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S P E C I A L P R O V I S I O N

SECTION 677 – INTELLIGENT TRANSPORTATION SYSTEMS (ITS) EQUIPMENT

Item 677.465__ – Motor Vehicle Detection System (MVDS) Without Pole

This special provision provides for installation of permanent Motor Vehicle Detection System (MVDS) sensors and all equipment necessary to provide a working MVDS. All provisions of Section 677(Special Provision to Section 677 - Intelligent Transportation Systems (ITS) Equipment – Base Specification), except as modified or changed below, shall apply.

Add to Description (Special Provision to Section 677 - Intelligent Transportation Systems (ITS) Equipment – Base Specification):

1.4 This work shall consist of furnishing, installing, wiring, connecting, configuring, testing, and providing GPS as-built documentation of a new, permanent Motor Vehicle Detection System (MVDS) sensor, hardware, software, integration, training, technical assistance and warranty, as well as any additional components and efforts necessary to provide a fully operational MVDS.

1.4.1 The MVDS shall be mounted to an existing structure or other ITS device, such as a CCTV or DMS support structure.

Add to 2.3 Technical Submittal (Special Provision to Section 677 - Intelligent Transportation Systems (ITS) Equipment – Base Specification):

2.3.9 Additional submittal requirements for MVDS sensor installations shall include the following:

2.3.9.1 Documentation of any software modifications required to interface equipment to NHDOT's existing statewide Advanced Traffic Management System (ATMS).

2.3.9.2 Underwriter's Laboratory approval certifications for all proposed equipment.

2.3.9.3 Typical life expectancy of each system component.

2.3.9.4 A list of parts that will require periodic replacement, including their typical life expectancy.

2.3.9.5 The address where the proposed equipment will be produced and serviced and the turnaround time for replacement and/or repair of equipment.

2.3.9.6 Available maintenance plans.

2.3.9.7 Environmental operating requirements for all equipment and associated equipment including heating, cooling, circuit, and grounding requirements.

2.3.9.8 Documentation and user instructions for any MVDS system control software provided by the MVDS manufacturer.

2.3.9.9 Complete electronic user documentation for the MVDS sensor unit, including instructions on operation, calibration and data retrieval.

2.3.9.10 Maintenance manuals for the MVDS sensor unit, which shall include instructions suitable for technicians to perform routine services and minor repairs.

Add to Materials (Special Provision to Section 677 - Intelligent Transportation Systems (ITS) Equipment – Base Specification):

2.6 MVDS Sensor.

2.6.1 All MVDS detectors installed under this Contract shall be provided by the Design-Build Team from one single manufacturer for synchronicity, and shall include all materials necessary to connect to the proposed communications and control systems.

2.6.2 The MVDS shall be compatible with the NHDOT's existing statewide Advanced Traffic Management System (ATMS).

2.6.3 The MVDS shall be capable of integrating and providing data to the NHDOT ATMS. The MVDS shall be managed and controlled from NHDOT's ATMS at NHDOT's Traffic Management Center (TMC).

2.6.4 The data produced by the MVDS shall be consistent with National Transportation Communications for ITS Protocol (NTCIP) objects.

2.6.5 The MVDS device shall transmit, receive, and analyze an FCC certified, low-power microwave radar signal to detect vehicle presence, provide a detection output, and generate volume, occupancy, and speed data.

2.6.6 The MVDS shall be suitable for continuous duty, non-environmentally controlled, outdoor use.

2.6.7 The detector unit shall be enclosed in a rugged weatherproof case meeting NEMA 4X standards. The total weight of the detector unit assembly shall not exceed 5 pounds.

2.6.8 The detector unit shall have an operating temperature range of -40° F to +140° F, minimum.

2.6.9 The detector unit shall be resistant to vibration and shock in accordance with applicable NEMA TS 2-2003 requirements, or approved equivalent.

2.6.10 Any components of the MVDS system housed inside a remote ITS equipment cabinet shall be field hardened and rated by the manufacturer to meet the requirements of the NEMA TS2 Standard. The design shall be inherently temperature compensated to prevent abnormal operation. The circuit design shall include such compensation as is necessary to overcome effects due to temperature in the specified environmental range.

