2 SPP modules

8.2 - Optional Extension (EX) cards shall provide additional contact closures (user configurable form 1 to 4 outputs each)

8.3 - Optional AC module shall provide SDLC interface to NEMA TS2 controllers.

8.4 - The ACM shall provide all the higher level processing and interface functions of the system

8.5 - The ACM module shall be powered by via a 9-28 VDC input

8.6 - The ACM module shall be mountable on a shelf, cabinet, or DIN rail.

8.7 - The ACM module front panel shall provide status LEDs to monitor:
- 8.7.1 - Line Quality
- 8.7.2 - Fault Monitor

8.8 - The ACM module shall support the following external interfaces
- 8.8.1 - Ethernet
- 8.8.2 - USB
- 8.8.3 - EX port (to EX card or Port 1 module)

8.9 - Power Consumption for an ACM module shall be under 0.7 watt

8.10 - The ACM module shall operate at temperatures from -37 ˚F / -38.3 ˚C to +176 ˚F / +80 ˚C

8.11 - The ACM module shall operate in humidity up to 95% (non-condensing)

8.12 - The ACM module shall be no larger than 4.3” W x 3.5” D x 1.2” H / 11 cm W x 8.8 cm D x 3 cm H

9 AccuSense Connect (AC) module

9.1 - Each AC shall be capable of supporting an SDLC interface to a TS2 controller that conforms to the NEMA TS2-2003 Detector Rack signaling specifications

9.2 - Each AC shall be configurable

9.2.1 - The AC shall support 64 channels organized as 4 racks of 16 channels each

9.2.2 - The AC shall support detection messages for either presence or pulse mode

9.2.3 - The AC shall support up to 31 seconds of delay timing

9.2.4 - The AC shall support up to 7.5 seconds of extension (carryover) timing

9.3 - The AC front panel shall provide status LEDs to monitor:

9.3.1 - Detection channel status

9.3.2 - Line Quality

9.3.3 - Fault Monitor

9.4 - The AC shall be configurable via software to provide:

9.4.1 - Presence or pulse mode

9.4.2 - Delay timing

9.4.3 - Extension timing

9.5 - The AC shall be powered by an external 9-28VDC input.

9.6 - The AC shall be mountable on a shelf, cabinet, or DIN rail.

9.7 - The AC shall support the following external interfaces

9.7.1 - USB

9.7.2 - EX port (to ASC or ACM)

9.8 - The AC power consumption shall be under 300 milliwatts

9.9 - The AC shall operate at temperatures from -37 ˚F / -38.3 ˚C to +176 ˚F / +80 ˚C

9.10 - The AC shall operate in humidity up to 95% (non-condensing)

9.11 - The AC shall be no larger than 4.3” W x 3.5” D x 1.2” H / 11 cm W x 8.8 cm D x 3 cm H

10 AccuSense Isolator Module

10.1 - An AccuSense Isolator Module (AIM) shall be used between each AccuSense Radio and ASC, except in cases where the ASC or ACM is battery or solar powered

10.2 - The AIM shall support one or two AccuSense Radio devices

10.3 - The AIM shall extend the communication range between the ASC and AccuSense Radio from 33 feet (10 m) to 2000 feet (600 m)

10.4 - The AIM shall provide electrical isolation of 1500V

10.5 - The AIM shall provide surge protection of up to 12A

10.6 - The AIM shall provide VAC power cross protection

10.7 - The single-port AIM shall be no larger than 5” H x 4” W x 4” D / 12.7 cm H x 10 cm W x 10 cm D

10.8 - The dual-port AIM shall be no larger than 4.3” W x 3.5” D x 1.2” H / 11 cm W x 8.8 cm D x 3 cm H

11 Epoxy

11.1 - The epoxy shall be a two part poly-urea based joint sealant.

11.2 - It shall have self-leveling characteristics.

11.3 - The surface the epoxy will be bonding to shall be free of debris, moisture and anything else which might interfere with the bonding process.

11.4 - The epoxy shall be approved by the manufacturer of the detection system.

12 Limited Warranty

12.1 - The supplier shall provide a limited five-year warranty for the Wireless Battery- Powered Magnetometer Vehicle Detection System, with the exception of the batteries for the standard life repeater.

12.2 - During the warranty period, technical support shall be available from the supplier via telephone within 2 business days of the time a call is made by a user, where this support shall be provided by factory-authorized personnel or factory-authorized installers

12.3 - During the warranty period, standard updates to the software shall be available from the supplier without charge

13 Maintenance and Support

13.1 - The supplier shall maintain a sufficient inventory of parts to provide support and maintenance of the system, where these parts shall be available for delivery within 30 days of receipt of a purchase order by the supplier at the supplier’s then-current pricing and terms of sale

13.2 - The supplier shall maintain an ongoing program for customer support for the system via telephone, email, or trained personnel sent to the installation upon receipt of a purchase order at the supplier’s then-current pricing and terms of sale for technical support services.

13.3 - Installation and/or training support shall be provided by a factory-authorized representative

13.3.1 - The Contractor shall notify the Engineer and the Manufacturer’s certified installation personnel 10 working days prior to the installation.

13.3.2 - Prior to installation, personnel that have been certified by the manufacturer, shall test and pre-configure the components and record all detection component ID numbers on a project drawing. Certifying of personnel is solely at the discretion of the manufacturer.

13.3.3 - Installation procedures, wire pulls and the ultimate location of AccuSense Radios and RPs will be at the discretion of the Manufacturer’s certified personnel. The Contractor shall install each sensor in the roadway per Manufacturer’s recommendations.

13.3.4 - The contractor will install Presence sensors for stop bar detection only; and Full function sensors will be deployed for all other detection applications.

13.4 - All documentation shall be provided in the English language.