



STATE OF MAINE
DEPARTMENT OF TRANSPORTATION
16 STATE HOUSE STATION
AUGUSTA, MAINE 04333-0016

Janet T. Mills
GOVERNOR

Bruce A. Van Note
COMMISSIONER

April 8, 2020
Subject: Traffic Signal Modifications
State WIN: 023905.00
Location: **Holden**
Amendment No. 1

Dear Sir/Ms.:

Please make the following changes to the Bid Documents:

In the Bid Book:

REMOVE pages 19 – 26, CONTRACT AGREEMENT, OFFER & AWARD, 2 copies, 4 pages each, and **REPLACE** with the attached, revised CONTRACT AGREEMENT, OFFER & AWARD, 2 copies, 4 pages each.

REMOVE page 52, SPECIAL PROVISION – SECTION 107 – PROSECUTION AND PROGRESS – (Contract Time), 1 page, dated February 19, 2020, and **REPLACE** with the attached, revised SPECIAL PROVISION – SECTION 107 – PROSECUTION AND PROGRESS – (Contract Time), 1 page, dated April 7, 2020.

ADD the attached SPECIAL PROVISION - SECTION 718 - TRAFFIC SIGNALS MATERIAL, 22 pages, dated November 25, 2019.

The following questions have been received:

Question: The spec calls for the Advanced Vehicle Detection system hardware to operate without degradation over a temperature range of -40 to 130 degrees Fahrenheit. Will you accept an Advanced Vehicle Detection system that is rated to -29 Fahrenheit?

Response: Yes.

Question: Special Provision 643 - Page 1 of 3 P.69 states "Remote (back of queue) vehicle detection device to be in a G-sized pole mounted cabinet with cellular connection to ATCC. Cabinet to include 15 Amp Circuit and GFI outlet with confirmation light of triggered event. Additional information can be found in Special Provision 718.14." Could you please provide Special Provision 718.14?

Response: See the attached SPECIAL PROVISION - SECTION 718 - TRAFFIC SIGNAL MATERIALS.

Question: The plan set and Special Provision Section 643 makes reference to Special Provision Section 718. Specifically, the following items:

- 718.07 Controller
- 718.08 Controller Cabinets
- 718.13 Field Monitoring Unit
- 718.14 Remote Detection Device
- 718.15 Messenger Wire
- 718.16 Emergency Vehicle Preemption System

We do not see Special Provisions for these items included in the Project documents.

Response: See previous response.

Question: The Contract Agreement indicates that all work shall be completed by July 2, 2020. The current lead-time for ATC Cabinet is 12+ weeks. Could the completion date be modified to accommodate equipment lead-, assembly, testing and installation times?

Response: The completion date will be extended to August 31, 2020.

Consider these changes and information prior to submitting your bid on **April 15, 2020**.

Sincerely,



George M. A. Macdougall P.E.
Contracts & Specifications Engineer

CONTRACT AGREEMENT, OFFER & AWARD

AGREEMENT made on the date last signed below, by and between the State of Maine, acting through and by its Department of Transportation (Department), an agency of state government with its principal administrative offices located at Child Street, Augusta, Maine, with a mailing address at 16 State House Station, Augusta, Maine 04333-0016, and

_____ a corporation or other legal entity organized under the laws of the State of _____, with its principal place of business located at _____

The Department and the Contractor, in consideration of the mutual promises set forth in this Agreement (the "Contract"), hereby agree as follows:

A. **The Work.**

The Contractor agrees to complete all Work as specified or indicated in the Contract including Extra Work in conformity with the Contract, **WIN. 023905.00** for **Traffic Signal Modifications** in the town of **Holden**, County of **Penobscot**, Maine. The Work includes construction, maintenance during construction, warranty as provided in the Contract, and other incidental work.

The Contractor shall be responsible for furnishing all supervision, labor, equipment, tools supplies, permanent materials and temporary materials required to perform the Work including construction quality control including inspection, testing and documentation, all required documentation at the conclusion of the project, warranting its work and performing all other work indicated in the Contract.