2.6.11 The MVDS shall include an OEM approved power supply system consisting of a circuit breaker, AC surge protector, lightning surge protection, and an AC/DC converter.

2.6.11.1 Solar or DC powered sites shall include a circuit breaker and surge protection devices for both lightning and transient voltage.

2.6.12 The MVDS unit shall be operable from 10 – 24V DC dissipating not more than 15W.

2.6.13 The MVDS detector shall be capable of receiving power and communicating through an RS-232 or RS-485 cable, supplied by the MVDS manufacturer. Cables shall be shielded, UV-resistant and rated for outdoor use. Cable connector pins must be soldered to the cable conductors, assembled and tested by the cable manufacturer.

2.6.14 The MVDS detector unit shall include a single MS connector which provides power to the unit, output contact closure wire pairs for each of the required detection zones and serial communication lines for programming and testing. Connections shall be environmentally sealed.

2.6.15 A serial-to-Ethernet converter device shall be provided to convert serial data communications from the detector unit to Ethernet data for transmission through the proposed communication system. The device shall be compatible with the proposed communication system for the site, and capable of transmitting reliable data to the NHDOT ATMS.

2.6.16 The MVDS shall store average interval data in non-volatile flash memory.

2.6.17 The MVDS shall have the capability to be controlled and tested locally at the MVDS site utilizing a laptop computer with manufacturer software. Data collected by the MVDS shall also be viewable at the MVDS site through the same software.

2.6.18 The MVDS shall comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules or the appropriate Spectrum Management Authority. The MVDS shall not interfere with any known equipment.

2.6.19 The MVDS shall transmit on a frequency band of 24-24.25 GHz (K-band) or another approved spectral band.

2.6.20 No component of the MVDS system shall emit a noise level exceeding the peak level of 55 dBA when measured at a distance of three feet away from its surface.

2.6.21 The MVDS unit shall achieve a Mean Time Between Failures (MTBF) of 10 years or more.

2.6.22 The MVDS sensor shall have a minimum 250-foot detection range and the capability to detect a minimum of 12 lanes of traffic, by lane and by direction.

2.6.23 The MVDS mounting shall be capable of rotating the detector unit up to 120 degrees left or right from vertical.

2.6.24 The MVDS's field of view shall cover an area defined by a beam of known shape and characteristics, and its maximum detection range shall be as follows:

(a) Elevation beam width of 50° to 70°.

(b) Azimuth beam width of 6° to 15°.

(c) Minimum detection range from 6 feet to 250 feet.

2.6.25 MVDS vehicle detector shall be capable of meeting the minimum data collection accuracy levels as specified in 3.14.6 below.

2.7 Ground rods for grounding systems, if required, shall be ¾ -inch in diameter, and no less than 8–feet in length after installation

Add to 3.6 ITS Device and System Testing (Special Provision to Section 677 - Intelligent Transportation Systems (ITS) Equipment – Base Specification):

3.6.9 MVDS testing shall be completed by the Design-Build Team, following NHDOT standard testing plans for ITS devices, located on NHDOT's website (http://www.nh.gov/dot/business/contractors.htm).

Add to Construction Requirements (Special Provision to Section 677 - Intelligent Transportation Systems (ITS) Equipment – Base Specification):

3.12 The MVDS system shall be installed in accordance with the National Electric Safety Code (NESC).

3.13 MVDS Equipment Installation.

3.13.1 The Design-Build Team shall install all sensors, equipment and system components in accordance with the manufacturers' recommendations. The Design-Build Team shall arrange to have a technician certified by the manufacturer of the MVDS present at the time the equipment is installed, turned-on, and calibrated.

3.13.2 All mounting accessories for sensors and equipment, as required, shall be provided and installed by the Design-Build Team as recommended by the MVDS manufacturer.

3.13.3 All additional required conduit, wiring, junction boxes, mounting equipment and appurtenances to form a fully functional Motor Vehicle Detection System, as recommended by the manufacturer, shall be provided and installed by the Design-Build Team.

3.13.4 The mounting and alignment of the MVDS at the proposed location, data integration, communication, and testing of the MVDS system shall be completed by the Design-Build Team in collaboration with the Department, specifically the New Hampshire Department of Transportation, Bureau of Transportation Systems Management and Operations.

