# 3519R06 - Roadway Weather Information Service (RWIS) Equipment Technical Specifications

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# 1. Remote Processing Unit / Data Logger

The remote processing unit (RPU) or Data Logger shall gather data from all-weather sensors at the RWIS site, and transmit the collected data to the central processing unit (CPU) at the vendor's facility. The RPU shall be compatible with existing PennDOT systems and shall have sufficient computing power to perform all tasks without any performance degradation.

# CHARACTERISTICS

Provide RPU or data logger meeting or exceeding the following requirements:

- Provide software capable of calculating the 24-hour precipitation accumulation and storing this data for subsequent transmission to the central processing unit.
- For RPU-equipped station, RPU shall meet or exceed specifications for Vaisala RWS200 RPU interface or equivalent.
- For data logger-equipped station, data logger shall meet or exceed specifications for Campbell Scientific CR6 or equivalent.

#### ENCLOSURE

Enclose the RPU or data logger in a NEMA 4 lockable aluminum enclosure sized to accommodate the RPU, video hardware such as encoder/decoder, and communications equipment. Fit all cabinets with locks using a "Best" 7 pin interchangeable core and keyed alike.

#### CPU INTERFACE WITH RPU OR DATA LOGGER

- Provide ten serial interfaces (two systems dedicated and eight for device interfaces) and an onboard Ethernet port 10/100 Mbps.
- Provide RPU/data logger-CPU communications via one CCITT V.24/EIA-232 communication interface port on the remote processing unit or Data logger using TCP/IP.
- Provide standard equipment and software with TCP/IP (Transmission Control Protocol/Internet Protocol), PPP (Point-to-Point Protocol), and SNMP (Simple Network Management Protocol) to assure the RWIS has the capability to implement complex protocols and to support National Transportation Communication for ITS Protocol for Environmental Sensor Stations (NTCIP-ESS) data communication standards. All RWIS and associated control equipment shall meet or exceed all the latest approved versions of the NTCIP Standards during installation of (ESS).
- The central processing unit may poll the remote processing unit at a time interval that can be changed at a workstation linked to the CPU, and configurable from 1 min to 1 hour.

The remote processing unit or data logger shall independently automatically report data to the central processing unit on pre-determined intervals.

# 2. Cellular Modem

Furnish, install, configure, integrate, and test, cellular modems at RWIS locations as required. Provide necessary ancillary equipment, hardware and cabling to integrate new modem into the communications network.

• Cellular modems shall provide connectivity between the RWIS RPU and CPU using a cellular provider and be capable of both Ethernet and CDMA communications. Cellular modems shall be compatible with existing 4G LTE networks, at a minimum, with ability for compatibility with future 5G networks.

# 3. Roadway Sensors

The system shall be specifically designed for monitoring and displaying pavement surface conditions (e.g. dry, moist, wet, slush, frost, snow, and ice), surface friction and pavement temperature, as well as vehicle count, speed and length data. The system shall include single or multiple sensor arrays working collectively to provide the required data elements.

# GENERAL

- These specifications list minimum requirements. Sensors that use alternate technologies or alternate methods to collect the required data are acceptable.
- Sensors shall allow for interoperability between multiple vendors' field controllers. All sensors shall meet or exceed current NTCIP standards and be compatible with a NTCIP-based RPU or data logger.
- Sensors shall support at least one of following communication protocols in order to transmit data to the RPU or data logger:
  - o Wireless
  - Analog/Digital
  - o Ethernet
- In-pavement and non-invasive sensors are acceptable.
- Systems shall be compliant with appropriate FCC regulations, appropriate UL laboratories, and CE Compliance.

#### PAVEMENT CONDITION SENSORS

Configurations of pavement condition sensors mounted on poles or existing infrastructure without pavement alteration (non-invasive) or that require altering pavement to install (in-pavement) are acceptable. Either sensor shall meet the following minimum specifications:

#### IN-PAVEMENT CONDITION SENSORS

• In-pavement surface condition sensors shall meet or exceed specifications of Vaisala DRS511 or equivalent.

