SPECIAL PROVISION

SECTION 654

INTELLIGENT TRANSPORTATION SYSTEMS

(Road Weather Information Station (RWIS) System Equipment)

**654.53 Road Weather Information Station:** This work shall consist of furnishing, installing, integrating and testing a solar powered Road Weather Information Station (RWIS) system. This RWIS system shall include a new steel pole with multiple weather sensors mounted to a reinforced concrete foundation.

This work also includes integrating the data obtained by the RWIS system into the Maine Department of Transportation (MaineDOT) Advanced Transportation Management System (ATMS), New England Compass ATMS (Compass ATMS). Compass was developed by the Southwest Research Institute (SwRI) and is used by Maine, New Hampshire, and Vermont. This integration effort shall include the development of a live, supported dataflow using an open vendor API from the RWIS System Equipment to Compass ATMS and MaineDOT. RWIS data shall also be integrated into MaineDOT’s existing Road and Weather software as part of this project.

MaineDOT currently maintains RWIS systems manufactured by Vaisala and Campbell Scientific. Both of these vendor’s RWIS systems are currently integrated into both Compass and the existing Road and Weather software.

The Contractor shall provide a qualified System Integrator to integrate the RWIS system data into Compass. The System Integrator shall be responsible for the full integration and function of new RWIS data in Compass. Integration into MaineDOT’s Road and Weather software shall be the responsibility of the Contractor and can be done separately of the Compass integration. MaineDOT has an existing contract for the Road and Weather software and will pay any associated licensing fees after the initial six months.

654.021 General: The following specifications detail a typical RWIS system as currently deployed in the State of Maine. If any of the following hardware-specific requirements listed in the following sections cannot be met by a willing Bidder, but the Contractor believes that strict conformance to the given requirement is unnecessary or may be accomplished differently, the Contractor shall provide a list of the requirements that cannot be strictly met along with a justification for how the Contractor’s proposed RWIS System Equipment may be considered functionally equivalent in accordance with Special Provision 103.

