

# Special Specification 6142

## Bluetooth Detection System



### 1. DESCRIPTION

Furnish and install Bluetooth Detection System as shown in the plans, as detailed in the special specifications and as directed.

Ensure after the setup, there are no external tuning controls of any kind, which will require an operator.

### 2. MATERIALS

The Bluetooth Detection System will consist of a UV-protected, IP65 housed sensor, 2 external Bluetooth antennas, a CAT5e cable for Power over Ethernet, and a non-corrosive fixing bracket.

Provide documentation on the auto-configuration and auto-calibration processes.

Provide a Bluetooth Detection System that does not cause interference or alter the performance of any known equipment.

Furnish all new equipment and component parts in an operable condition at the time of delivery and installation.

Provide design to prevent reversed assembly or improper installation of connectors, fasteners, etc. Design each item of equipment to protect personnel from exposure to high voltage during equipment operation, adjustments, and maintenance.

Include licenses for all equipment, where required, for any software or hardware in the Bluetooth Detection System.

Provide all Bluetooth Detection Systems from the same manufacturer.

Provide Bluetooth Detection System firmware that is upgradeable by external local or remote download.

2.1. **Sensor Performance.** Ensure the Bluetooth Detection System maintains accurate performance in all weather conditions, including rain, freezing rain, snow, wind, dust, fog and changes in temperature and light.

2.2. **Performance Maintenance.** Provide Bluetooth Detection System that does not require cleaning or adjustment to maintain performance. Ensure it does not rely on battery backup to store configuration information. Ensure the Bluetooth Detection System, once calibrated, does not need recalibration to maintain performance over entire operational temperature range unless the roadway configuration changes. Provide remote connectivity to the Bluetooth Detection System to allow operators to change the unit's configuration, update the unit's firmware programming and recalibrate the unit automatically from a centralized facility. The sensor can be accessed remotely through both TCP/IP and GPRS (both dynamic and static).

The sensor must be configurable through a web browser and at TransVista through the centralized Traffic Management Software System.

2.3. **Cabling.** Supply the Bluetooth Detection System with a connector cable of the appropriate length for each installation site.

The Bluetooth antennas must be connected with the sensor through standard SMA-connectors.

- 2.4. **Communication.** The Bluetooth Detection System sensor must operate with two directional antennas for optimized detection of traffic in multiple lanes. The antennas must be optimized for detection across multiple lanes; they have a narrow vertical angle of 30°, and a wide horizontal (azimuth) angle of 110°, and have a 90° difference in the polarization to avoid interference. Each of the receiving channels must have the ability to capture signals as weak as -102dBm or more. The antennas are attached to the body of the sensor with stainless steel brackets.

The sensor must have an internal GPS for automatic clock synchronization and positioning. If a GPS signal is not available the sensor will capture its clock synchronization signal via NTP (Network Time Protocol). Once the clock signal has been captured it must start detecting Bluetooth® devices automatically. It must be possible to view real time scans to verify operations. The sensor must have diagnostics data recording reboots, GPS reception, data transfers and error messages related with GPRS and TCP/IP. The GPRS antenna must be inside the sensor housing.

For security purposes the sensor must have a configurable firewall; and thereby only admit connections from computers that have pre-selected IP-addresses or a subnet of pre-selected IP-addresses.

Ensure that the Bluetooth Detection System provides communication options that include RS-232, RS-485 or TCP/IP.

- 2.5. **Operating System Software.** The operator must be able to upload new firmware into non-volatile memory of the Bluetooth Detection System over any supported communication channel including TCP/IP networks.

- 2.5.1. **Software.** Provide any and all programming and software required to support the Bluetooth Detection System. Install the programming and software in the appropriate equipment at the time of acceptance testing. Complete and pass acceptance testing using a stable release of the programming and software provided.

Provide software update(s) free of charge during the warranty period.

- 2.6. **Manufacturing Requirements.** Ensure the assembly of the units adheres to industrial electronic assembly practices for handling and placement of components.

The Bluetooth Detection System must undergo a rigorous sequence of operational testing to ensure product functionality and reliability. Include the following tests:

- functionality testing of all internal subassemblies,
- unit level burn-in testing of 24 hr. duration or greater, and
- final unit functionality testing prior to shipment.

Provide test results and all associated data for the above testing, for each purchased Bluetooth Detection System by serial number. Additionally, maintain and make available manufacturing data for each purchased Bluetooth Detection System by serial number.