The Department shall have the right to alter the nature and extent of the Work as provided in the Contract; payment to be made as provided in the same.

B. **Time.**

The Contractor agrees to complete all Work, except warranty work, on or before **August 31, 2020**. Further, the Department may deduct from moneys otherwise due the Contractor, not as a penalty, but as Liquidated Damages in accordance with Sections 107.7 and 107.8 of the *State of Maine Department of Transportation Standard Specifications, November 2014 Edition* and related Special Provisions.

C. Price.

The quantities given in the Schedule of Items of the Bid Package will be used as the basis for determining the original Contract amount and for determining the amounts of the required Performance Surety Bond and Payment Surety Bond, and that the amount of this offer is _____

\$ _____ Performance Bond and Payment Bond each being 100% of the amount of this Contract.

D. Contract.

This Contract, which may be amended, modified, or supplemented in writing only, consists of the Contract documents as defined in the Plans, *Standard Specifications, November 2014 Edition, Standard Details November 2014 Edition* as updated through advertisement, Supplemental Specifications, Special Provisions, Contract Agreement; and Contract Bonds. It is agreed and understood that this Contract will be governed by the documents listed above.

E. Certifications.

By signing below, the Contractor hereby certifies that to the best of the Contractor's knowledge and belief:

1. All of the statements, representations, covenants, and/or certifications required or set forth in the Bid and the Bid Documents, including those in the Federal Contract Provisions Supplement, and the Contract are still complete and accurate as of the date of this Agreement.
2. The Contractor knows of no legal, contractual, or financial impediment to entering into this Contract.
3. The person signing below is legally authorized by the Contractor to sign this Contract on behalf of the Contractor and to legally bind the Contractor to the terms of the Contract.

F. Offer.

The undersigned, having carefully examined the site of work, the Plans, *Standard Specifications November 2014 Edition*, *Standard Details November 2014 Edition* as updated through advertisement, Supplemental Specifications, Special Provisions, Contract Agreement; and Contract Bonds contained herein for construction of:

WIN. 023905.00 - Traffic Signal Modifications - in the town of Holden

County of Penobscot, State of Maine, on which bids will be received until the time specified in the "Notice to Contractors" do(es) hereby bid and offer to enter into this contract to supply all the materials, tools, equipment and labor to construct the whole of the Work in strict accordance with the terms and conditions of this Contract at the unit prices in the attached "Schedule of Items."

The Offeror agrees to perform the work required at the price specified above and in accordance with the bids provided in the attached "Schedule of Items" in strict accordance with the terms of this solicitation, and to provide the appropriate insurance and bonds if this offer is accepted by the Government in writing.

As Offeror also agrees:

First: To do any extra work, not covered by the attached "Schedule of Items," which may be ordered by the Resident, and to accept as full compensation the amount determined upon a "Force Account" basis as provided in the *Standard Specifications, November 2014 Edition*, and as addressed in the contract documents.

Second: That the bid bond at 5% of the bid amount or the official bank check, cashier's check, certificate of deposit or U. S. Postal Money Order in the amount given in the "Notice to Contractors", payable to the Treasurer of the State of Maine and accompanying this bid, shall be forfeited, as liquidated damages, if in case this bid is accepted, and the undersigned shall fail to abide by the terms and conditions of the offer and fail to furnish satisfactory insurance and Contract bonds under the conditions stipulated in the Specifications within 15 days of notice of intent to award the contract.

Third: To begin the Work as stated in Section 107.2 of the *Standard Specifications November 2014 Edition* and complete the Work within the time limits given in the Special Provisions of this Contract.

Fourth: The Contractor will be bound to the Disadvantaged Business Enterprise (DBE) Requirements contained in the attached Notice (Additional Instructions to Bidders) and submit a completed Contractor's Disadvantaged Business Enterprise Utilization Plan with their bid.

Fifth: That this offer shall remain open for 30 calendar days after the date of opening of bids.