654.026 RWIS System Equipment – General

1. All software and data interfaces shall be designed to reflect the latest NTCIP and Traffic Management Data Dictionary Standards. Specifically, the system shall support NTCIP 1204 v03.08 protocol.
2. The RWIS System shall include a controller (controller or Data Logger) that shall satisfy the following requirements:
   1. The controller shall have a modern processor, manufactured within the previous 12 months.
   2. The controller shall have a minimum of 512MB DDR3 and 2GB of NAND flash memory.
   3. The controller shall have internal/integral Ethernet communications and support direct Ethernet connections.
   4. The controller shall provide a means for real-time clock synchronization and location definition at least once daily.
   5. The controller shall have remote access capability for local maintenance purposes (WLAN, WiFi, Bluetooth or equivalent).
   6. The controller shall keep records and show calibration history of the attached sensors.
   7. The controller shall operate in the temperature range of -34°F to +150°F.
3. The RWIS System Equipment shall include a Sensor Interface and Power Management system that shall satisfy the following requirements:
   1. All sensor connectors shall be MIL-SPEC circular connectors rated to IP66/IP68.
   2. The controller shall include Ethernet interfaces for sensor and peripheral connections including at least two spare ports.
   3. Ethernet connections shall support Power over Ethernet (PoE) functionality.
   4. The controller shall have serial interfaces for sensor and peripheral connections without extension modules including at least two spare ports.
   5. The controller shall have centralized bus-bar for sensor grounding. The bus-bar shall be copper.
   6. Sensor cables shall be connected to bus-bar for grounding.
   7. The controller shall have built-in surge arrestors that shall be field replaceable.
   8. Where indicated on the Plans, the controller shall have the capability to operate with solar power technology (direct current).
   9. Where indicated on the Plans, the controller shall have a battery charger.
4. The RWIS System shall include a Power Supply that shall satisfy the following basic requirements:
   1. Where public utility power is provided, the Power Supply shall withstand an alternating current (AC) range of 89VAC to 135VAC
   2. Power shall have in-built surge protection against transients.
   3. Power shall be at least 240W to ensure sensor heating under all conditions.
   4. Power supply shall have stable output of ±1 percent.
   5. Power supply shall allow parallel connection when additional power is required.
5. The AC Supply shall satisfy the following requirements:
   1. The controller AC supply shall have surge protection level at least 6kV/3kA. Surge protection units shall be field replaceable.
   2. AC Supply shall include a main disconnect circuit breaker for maintenance purposes.
   3. Where AC power systems are employed, the RWIS System shall include a Battery Back-Up that shall satisfy the following requirements:
      1. The battery back-up system shall provide sufficient power for all RWIS system components for a minimum of 24 hours at full function in the absence of AC power.
      2. At the end of the initial 24 hours without AC power, the battery back-up system shall provide sufficient power for critical sensors (as defined by the manufacturer) for an additional 24 hours. This low power or survival mode may include less frequent polling of the sensor data but not less than once every ten (10) minutes.
      3. At the end of 48 hours without AC power, the battery back-up system shall not have discharged more than 50 percent of the rated capacity of the battery back-up system.
      4. Back-up batteries shall be sealed and spill proof and shall be considered maintenance-free.
      5. The battery back-up system shall be Ethernet ready. The Contractor shall furnish and install an Ethernet patch cord to connect the battery-back-up system to the Ethernet switch in the controller cabinet.
      6. The Contractor shall submit for approval a Technical Submittal calculation for the battery back-up system that demonstrates compliance with the required hold-up time of the back-up system. This calculation shall include the manufacturer’s specified loads for each sensor, the controller, and other pieces of equipment to be powered during the full function period and the low power/survival mode period. The battery calculation shall be measured from 0°F. The Technical Submittal shall be submitted in accordance with Special Provision 654.
6. Where solar power systems are employed, the RWIS System shall include the following solar power components:
   1. Solar Power Autonomy
      1. The solar panels, in combination with the batteries, shall provide four (4) days, minimum, autonomy under no-light conditions when the batteries are fully charged and to provide 24 hours per day, 7 days per week, 365 days per year operation with no loss of operations.
      2. The batteries shall provide sufficient power to maintain the RWIS system full functionality for the four days.
      3. At the end of four days, the system shall be capable of maintaining power to the critical sensors (as defined by the manufacturer) for up to 24 additional hours. The system shall be capable of switching to low power/survival mode automatically as well as manually through remote commands.
      4. At the end of the initial four days on continuous, full function operation under no-light conditions, the batteries shall still retain at least 50 percent of their full design capacity at 0°F.
      5. The solar panels shall be sufficient to recharge the batteries from 50 percent to 100 percent of rated capacity under full RWIS system load within 48 hours.