#### NON-INVASIVE PAVEMENT CONDITION SENSORS

• Non-invasive surface condition sensors shall meet or exceed specifications of Vaisala DSC211 or equivalent.

# PAVEMENT TEMPERATURE SENSOR

• Pavement temperature sensors shall meet or exceed specifications of Vaisala DST111 (noninvasive) or DRS511 (in-pavement). For stations equipped with in-pavement sensing, a subsurface temperature probe shall also be installed meeting or exceeding specifications of Vaisala DTS12G.

# 4. Atmospheric Sensors

Procure and install atmospheric sensors providing the minimum meteorological measurements noted below. Provide all materials, workmanship, equipment, enclosures, cables, connectors, installation/mounting kits, covers, rodent/bird protection, heaters/fans, shields, etc. as required to ensure successful sensor installation, operation and accurate data measurement and reporting to the RPU, data logger or CPU. Test sensor for accuracy after installation and provide certification to the RWIS Project manager or inspector for verification and validation. Provide each type of the following sensors on the instrument structure at each RWIS site.

#### GENERAL

- These specifications list minimum requirements. Sensors that use alternate technologies or alternate methods to collect the required data are acceptable.
- Sensors shall allow for interoperability between multiple vendors' field controllers. All sensors shall meet or exceed current NTCIP standards and be compatible with a NTCIP-based RPU or data logger.
- Sensors shall support at least one of following communication protocols transmit data to the RPU data logger:
  - o Wireless
  - Analog/Digital
  - o Ethernet
- Systems shall be compliant with appropriate FCC regulations, UL laboratories and CE Compliance.

#### VISIBILITY AND PRECIPITATION SENSOR(S)

• Visibility and precipitation sensors shall meet or exceed specifications of Vaisala PWD22 or equivalent. The Department's Project Manager may opt to install a "tipping bucket" -style precipitation sensor instead, which shall meet or exceed specifications of Vaisala RG13H or equivalent.

# AIR TEMPERATURE AND RELATIVE HUMIDITY SENSOR(S)

• Air temperature and humidity sensors shall meet or exceed specifications of Vaisala HMP155E or equivalent.

#### BAROMETRIC PRESSURE SENSOR

• Barometric pressure sensors shall meet or exceed specifications of Vaisala PTB110 or equivalent.

# WIND SPEED AND DIRECTION SENSOR

• Wind speed and direction sensors shall meet or exceed specifications of Vaisala WMT700 or equivalent.

# 5. Video Camera Assembly

Provide an outdoor rated video IP camera (or IP through an Encoder in the control cabinet) assembly that will supply color daytime video imagery from the RWIS site and infrared video imagery within low-light thresholds. Provide an assembly consisting of a camera, lens, camera housing, at the RWIS site. Furnish all hardware tools, equipment, cables, materials, supplies, manufactured articles, and perform all operations and integration as required to provide the ability to view images from each RWIS site through the web-browser.

#### GENERAL

CCTV shall be capable of providing still images, at configurable time intervals, which will be the main output from the CCTV. Streaming video may be a future capability.

#### CAMERA

- For fixed-position cameras, hardware shall meet or exceed specifications of Mobotix M12 or equivalent.
- For pan-tilt-zoom cameras, hardware shall meet or exceed specifications of Axis Q6042-E or equivalent.

# 6. Weather Station

Weather Stations shall gather data from atmospheric weather sensors and transmit the collected data to the CPU at the vendor's facility.

Provide weather stations that meet or exceed the minimum RWIS requirements stated above for the following atmospheric weather parameters:

- Precipitation
- Air Temperature and Relative Humidity
- Wind Speed and Direction

# 7. Website Hosted Data Display and Access Requirements

The concept of the RWIS integration and communications design is that the CPU shall be the central repository and distribution hub for all data reported from all existing and future RWIS sites, including traffic data. The RWIS locations will be polled or report to the CPU on regular intervals as noted herein, and the CPU will host a web-based interactive map allowing for display of any and all information in a winter severity index format. The CPU will host data in a secure format (for PennDOT access) and in a public format (for public access) that provides select data based on PennDOT's preferences. Data requirements for RWIS site include traffic data.