Sixth: The Bidder hereby certifies, to the best of its knowledge and belief that: the Bidder has not, either directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken any action in restraint of competitive bidding in connection with its bid, and its subsequent contract with the Department.

IN WITNESS WHEREOF, the Contractor, for itself, its successors and assigns, hereby execute two duplicate originals of this Agreement and thereby binds itself to all covenants, terms, and obligations contained in the Contract Documents.

CONTRACTOR

Date

(Signature of Legally Authorized Representative
of the Contractor)

Witness

(Name and Title Printed)

G. Award.

Your offer is hereby accepted.
documents referenced herein.

This award consummates the Contract, and the

MAINE DEPARTMENT OF TRANSPORTATION

Date

By: Bruce A. Van Note, Commissioner

Witness

CONTRACT AGREEMENT, OFFER & AWARD

AGREEMENT made on the date last signed below, by and between the State of Maine, acting through and by its Department of Transportation (Department), an agency of state government with its principal administrative offices located at Child Street, Augusta, Maine, with a mailing address at 16 State House Station, Augusta, Maine 04333-0016, and

_____ a corporation or other legal entity organized under the laws of the State of _____, with its principal place of business located at _____

The Department and the Contractor, in consideration of the mutual promises set forth in this Agreement (the "Contract"), hereby agree as follows:

A. The Work.

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The Contractor shall be responsible for furnishing all supervision, labor, equipment, tools supplies, permanent materials and temporary materials required to perform the Work including construction quality control including inspection, testing and documentation, all required documentation at the conclusion of the project, warranting its work and performing all other work indicated in the Contract.

The Department shall have the right to alter the nature and extent of the Work as provided in the Contract; payment to be made as provided in the same.

B. Time.

The Contractor agrees to complete all Work, except warranty work, on or before **August 31, 2020**. Further, the Department may deduct from moneys otherwise due the Contractor, not as a penalty, but as Liquidated Damages in accordance with Sections 107.7 and 107.8 of the *State of Maine Department of Transportation Standard Specifications, November 2014 Edition* and related Special Provisions.

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\$ _____ Performance Bond and Payment Bond each being 100% of the amount of this Contract.

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WIN. 023905.00 - Traffic Signal Modifications - in the town of Holden

County of Penobscot, State of Maine, on which bids will be received until the time specified in the "Notice to Contractors" do(es) hereby bid and offer to enter into this contract to supply all the materials, tools, equipment and labor to construct the whole of the Work in strict accordance with the terms and conditions of this Contract at the unit prices in the attached "Schedule of Items."

The Offeror agrees to perform the work required at the price specified above and in accordance with the bids provided in the attached "Schedule of Items" in strict accordance with the terms of this solicitation, and to provide the appropriate insurance and bonds if this offer is accepted by the Government in writing.

As Offeror also agrees:

First: To do any extra work, not covered by the attached "Schedule of Items," which may be ordered by the Resident, and to accept as full compensation the amount determined upon a "Force Account" basis as provided in the *Standard Specifications, November 2014 Edition*, and as addressed in the contract documents.

Second: That the bid bond at 5% of the bid amount or the official bank check, cashier's check, certificate of deposit or U. S. Postal Money Order in the amount given in the "Notice to Contractors", payable to the Treasurer of the State of Maine and accompanying this bid, shall be forfeited, as liquidated damages, if in case this bid is accepted, and the undersigned shall fail to abide by the terms and conditions of the offer and fail to furnish satisfactory insurance and Contract bonds under the conditions stipulated in the Specifications within 15 days of notice of intent to award the contract.

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Sixth: The Bidder hereby certifies, to the best of its knowledge and belief that: the Bidder has not, either directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken any action in restraint of competitive bidding in connection with its bid, and its subsequent contract with the Department.

IN WITNESS WHEREOF, the Contractor, for itself, its successors and assigns, hereby execute two duplicate originals of this Agreement and thereby binds itself to all covenants, terms, and obligations contained in the Contract Documents.