      6. Batteries - The batteries shall meet the requirements of the AC Battery Back-up system as defined above.
   2. Photovoltaic (PV) panels with mounting brackets
      1. The solar panel array shall be made up of one or more PV panels along with support and mounting brackets to attach firmly and securely to a steel support pole.
      2. The mounting bracket shall provide flexibility to aim the solar panel to maximize sun exposure.
      3. The solar panel array shall be designed to operate over a free air temperature range of -30°F to +122°F.
      4. The solar power array shall be Underwriter’s Laboratory (UL) approved. UL certification shall be provided with the Technical Submittal.
   3. The equipment cabinet shall include a manual generator transfer switch to allow the cabinet to be switched from solar power to provide 120 VAC generator power. The generator will be provided by MaineDOT as required. The generator transfer switch shall be mounted through the cabinet wall facing away from or downstream of the direction of traffic.
   4. Control Devices
      1. Control devices should include a solar controller and a battery charge controller, with all necessary connector cables and ancillary equipment.
      2. The control devices shall prevent the batteries from overcharging.
      3. The control devices shall include low voltage disconnect devices which disconnect the batteries to prevent damage in the event of a very low state of charge.
      4. If the control devices include a power inverter, the power inverter shall provide 120 VAC power to the controller with three (3) percent or less total harmonic distortion and five (5) percent +/- output voltage regulation.
      5. The control devices shall be temperature compensated such that the battery charging voltage is automatically adjusted based on temperature variations to maximize battery life.
      6. The control devices shall include a system monitoring device which allows maintenance personnel to assess critical system parameters such as battery condition and solar panel output.
      7. The control devices shall include overcurrent protection to ensure safe power output in the event of a malfunction of the solar power system.
   5. Solar Power Technical Submittal
      1. The solar power Technical Submittal shall include all components of the solar power system including catalog cuts and shop drawings for the solar panels, the batteries, the charging system and inverters (as required), solar panel mounting hardware, supplemental battery cabinets, and all other equipment and hardware for a fully functional solar power system. The Technical Submittal shall be submitted in accordance with Special Provision 654.
      2. The Contractor shall submit for approval a solar calculation which demonstrates compliance with the power requirements. This calculation shall include the manufacturer’s specified loads for each sensor, the controller, and other pieces of equipment to be powered. The solar calculation shall be measured from 0°F during lowest solar exposure weeks (late December/early January).
      3. The Technical Submittal shall include shop drawings and calculations for the solar panel support pole(s) and foundation(s).
      4. The Technical Submittal shall indicate the power requirement for the sensors indicated to be functional under the low power/survival mode.
7. The RWIS System Equipment shall include a fiber optic communications system that shall satisfy the following requirements:
   1. The controller shall support at least two parallel communication lines out from the station, with one communication line being a cellular modem.
   2. The controller shall be native Ethernet, allowing Ethernet communications via cellular modem or fiber optic Ethernet switch.
   3. The controller cellular communication shall support modern networks: 3G/4G/LTE.
   4. The controller cellular communication shall support dual SIM usage for data transmission purposes.
   5. The controller shall support an RJ-45 port.
   6. Where the controller includes a WLAN for local remote access, the controller shall have user definable time-out for WLAN broadcasting to prevent unintentional use of WLAN.
      1. The controller WLAN shall have the ability to be used as a hotspot.
      2. The controller WLAN shall have the ability to be used as a client.
   7. The controller shall have two Ethernet networks: one for internal communications and second for external communications.
   8. The controller’s internal network shall be Ethernet based.
   9. The controller shall be connected to the Ethernet switch via Ethernet patch cord furnished and installed by the Contractor.
8. The controller shall include a cabinet enclosure that shall satisfy the following requirements:
   1. The controller enclosure shall not have external connectors for sensors and other equipment, which may cause excessive amount of corrosion and malfunctions.
   2. All entries to the controller enclosure shall be completely encased in conduit with appropriate bushings to prevent insect and moisture entry. The sensor cable inlets shall be vandal-proof.
   3. The controller enclosure material shall be made of bare aluminum or stainless steel.
   4. The controller enclosure shall be equal to IP66 or NEMA-equivalent rating.
   5. The controller enclosure door shall have wind lock mechanism to maintain the door in an open position during maintenance.
   6. The controller enclosure shall include a fiber optic Ethernet switch matching the requirements of Item 654.311 Ethernet Switch with Fiber Optic Interfaces except that the switch may be shelf or wall-mounted.
   7. The controller enclosure shall include a fiber optic patch panel matching the requirements of Item 654.3331 Fiber Optic Patch Panel with 12 positions, except that the patch panel may be shelf or wall-mounted.