3.13.5 The Design-Build Team shall install, aim and calibrate all MVDS devices to accurately report speed, volume, occupancy, and vehicle classification.

3.13.6 The MVDS shall be mounted in a side-fired configuration on the proposed support structure in order to monitor the vehicles traveling along the adjacent highway.

3.13.7 The MVDS shall be mounted and angled up to 120 degrees left or right from vertical, as recommended by the manufacturer, to accurately aim the detection beam and collect accurate traffic data.

3.13.8 The Design-Build Team shall install the detector unit at a height above the road surface, as recommended by the manufacturer, based on the offset from the edge of travel lanes and the number of lanes being detected.

3.13.9 The MVDS shall be mounted so that the detection beam transmits perpendicular to the roadway traffic.

3.13.10 All MVDS systems and cabling shall be mounted to avoid interference by any other installed device, communication system equipment, guardrail, vegetation or other obstructions, and ensure full functionality of the installed hardware. If mounted to a CCTV support pole, the device shall not interfere with the raising and lowering operations of the camera lowering system.

3.13.11 When more than one MVDS is mounted to the same structure, or within 20 feet of another MVDS, the sensors shall be configured to operate on different radio frequency channels to avoid interference.

3.13.12 Cables supplied by the MVDS manufacturer shall provide connection between the MVDS detector and the cabinet equipment in a continuous length. Splicing of the cable shall not be permitted.

3.13.13 Cable connections shall be environmentally sealed.

3.13.14 The Design-Build Team shall apply a dielectric compound to the detector unit connection, as recommended by the MVDS manufacturer.

3.13.15 If the MVDS is mounted to another ITS device, the MVDS cabling shall be routed through mounting structure supports via an existing weatherhead closest to the final device mounting height. A drip loop shall be provided in the device cabling.

3.13.16 When no existing weatherhead is available, and for any length of the MVDS cabling installed exterior to the support structure, the MVDS cabling shall be housed in flexible liquid tight conduit, securely attached to the mounting structure supports, without compromising the structures anticorrosion finish.

3.13.16.1 Conduit ends shall be permanently sealed with a silicone duct sealant and shall be water tight.

3.13.16.2 All instrument interconnecting wires shall be UV rated and weatherproof, or housed within conduit.

3.13.16.3 All conduits shall be sufficient size in accordance with the National Electric Code (NEC).

3.13.17 The Design-Build Team shall supply all connecting cables required to connect the MVDS to the proposed communication system.

3.13.18 Except for the detector unit, all MVDS equipment shall be installed in a suitable equipment cabinet as shown on the plans or as directed by the Engineer.

3.13.19 Each MVDS installed shall include all equipment necessary to collect, store and transmit data through its own data stream, and shall operate independently from any other MVDS installed.

3.13.20 The Design-Build Team shall be responsible for integrating end-to-end connectivity between the MVDS site and the NHDOT wireless communications or fiber backbone, or securing cellular carrier services as required.

3.13.21 All MVDS power and communication cabling shall be protected from surges with transient voltage surge suppression devices as recommended by the device manufacturer, in accordance with Section 3.15 below.

3.14 MVDS Calibration and Performance.

3.14.1 The Design-Build Team shall coordinate any software modifications required to interface the installed equipment to the existing NHDOT ATMS. The Design-Build Team shall be responsible for the end-to-end integration of the MVDS equipment with NHDOT's ATMS.

3.14.2 NHDOT and other stakeholders shall have access to the NHDOT ATMS concurrently with this installation.

3.14.3 The MVDS shall be calibrated by the Design-Build Team, and shall include individual lane calibration for all possible travel lanes and directions of travel at the installation site, or as directed by the Engineer.

3.14.4 The MVDS detection zones shall be set up using manufacturer software and a laptop computer supplied by the Design-Build Team.

3.14.5 The MVDS shall be calibrated to provide volume, speed, and occupancy for the proposed detection zones, and shall be calibrated to collect data at polling cycle intervals of 30 seconds.