Externally, the Bluetooth Detection System must be modular in design to facilitate easy replacement in the field. Ensure the total weight of the Bluetooth Detection System does not exceed 5 lb.

Ensure all external parts are protected against corrosion, fungus growth and moisture deterioration.

- 2.7. **Support.** Ensure installers and operators of the Bluetooth Detection System are fully trained in the installation, auto-configuration and use of the device.

The manufacturer must train installers and operators to correctly perform the tasks required to ensure accurate Bluetooth Detection System performance. The amount of training necessary for each project will be

determined by the manufacturer (not less than 4 hr.) and must be included, along with training costs, in the manufacturer's quote. In addition, provide technical support to provide ongoing operator assistance.

- 2.8. **Power Requirements.** Provide the Bluetooth Detection System that operates at 12 to 24 VDC from a separate power supply to be provided as part of the bid item and ensure it does not draw more than 2W of power each.

Provide the separate power supply or transformer that operates from 115 VAC  $\pm 10\%$ , 60 Hz  $\pm 3$  Hz.

Provide equipment operations that are not affected by the transient voltages, surges and sags normally experienced on commercial power lines. Check the local power service to determine if any special design is needed for the equipment. The extra cost, if required, must be included in the bid of this item.

- 2.9. **Wiring.** Provide wiring that meets the requirements of the National Electric Code. Provide wires that are cut to proper length before assembly. Provide cable slacks to facilitate removal and replacement of assemblies, panels, and modules. Do not double-back wire to take up slack. Lace wires neatly into cable with nylon lacing or plastic straps. Secure cables with clamps. Provide service loops at connections.

- 2.10. **Transient Suppression.** Provide DC relays, solenoids and holding coils that have diodes or other protective devices across the coils for transient suppression.

- 2.11. **Power Service Protection.** Provide equipment that contains readily accessible, manually re-settable or replaceable circuit protection devices (such as circuit breakers or fuses) for equipment and power source protection.

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

- 2.12. **Fail Safe Provision.** Provide equipment that is designed such that the failures of the equipment will not cause the failure of any other unit of equipment. Ensure automatic recovery from power failure will be within 15 sec. after resumption of power.

- 2.13. **Mechanical Requirements.** Enclose the Bluetooth Detection System in a rugged, water-tight NEMA 4X & IP 67 polycarbonate enclosure.

Do not use silicone gels or any other material for enclosure sealing that will deteriorate under prolonged exposure to ultraviolet rays. Ensure the overall dimensions of the box, including fittings, do not exceed 8 in. x 8 in. x 6 in. Ensure the overall weight of the box, including fittings, does not exceed 6.5 lbs.

Coat all printed circuit boards with a clear-coat moisture and fungus resistant material (conformal coating).

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

- 2.13.1. **Modular Design.** Provide equipment that is modular in design to allow major portions to be readily replaced in the field. Ensure modules of unlike functions are mechanically keyed to prevent insertion into the wrong socket or connector.

Identify modules and assemblies clearly with name, model number, serial number and any other pertinent information required to facilitate equipment maintenance.

- 2.13.2. **Connectors and Harnesses.** Provide external connections made by means of connectors. Provide connectors that are keyed to preclude improper hookups. Color code and appropriately mark wires to and from the connectors.

Provide connecting harnesses of appropriate length and terminated with matching connectors for interconnection with the communications system equipment.

Provide pins and mating connectors that are plated to improve conductivity and resist corrosion. Cover connectors utilizing solder type connections by a piece of heat shrink tubing securely shrunk to insure that it protects the connection.

- 2.13.3. **Environmental Requirements.** Provide Bluetooth Detection System capable of continuous operation over a temperature range of  $-22^{\circ}\text{F}$  to  $+165^{\circ}\text{F}$  and a humidity range of 5% to 95% (non-condensing).

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### 3. CONSTRUCTION

- 3.1. **General.** Provide equipment designed and constructed with a minimum number of parts, subassemblies, circuits, cards, and modules to maximize standardization and commonality.

Design the equipment for ease of maintenance. Provide component parts that are readily accessible for inspection and maintenance. Provide test points that are for checking essential voltages and waveforms.

- 3.2. **Mounting and Installation.** Install the Bluetooth Detection System according to manufacturer's recommendations to achieve the specified accuracy and reliability.

Verify, with manufacturer assistance, the final Bluetooth Detection System placement if the Bluetooth Detection System is to be mounted near large planar surfaces (sound barrier, building, parked vehicles, etc.) that run parallel to the monitored roadway.