654.027 RWIS System Sensors: The Contractor shall furnish, install, integrate and test environmental and weather sensors that shall measure several environmental characteristics. The following sensor equipment shall be included:

* Wind Speed and Direction Sensor
* Present Weather Detector (may include visibility, precipitation and accumulation sensors if the single sensor can meet the functional requirements)
* Air Temperature and Humidity Sensor
* Barometric Pressure Sensor
* Road Surface Sensors (Non-Invasive and Subsurface Probe)

1. Wind Speed and Direction Sensor
   1. The sensor shall measure both wind speed and wind direction.
   2. The sensor shall be weather resistant and have an operational temperature of -40°F to +140°F.
   3. The sensor shall fully compensate for the effect of temperature, humidity and pressure.
   4. Measurement Parameters:
      1. The wind speed sensor shall have a measurement range of 0 to 150 miles per hour (mph).
      2. Wind speed shall be user selectable in units of miles per hour (mph) and meters per second (mps).
      3. Wind speed resolution shall be to the whole integer for the selected unit (i.e. 5 mph or 3 mps) and accuracy shall be within one (1) percent of actual.
      4. Wind direction shall be measured in degrees. Wind direction resolution shall be +/- 3 degrees.
      5. Wind speed and direction shall be reported as instantaneous value and rolling average value to a customized average time.
      6. Wind speed and direction minimum and maximum values shall be available over a customized time period (i.e. 10 minutes).
      7. Wind speed shall be available as 3-second gust values.
2. Visibility Sensor (or visibility function of Present Weather Sensor)
   1. The visibility sensor may be integrated into a single sensor unit that operates as a Present Weather Detector. If they are separate units, the visibility sensor shall meet the requirements of parts b. through g. below.
   2. The sensor shall have a measurement range of up to 10 miles with an accuracy of +/- 10 percent.
   3. The sensor shall utilize back scatter optical technology.
   4. The sensor shall have an operational temperature range of -40°F to +131°F.
   5. The sensor shall have an operating humidity range of 0-100 percent relative humidity.
   6. The sensor shall be IP66 rated.
   7. The sensor shall be capable of detection through the following weather conditions:
      * 1. Clear visibility
        2. Fog
        3. Mist
        4. Haze (from smoke or other particulates)
        5. Rain
        6. Freezing rain
        7. Snow
3. Precipitation and Accumulation Detector (or precipitation function of Present Weather Sensor)
   1. The precipitation detector may be integrated into a single sensor unit that operates as a Present Weather Detector or may be provided as independent sensors.
   2. The precipitation sensor shall meet the requirements of c. below, regardless whether it is part of a Present Weather Sensor or if it is a stand-alone sensor.
   3. Measurement Parameters:
      1. The sensor shall detect the following types of precipitation:
         1. Rain
         2. Freezing Rain
         3. Drizzle
         4. Freezing Drizzle
         5. Mixed Rain/Snow
         6. Snow
         7. Sleet/Ice Pellets
      2. The sensor shall be capable of measuring rain precipitation accumulation rate to an accuracy of 0.05 inches per hour measured over a 10 minute time period.
      3. The sensor shall be capable of measuring snow accumulation and amount of new snow since previous readings. Snow accumulation sensitivity shall be at least 0.5 inches per hour with an accuracy of +/- 10 percent.
4. Air Temperature and Humidity Sensor
   1. The sensor shall contain a radiation shield to protect the sensor from solar radiation influence and from precipitation. The radiation shield shall contain no moving parts.
   2. The sensor shall combine air temperature detector (AT), relative humidity detector (RH), and dew point detector (DP) into a single unit. Alternatively, dew point may be calculated by the controller or via the Road and Weather software.
   3. The sensor shall have integral surge protection.
   4. The sensor shall be IP66 rated.
   5. The AT detector shall have an operational range of -40°F to +140°F.
   6. The RH detector shall have an operational range of 0-100 percent RH.
   7. Measurement Parameters:
      1. AT detector shall provide instantaneous and rolling one minute average values. The AT detector shall hold the previous five observations.
      2. AT detector shall have rolling 24-hour minimum and maximum temperature values.
      3. AT detector shall have an accuracy of 0.5°F over the range of 0°F to +100°F.
      4. RH detector shall provide rolling one minute average values from the previous six observations.
      5. RH detector shall have an accuracy of two (2) percent and shall be reported to the nearest 0.1 percent (i.e. 90.8%).
      6. RH detectors shall provide a means (either directly or via software) to measure dew point temperature and frost point temperature.
      7. RH detector shall provide active measurements that maintain accuracy within 2% in condensing conditions.
5. Barometric Pressure Sensor
   1. The sensor shall be a silicon capacitive absolute pressure sensor designed for barometric pressure measurement.
   2. Measurement Parameters:
      1. The barometric pressure sensor shall conduct readings every 5 seconds and report the instantaneous readings.
      2. The barometric pressure sensor shall measure in units of inches of mercury (Hg).
      3. The barometric pressure sensor shall have an operational range of 18.0-31.0 inches Hg with a resolution of 0.03 inches Hg.
      4. The barometric pressure sensor shall have an accuracy of +/- 0.12 inches Hg over the temperature range of 0°F to +140°F.
6. Non-Invasive Pavement Sensors
   1. There shall be sensors that can measure the pavement surface temperature, ambient air temperature, relative humidity, pavement surface state, and friction coefficient remotely, without penetrating the roadway. The non-invasive sensors shall be Luft NIRS, Viasala DSC/DST, or equivalent.
   2. If a pavement sensor cannot meet the accuracy requirements for all of the measurements in part a., additional supplemental sensors shall be furnished and installed to meet the accuracy requirements.
   3. These non-invasive sensors shall have no moving parts.
   4. Non-invasive sensors shall collect data samples from the road surface in accordance with the performance standards established in this specification.
   5. The data generated by the non-invasive sensors shall be compatible with the current Road and Weather software currently in operation within the MaineDOT license for New England Compass ATMS.
   6. Measurement Parameters:
      1. The pavement surface state sensor shall have an operational range of -40°F to +140°F and 0-100 percent RH.
      2. The pavement surface state sensor shall be capable of remote readings at the range of 6.5 feet to 48 feet.
      3. The pavement surface state sensor shall identify the condition of the pavement remotely with the following surface states:
         1. Dry
         2. Moist
         3. Wet
         4. Snow/Frost
         5. Ice
         6. Slush
      4. The pavement surface state sensor shall measure the depth of precipitation on the pavement surface as shown below, all at a resolution of 0.01 millimeters:
         1. Water/Rain at 0.0 - 2.0 millimeters
         2. Ice at 0.0 – 2.0 millimeters
         3. Snow at 0.0 to 10.0 millimeters
      5. The pavement surface temperature sensor shall measure the pavement surface temperature every 60 seconds and have a resolution of 0.5°F.
      6. The pavement surface friction sensor shall estimate the friction coefficient (grip factor) at the range 0.01 to 1.00 at a resolution of 0.01 units.
7. Subsurface Pavement Sensor
   1. The sensor shall be a probe specifically designed for outdoor use and deployment within the pavement structure.
   2. The sensor shall measure the surface temperature, surface moisture, and estimate road weather condition as:
      1. Dry
      2. Damp
      3. Wet
      4. Freezing & Wet
      5. Icy
      6. Snowy
   3. The sensor probe shall be water-tight and weather-resistant.
   4. The sensor probe shall have an operational range of -40°F to +140°F.
   5. Measurement Parameters:
      1. Road surface temperature shall have an accuracy of +/- 1°F with a resolution of 0.5°F.
      2. Freezing point shall have an accuracy of +//- 1°F.