3.14.6 The MVDS shall be installed and calibrated to collect data meeting the following minimum accuracy limits:

3.14.6.1 The MVDS shall record motor vehicle volume data, per lane, within 10%.

3.14.6.2 The MVDS shall record motor vehicle speed data, per lane, within 10%.

3.14.6.3 The MVDS shall record individual vehicle speeds within 5%.

3.14.6.4 The MVDS shall record motor vehicle occupancy data, per lane, within 20%.

3.15 Grounding, Bonding and Transient Voltage Surge Suppression.

3.15.1 If the MVDS is not mounted to another ITS device or structure with existing transient protection, the MVDS shall include integral Transient Voltage Surge Suppression (TVSS) to protect against transients and surges on the incoming power and data connections to the MVDS equipment. The TVSS shall be a product recommended by the MVDS manufacturer for use with the MVDS.

3.15.2 The Design-Build Team shall furnish and install TVSS devices for all power and communications conductors.

3.15.3 The Design-Build Team shall provide and install a TVSS between the AC power mains and all MVDS equipment.

3.15.4 When mounted to a structure without existing TVSS or grounding system, the following components shall be supplied and installed by the Design-Build Team:

3.15.4.1 An air terminal and earth terminal shall be installed on the support structure. Both terminals shall be bonded to the structure and each other by an insulated wire.

3.15.4.2 The support structure's air terminal and ground terminal wires shall be bonded to the structure using an attached electric lug that allows for removal of the wires and independent resistance measurement of the earth ground resistance.

3.15.4.3 The support structure air terminal shall be attached to a minimum #6 AWG stranded bare copper wire bonded to the grounding system at the base of the support structure.

3.15.4.4 Any cabinet enclosure ground connections shall be made to a suitable common threaded heavy-gauge lug that can be attached to both sides (inside and outside) of the cabinet. The lug shall have the same composition as the cabinet.

3.15.4.5 The Design-Build Team shall supply and install a ground array system to be installed at the base of the support structure. The ground rod array system shall be connected to the MVDS support structure through an appropriate ground clamp. A #6 AWG copper wire shall be installed between the MVDS support structure and any equipment cabinets, providing a common ground system for each terminus.

3.15.4.6 The support structure shall be bonded to the earth terminal using an earth ground array system with a resistance no greater than 25 Ohms to ground. All metallic enclosures, lightning arrestors, and instrument mounting brackets shall be bonded to this system.

3.15.4.7 Additional ground rods shall be installed to meet the manufacturer's recommended resistance to ground, or a maximum of 25 ohms, whichever is less.

3.15.4.8 The external earth terminals shall not be encased in any foundation.

3.15.4.9 All electrical connections to and within the grounding system shall be exothermically welded where possible.

3.15.4.10 Anti-oxidation electrical compound shall be used on all attachment points of the ground system where dissimilar metals intended for grounding and bonding come in contact with each other and on ground wire attachment points when exothermic welding cannot be used.

3.15.4.11 The support structure shall be supplied with a lightning dissipater that is attached to a #6 AWG stranded bare copper wire bonded to the ground terminal.

3.15.4.12 The support structure lightning dissipater shall consist of a series of at least four spot dissipaters in a candelabra arrangement with a single mounting assembly. The lightning dissipater system shall include surge suppressor devices of the type recommended by the lightning dissipater manufacturer, and shall properly interface with the pole mounted dissipater, and the size and type of cables installed at the MVDS site.

3.15.4.13 The lightning dissipater shall be attached to the support structure using manufacturer-recommended clamps that are attached to the structure. These clamps shall rigidly hold the lightning dissipater to the support structure in winds up to 100 MPH.

3.15.4.14 The lightning dissipater shall be offset from the support structure and provide protection for the MVDS above installed equipment without interfering with the functionality of any equipment, sensors or other feature attached to the structure.

3.16 ITS Cables.

3.16.1 All equipment shall be installed using the Manufacturer's recommended cables.

3.16.2 The Design-Build Team shall furnish, install, connectorize, and test all Category 6 (Cat. 6) cables, of the types required for the application, at locations shown in the plans or as required to construct a complete, functional system.

3.16.2.1 The Cat. 6 cables shall not exceed 325 feet in length unless the Design-Build Team is granted written permission from the Engineer.

3.16.3 All cables shall be installed in a continuous run. Splicing will not be allowed.

3.16.4 All above ground cables shall be installed in flexible liquid tight conduit in accordance with Section 3.3.