Include, at a minimum, Bluetooth Detection unit, enclosures, connectors, cables, junction box, mounting equipment and hardware, controller interface boards and assemblies, local and remote software, firmware, power supply units and all other support, calibration, and test equipment for the Bluetooth Detection System.

Furnish the Bluetooth Detection System with bracket or band designed to mount directly to a pole or overhead mast-arm or other structure. Ensure the mounting assembly has all stainless steel, or aluminum construction, and supports the load of the Bluetooth Detection System. Incorporate for the mounting assembly a mechanism that can be tilted in three axes, and then locked into place, to provide the optimum area of coverage. Ensure the mounting bracket is designed and installed to prevent sensor re-positioning during 80 mph wind conditions.

Proper placement, mounting height and orientation of the Bluetooth Detection System systems must conform to the manufacturer's published requirements for the system provided. Install the Bluetooth Detection System units as shown on the plans. Analyze each proposed pole location to assure that the Bluetooth Detection System installation will comply with the manufacturer's published installation instructions. Advise the Engineer, before any trenching or pole installation has taken place, of any need to move the pole from the location indicated in the plans in order to achieve the specified detector performance. Confirm equipment placement with the manufacturer before installing any equipment.

Ensure alignment, configuration and any calibration of the Bluetooth Detection System takes less than 15 min. per lane once mounting hardware and other installation hardware are in place. Install Bluetooth Detection System units such that each unit operates independently and that detectors do not interfere with other Bluetooth Detection System units or other equipment in the vicinity.

- 3.3. **Electronic Components.** Provide electronic components in accordance with Special Specification 6006, "Electronic Components."

- 3.4. **Mechanical Components.** Provide external screws, nuts and locking washers that are stainless steel. Provide parts made of corrosion resistant material, such as plastic, stainless steel, anodized aluminum or brass. Protect materials from fungus growth and moisture deterioration. Separate dissimilar metals by an inert dielectric material.

- 3.5. **Documentation Requirements.** Provide documentation in accordance with, Special Specification 6005, "Testing, Training, Documentation, Final Acceptance, and Warranty."

Provide documentation ensuring emissions from the Bluetooth Detection System equipment are not harmful to the public

Provide additional test reports, for each of the following requirements:

- 3.5.1. **NEMA 4X Testing.** The Bluetooth Detection System enclosure must conform to test criteria set forth in the NEMA 250 Standard for Type 4X enclosures. Provide third party enclosure test results for each of the following specific Type 4X criteria:

- external Icing (NEMA 250 Clause 5.6);
- hose-down (NEMA 250 Clause 5.7);
- 4X Corrosion Protection (NEMA 250 Clause 5.10); and
- gasket (NEMA 250 Clause 5.14).

- 3.6. **Testing.** Perform testing in accordance with, Special Specification 6005, "Testing, Training, Documentation, Final Acceptance, and Warranty." Test all Bluetooth Detection System to ensure that they comply with all FCC and Department specifications.

Ensure the Bluetooth Detection System meets functional performance requirements of Section 2.1, "Sensor Performance," by the following methods:

- 3.7. **Experience Requirements.** The contractor or subcontractor involved in the installation and testing of the Bluetooth Detection System must, as a minimum, meet the following experience requirements:

One installed Bluetooth Detection System where system must been in continuously satisfactory operation and integrated into a Traffic Management Center providing accurate travel time results for at least 3 mo. Submit as proof, photographs or other supporting documents, and the names, addresses and telephone numbers of the operating personnel of the business or agency owning the system who can be contacted by the Department regarding the system.

Provide necessary documentation of contractor or subcontractor qualifications pursuant to contract award.

- 3.8. **Technical Assistance.** Ensure that a manufacturer's technical representative is available on site to assist the Contractor's technical personnel at each installation site and with Bluetooth Detection System equipment installation and communication system configuration.

Do not execute the initial powering up of the Bluetooth Detection System without the permission of the manufacturer's representative.

- 3.9. **Training.** Provide training in accordance with, Special Specification 6005, "Testing, Training, Documentation, Final Acceptance and Warranty."

- 3.10. **Warranty.** Provide a warranty in accordance with, Special Specification 6005, "Testing, Training, Documentation, Final Acceptance and Warranty."

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#### 4. MEASUREMENT

This item will be measured as each unit complete in place.

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#### 5. 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 price bid for "Bluetooth Detection System." This price is full

compensation for furnishing all equipment described under this Item with all cables, connectors, mounting assemblies, interface devices; all documentation and testing; all labor, materials, tools training, warranty, equipment, and incidentals.