654.028 Closed Circuit Television (CCTV) Camera System: The Contractor shall furnish, install, integrate and test a digital closed circuit television (CCTV) camera at the RWIS System location that shall provide streaming video adjacent to the RWIS system. The CCTV camera shall be connected to the controller and shall be remotely controlled via the RWIS communication system.

1. The CCTV camera shall be digital, IP addressable and Ethernet ready.
2. The CCTV camera shall be Underwriter’s Laboratory (UL) approved. The UL certification shall be provided with the technical submittal.
3. The CCTV shall have the capability to be viewed, controlled and tested locally at the controller utilizing a laptop computer with the manufacturer’s software. This shall include the capability to locally retrieve operational status and fault data for the camera.
4. The CCTV shall have a minimum resolution of HDTV 800 x 600.
5. The CCTV shall be capable of streaming video with H.264 and/or Motion JPEG video compression format.
6. The CCTV shall be capable of time triggered FTP.
7. The CCTV shall be powered by an industrial grade Power Over Ethernet Injector (POEI). The POEI shall provide operating power and Ethernet data to the CCTV.
8. The CCTV shall be housed in an environmentally hardened enclosure suitable for continuous outdoor use. The CCTV shall have an operating range of -40°F to +100°F, minimum.
9. The CCTV housing shall be IP66-rated.

654.029 RWIS System Support Structure and Foundation: The Contractor shall furnish and install a galvanized steel support structure on a steel reinforced concrete foundation.

1. The steel support structure shall be designed by the Contractor. Shop drawings and structural calculations shall be submitted to the Engineer for approval prior to beginning fabrication.
2. The steel support structure shall be designed in accordance with Standard Specification 643.023 for Traffic Signal Structures, with Fatigue Category II.
3. The steel support structure shall be installed on a steel reinforced concrete foundation. The foundation should be a drilled shaft foundation in accordance with Standard Specification 626.034 for Concrete Foundations.
4. The Contractor shall prepare shop drawings and structural calculations to support the size of the concrete foundation proposed for the steel support pole. Precast foundations are permitted if the diameter of the foundation is 24 inches or less and if the height of the steel support pole is 30 feet or less. The foundation design shall conform to the requirements of Standard Specification 626.036, regardless whether the installation will be precast or cast-in-place.
5. The solar panels required for the RWIS system shall be mounted on a steel support structure and concrete foundation conforming to these requirements.

