

ADAPTIVE TRAFFIC CONTROL (ATC) SYSTEM

**\*\*From Waterbury IM 089-2(43)(Re-advertised)**

- xx. DESCRIPTION. Work for this project includes the installation of Adaptive Traffic Control (ATC) on a four-intersection radio interconnected traffic control signal system at the locations indicated in the Plans. The four intersection system shall have Ethernet access and be remotely accessible via the internet over Fiber Optic Network.

All work under this section shall be performed in accordance with these provisions, the Plans, and Section 678 of the Standard Specifications.

Responsibilities of the Contractor, Rhythm Engineering, and VTrans with regards to the InSync ATC system are specified in the *Rhythm Engineering InSync Real-time Adaptive Traffic Control System* scope of work included in the Contract Documents.

- xx. GENERAL REQUIREMENTS. Video detection cameras will be provided by the Contractor under Section 678. The Contractor shall install the cameras at the locations indicated in the Plans.

The Contractor shall coordinate with Rhythm Engineering with respect to training and schedule and will inform VTrans of same. In particular, the Contractor shall specify a delivery date of the ATC system equipment a minimum of 45 days in advance of delivery and shall notify VTrans.

The Contractor shall coordinate with VTrans Connect Vermont Administrator Robert T. White, who has initiated coordination with the utility companies regarding internet access to the controller cabinet and remote access for Rhythm Engineering prior to their installation work.

- xx. WIRELESS RADIO INTERCONNECT SYSTEM.

(a) System Requirements.

- (1) Radio Communications Equipment. The location and type of radio antenna shall be as recommended by the radio supplier. The supplier's recommended equipment will be based on their on-site survey to provide reliable operation.
- (2) Radio Units. At each of the locations shown on the Plans, the Contractor shall furnish and install a radio unit. These units shall operate in the 5.725 - 5.875 Ghz unlicensed U-NII Upper Band. These units shall meet all applicable Federal Communications Commission (FCC) Part 15.407 U-NII regulations. The radio units shall have a sufficient number of distinct frequency channels such that no harmful interference exists between the two different radio links on this project. All units supplied for this project shall be identical models of current production and recent manufacture.

- a. The radio unit shall be a self-contained unit designed for outdoor use, and shall contain a fully integrated antenna within a weatherproof housing. The Contractor shall supply, install, and configure the radio units, along with all necessary cabling.
- b. The radio unit shall provide an RJ-45 Ethernet data interface and shall provide an aggregate throughput of 54 Mbps, minimum.
- c. The radio unit shall provide a transmitter output power of +15 dBm, minimum.
- d. The radio unit shall include an integrated antenna providing 20 dBi gain, minimum, and a beam width of 10 degrees azimuth, 10 degrees elevation.
- e. The radio unit shall provide a data throughput latency of 5 milliseconds, maximum.
- f. The radio unit shall be supplied by the manufacturer complete with integrated radio unit, a power supply, and ultraviolet protected CATS cabling over which power and data will be transported between the control cabinet and the radio unit.
- g. The data connector on the radio unit shall be RJ-45 female modular plug with a weather protected shell.
- h. The radio unit shall employ a cyclic redundancy check (CRC) on all wireless data, strongly reducing the likelihood of undetected errors in the data streams.
- i. The Contractor shall be responsible for optimally aligning the antennas of the radio units. The radio unit shall provide an audible beeper for aiding in antenna alignment.

(3) Antennas and Lightning Protection. The Contractor shall submit mounting plans for the radio units on the indicated poles for review and approval prior to installation.

- a. The radio units shall have integral lightning protection.
- b. Each radio unit shall be securely attached to a grounded metallic structure and such grounding and bonding shall be in conformance with the State of Vermont construction practices for grounding and bonding.
- c. The radio units shall be securely fastened to the support structure and shall be capable of withstanding wind loads of 90 miles per hour (MPH).

- d. A lightning surge protector device recommended by the radio unit manufacturer shall be installed in the cabinet between the lead-in cable and the controller at all locations. The protector shall be electrically bonded to the ground rod, which shall meet applicable State of Vermont specifications for ground at all locations. The grounding conductor for connecting the antenna to the protector shall be 6 AWG or larger copper wire. All connections shall be weatherproof with outdoor RF connection sealant tape or other approved method.
- (4) Environmental. The radio unit shall be fully operational and rated by the manufacturer for operation over the temperature range of -34° to +74°C (-30° to +165°F). The radio unit shall be fully operational with humidity levels of 95% at 40°C (104°F) non-condensing.
- (5) Management Software. The radio unit shall be supplied with management software for all discovery, status, and configuration of the unit. The management software shall also provide two-level password access, and over-the-air firmware reprogramming of the radio unit. The management software shall run on a laptop computer and on the Waterbury system management computer, if applicable. Any required cabling for connection of the specified laptop or PC computers to the radio unit shall be supplied with each radio unit.
- a. Submittals. The Contractor shall submit to the Engineer a Radio System Submittal and Radio Test Plan Submittal for review and approval to confirm conformance to the Plans and specifications. These submittals shall describe the radio equipment, antenna and mounting equipment, lightning protection, connections between them, and site survey results. The test plan submittal shall fully describe the test methods and equipment to be employed by the Contractor, and shall demonstrate that the Radio System will be fully tested in accordance with the specifications. Upon receiving the Radio System Submittal package and Radio Test Plan Submittal package, the Engineer will respond in writing within ten (10) working days, indicating acceptance or rejection. The Contractor shall address all comments from the Engineer and shall resubmit all affected elements.
  - b. Construction Requirements. All work associated with wireless radio interconnect systems shall be completed prior to turn on of new traffic signals. The Contractor shall make the necessary changes to the signal equipment to integrate the radio system equipment into the signal control operations.

The Contractor shall perform an "On-the-Air" test once the system is installed to confirm reliable operation, as defined above. The Contractor shall execute the approved radio system test plan and submit a test report to the Engineer. The Engineer will respond in writing within ten (10) working days, indicating acceptance or rejection. The Contractor shall address all comments from the Engineer and shall retest and resubmit all affected elements, as directed by the Engineer.

xx. METHOD OF MEASUREMENT. The quantity of Special Provision (ATC, INSYNC) at the location specified to be measured for payment will be the number of each system installed in the complete and accepted work.

xx. BASIS OF PAYMENT. The accepted quantity of Special Provision (ATC, INSYNC) at the location specified will be paid for at the Contract unit price per each. Payment will be full compensation for furnishing, handling, and placing all materials and equipment specified in the Contract Documents not otherwise paid for under other Contract items. At the discretion of the Engineer, the Contractor may be required to replace poles and cabinet/controllers that are lost or damaged due to an accident. If required, such work will be considered Extra Work under Subsection 109.06 and additional payment will be allowed. Any equipment that is defective or damaged prior to the beginning of the Contract shall be maintained in at least as good condition, until it is replaced as part of the Contract.

Payment will be full compensation for furnishing, transporting, handling, and installing the materials and equipment specified and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
900.620 Special Provision (ATC, INSYNC) (VT Route 100 @ I-89 Northbound Off-Ramp)	Each