- The system is hosted outside of the Commonwealth Network and shall provide authorized users the ability to password-protect any and all data being received from specific RWIS field sites at the CPU. This would then require users accessing protected data sets via the CPU to enter a valid password prior to being able to view the data.
- 2) The system shall provide authorized users the ability to password-protect any and all configuration and control capabilities for specific RWIS field sites. This would then require users accessing protected control data via the CPU to enter a valid password prior to being able to modify any settings.
- 3) The Contractor shall be responsible for developing and implementing a method for backing up archived RWIS data and program files at least once per day and storing a minimum of two (2) years of historical data. The Contractor shall demonstrate the successful operation of the backup process during acceptance of the system.
- 4) The system shall make data available and coordinate integration of such data with the Next Gen ATMS, Traffic Management Centers, PennDOT Maintenance Decision Support System (MDSS), the Pennsylvania Turnpike Commission RWIS system, and 511PA through automated data feeds, or Application Programming Interface (API) including but not limited to: CSV, ASCII, RSS, JSON or XML.
- 5) The Contractor shall provide internet-based information displays from each RWIS site. The system shall consist of a host web server and user-friendly graphical user interface with dynamic web mapping available through the internet. The web interface shall also be available through mobile device via a mobile friendly website, or mobile application that can be fed in RSS, ASCII, JSON or XML format.
- 6) The RWIS Website shall be capable of displaying data in a Winter Severity Index (WSI) format. The WSI shall quantify winter severity via a single number that factors in number of snow events, number of freezing rain events, total snow amount, total storm duration, and total number of incidents. The WSI will be used by PennDOT as a planning and management tool to evaluating estimate labor and equipment use across counties and from year to year. The WSI shall use a 0 to 100 scale.
- 7) The RWIS Website solution shall be capable of supporting all RWIS sites provided or retrofitted under this contract. In addition, the RWIS website solution shall be capable to be expanded by the same number of RWIS sites provided under this contract.

- 8) The system shall be capable of grouping RWIS locations and be user-configurable.
- 9) The system shall be capable of polling all remote devices at configurable intervals no greater than 10 minutes and capable of completing the poll for all devices within 10 minutes. The system shall immediately refresh the website as new data is polled and verified for accuracy.
- 10) The system shall include automated and configurable reports to indicate variances in values, trends over time, and spatial comparisons.
- 11) The system shall be capable of viewing past and present weather data, as well as prediction of near-term future weather data.
- 12) The system shall be capable of displaying weather and forecasted data in the same screen. In addition, the system shall be able to display data in a mobile solution.
- 13) The system shall not require any client licenses or client software installed on each machine to view the webpage when used with the current editions of a modern internet browser.
- 14) The system shall be compatible with PennDOT's existing Operating Systems (Microsoft Windows 10) and major software suites such as Microsoft Office 365.
- 15) The system shall validate all incoming data based on historical trends and other data sources to ensure the highest data quality.
- 16) The system shall support all System Alarms as noted and all communications options established herein.
- 17) The system shall also support an interface with the Federal Highway Administration's Clarus Initiative using an automated data feed.

# 8. Application Alerts

The program shall provide authorized users the ability to configure system alarms, which are activated by configurable thresholds of data being reported by specified RWIS sites.

- 1) Alarms shall be configurable by the user in presentation, giving the user an audio, visual, email, hardcopy (print out of alarm message), alphanumeric paging, cell phone or SMS text message notification.
- 2) All alarms shall originate from the CPU.
- 3) An alarm may be set for any of the data types being reported by the RWIS site equipment and may be activated by a device reporting values above or below a user defined threshold.
- 4) Alarms may be set to activate in response to device error codes or specific diagnostic reports being received by the CPU.
- 5) Users may select the site at which specific alarms shall apply.