654.031 RWIS System Construction Requirements: The Contractor shall install the RWIS system equipment in accordance with the Plans. The Contractor shall be responsible for all other work to provide a fully functional, operational, and integrated RWIS system at the locations identified in the Plans.

The Contractor shall install, configure, integrate, and test the RWIS System data into the Compass ATMS and its Road and Weather software. The RWIS System Equipment shall continuously measure and record RWIS System data. The system data shall be available to MaineDOT in the Compass ATMS mapping feature and other related internal programs.

1. Power Requirements
   1. Each RWIS location shall be supplied with adequate power to meet the site and sensor design loads. The power may be AC (public utility power as provided by others) or DC (solar power system) as required by the Plans.
   2. Where AC power is provided by others, the Contractor shall coordinate the power connections at the controller cabinet.
   3. Where solar power is provided, the Contractor shall furnish, install, configure and test the solar power system equipment to provide the required power to the RWIS equipment.
2. Grounding System Requirements
   1. All RWIS sites shall be grounded to a minimum of 25 ohms to ground. If other national, state, or local grounding requirements are more stringent than those of the manufacturer, the applicable national, state, or local code shall apply.
   2. The Contractor shall install solid copper or copper clad ground rod (minimum ¾-inch x 10-foot) along with #4 AWG ground wire and fittings at the base of the RWIS equipment pole. The Contractor shall install additional ground rods required to meet the minimum grounding requirement.
   3. The Contractor shall install ground rod(s) for the solar panel support pole to achieve a minimum of 25 ohms to ground.
   4. The ground wire shall be exothermically welded to each ground rod installed with all ground rods attached to every other ground rod via the ground wire.
   5. The RWIS grounding system shall be bonded to the controller enclosure bus-bar and the steel support structure in accordance with National Electric Code (NEC) requirements.
   6. The solar panel support grounding system shall be bonded to the steel support structure.
3. Communication Requirements
   1. The Contractor shall furnish and install a cellular modem compatible with the RWIS system and with the MaineDOT communications system.
   2. The RWIS system shall transmit weather sensor data to Compass and MaineDOT’s Road and Weather software currently in operation.
   3. The Contractor shall provide all necessary equipment, cables, hardware, and ancillary equipment to capture the RWIS sensor data and transmit the data to Compass and to the Road and Weather software at the MaineDOT TMC.
   4. The communication system shall allow for configuration control and trouble-shooting of the RWIS equipment through both a local onsite connection and through a remote connection to the controller.
4. Software and Integration Requirements
   1. The Contractor shall provide the qualifications of the System Integrator to the Department as a condition of Contract Award as described in Special Provision 103. All work associated with system integration shall be under the direct supervision of the System Integrator. The System Integrator shall demonstrate working knowledge of Compass and have experience working with the RWIS System data to be supplied under this project.
   2. The RWIS System shall be fully compatible with the Compass and the current MaineDOT Road and Weather software.
   3. If the Contractor proposes to supply equipment that is not fully compatible with Compass or the current Road and Weather software, the Contractor shall be required to fully integrate the non-compatible equipment into Compass and the Road and Weather software so that the new equipment operates in the programs in the same manner as the existing RWIS. All costs associated with software development, coordination with the New England Compass ATMS developer, and for all integration services shall be the responsibility of the Contractor.
   4. The Contractor shall be responsible for the cost of integration and for the first six months of the Road and Weather Software licensing fees. After the initial six month period, the software licensing fees will be paid by MaineDOT.
   5. The Contractor shall update the map feature and station summary pages of Compass for each new RWIS site installed on this project.
   6. The Contractor shall ensure that Compass and the Road and Weather software reporting functions include and incorporate the new RWIS sites installed on this project.
   7. The RWIS system shall have the capability of generating alerts, watches, or warning. The user shall have the ability to set no less than two levels of alarms, both an audible and visual alarm, displayed on the operator’s screen when viewing the Road and Weather software. The system shall have the ability to inform automatically via email when alarm criteria is met.
   8. RWIS System data integration shall be accomplished with minimal interruption to the existing MaineDOT Traffic Management Center (TMC) operations or the existing Road and Weather software in use at the TMC. Any required downtime of the Compass ATMS shall be approved by the Resident at least seven (7) days in advance. The System Integrator shall use the Compass ATMS test environment to demonstrate the system operations prior to going live with the RWIS System data.
5. Sawing Bituminous Pavement
   1. Sawcutting bituminous pavement shall be with a power-driven saw with an abrasive blade of sufficient width to provide the required cuts.
   2. The sawcut shall be vertical and not exceed two inch depth.
   3. Debris from the sawing operation shall be removed and disposed of by the Contractor before reopening the roadway to traffic.
6. System Testing
   1. All RWIS sensors and equipment installed under this project shall be tested prior to final acceptance. There are three stages of tests required: Stand-Alone Testing, Central Control Testing, and Operational Testing. Subsystem testing will not be required.
   2. Testing shall be conducted in accordance with Special Provision 654.
   3. Supplemental Testing Requirements
      1. Stand-Alone Testing - If a sensor or unit fails to pass the stand-alone test, the Contractor shall correct the problem or replace the sensor or unit and retest until satisfactory results are achieved.
      2. Central Control Test Requirements – This test shall be performed at the TMC in Augusta in Compass and the MaineDOT Road and Weather software. This test shall verify that all the RWIS sensors and equipment and transmitting data to the appropriate software in accordance with the Contract Documents.
      3. Operational Testing – The RWIS system must demonstrate successful transmission of data and be fully integrated with the TMC operations. In the event that there is a single failure associated with any RWIS component or data transmission, the test shall be suspended while the Contractor resolves the failure (either by fixing the sensor or replacing the sensor). Upon successful repair/replacement, the test shall continue to the end of the 30 days, or a minimum of seven days, whichever is longer. Upon the failure of any second sensor or equipment, the Operational Test period shall be restarted for the full 30 days upon repair/replacement. The completion of the Operational Test period and the submission of all test reports shall be documented as the date of Final System Acceptance, provided all other work has been completed to the satisfaction of the Resident.
   4. MaineDOT reserves the right to examine and test/retest any and all test steps for the project as Quality Assurance. If MaineDOT determines that any test procedure does not show the result indicated by the final test results, the Contractor shall update and/or repair the defect at no additional cost to the Department.
   5. As part of the final testing, the Contractor shall provide to MaineDOT a complete set of maintenance and user manuals along with all the wiring and assembly schematics/diagrams, including any material safety data sheets (MSDS), prepared by the manufacturer and any toxic substances (coatings, liquids, or other) used.
7. Training
   1. If the Contractor elects to provide new or modified Road and Weather software, the Contractor shall provide a training program consisting of the furnishing of educational training in the operation of the new software.
   2. The training shall be scheduled after Stand-Alone Testing but prior to the end of the Operational Testing period.
   3. The Contractor shall provide qualified instructors familiar with the operation of the software to conduct the training. Training shall consist of hands-on demonstrations as feasible.
   4. The Contractor shall develop and supply all necessary manuals, displays, class notes, visual aids, and other instructional materials as required to conduct the training program. The Contractor shall supply sufficient materials for up to 10 participants, plus one spare copy of all materials.
   5. Training will be conducted at the MaineDOT Main Office in Augusta, Maine. The Contractor shall coordinate a specific classroom facility with the Resident at least three weeks prior to the training date.
   6. The training session shall be up to four (4) hours and shall accommodate up to 10 people. Typical training topic areas include:
      1. An overview of the software and its operation.
      2. New/modified features of the software.
      3. Interactions of the Road and Weather software with Compass ATMS.
      4. Producing reports using the Road and Weather software.

654.061 Method of Measurement: Road Weather Information Station (RWIS) equipment will be measured for payment by the lump sum complete in place per site, satisfactorily installed, tested, operational, and accepted.

654.07 Basis of Payment: Road Weather Information Station (RWIS) equipment will be paid for at the contract lump sum price for each location. Such price will be full compensation for furnishing and installing all materials, including but not limited to the sensors; CCTV camera; controller and enclosure cabinets with all internal hardware; solar power service; support poles and foundations; communication equipment; grounding; sawcutting pavement; integration and software modifications; system testing; training; warranties and guaranties; and all appurtenances and incidentals required for a complete and functional installation and for furnishing all assembly hardware, tools, labor, and testing necessary for completing the installation.

Payment will be made under the following:

Pay Item Pay Unit

654.53 Road Weather Information Station LS