CONTRACTOR

Date

(Signature of Legally Authorized Representative
of the Contractor)

Witness

(Name and Title Printed)

G. Award.

Your offer is hereby accepted.
documents referenced herein.

This award consummates the Contract, and the

MAINE DEPARTMENT OF TRANSPORTATION

Date

By: Bruce A. Van Note, Commissioner

Witness

SPECIAL PROVISION
SECTION 107
PROSECUTION AND PROGRESS
(Contract Time)

The contractor will be allowed to commence work on this project as long as all applicable plans required under this contract have been submitted, approved, and a pre-construction meeting held.

The completion date for this contract is **August 31, 2020**.

All work schedule changes must be submitted for approval to the Department a minimum of 48 hours prior to the requested change.

All travel lanes shall be open to traffic and the roadway in safe operating condition when the contractor suspends work for holidays or extended periods of time as directed.

Absences must be requested at least 72 hours in advance and are subject to Department approval based on existing roadway condition, paving deadlines, adherence to schedule, traffic restrictions, etc. The Contractor must assure that the roadway surface and signage are maintained for safe passage of the traveling public during any approved absences. The Contract Completion Date will not be modified due to approved absences.

**SPECIAL PROVISION
SECTION 718
TRAFFIC SIGNALS MATERIAL**

The provisions of Section 718 of the Standard Specifications shall apply with the following additions and modifications:

718.07 Controllers Traffic signal controllers shall be modified as follows:

Delete all paragraphs in 718.07 and add the following text:

All controllers shall be rack-mounted, solid state, menu driven, keyboard units conforming to the ATC 5201 v06.25 Advanced Transportation Controller (ATC) Standard. The controller shall be supplied with all necessary interfaces needed to support Advanced Transportation Controller Cabinet (ATCC) / Serial Interface Unit (SIU) communications. Controllers shall be supplied with an internal real-time clock/calendar capable of daily, weekly, and yearly events time programming. The controller shall be designed and supplied to provide the number of phases and sequencing as shown on the plans without any auxiliary equipment.

Traffic signal controllers shall be supplied as follows:

- Contain ATC API operational software conforming to ATC 5401 Standard v02.
- Be configured to operate in an ATCC 5301 v02 cabinet platform.
- Be supplied with the appropriate version of the Linux operating system, Board Support Package (BSP) and internal processing levels necessary to support connected vehicle (CV) as well as local and system operations.
- Shall be fully compliant with NTCIP 1201 and 1202 standards.
- Include a minimum of 3 High Speed USB 2.0 ports.
- Include a minimum of 3 10/100BaseT, RJ45 Ethernet connector ports.
- Meet the functional requirements of the NEMA TS-2, 2016 Standard, including all amendments.
- Support Flashing Yellow Arrow (FYA) and Flashing Red Arrow (FRA) operation with the ability to provide a minimum of 6 flashing pairs.
- Contain the ability to alter the controller unit's internal database using a built-in front panel keyboard, using a computer connected to the controller unit with a USB cable or an Ethernet cable, and remotely using the central management system application.
- Be supplied and installed with the ability to collect, store, and report various measures of effectiveness (MOE's).
- Shall collect and process all 255 high resolution enumerations as defined in the report "Indiana Traffic Signal Hi Resolution Data Enumerations", dated November 2012. This data will be processed in the controller and available via download from the controller

USB Ethernet port or, if available, via system communications. As a minimum, the controller will be set up to provide the following performance reports:

- Approach delay
 - Preemption events
 - Transit Priority Events
 - Split Monitor
 - Approach Volumes
 - Purdue Coordination Diagrams
 - Arrivals on Red
 - Arrivals on Green
 - Phase Termination
 - Pedestrian Delay
- Be able to backup and restore Controller programming data to a USB memory device connected to the front of the controller. No additional software shall be required to perform this function.
 - Be able to upgrade the Controller firmware via USB memory device connected to the front of the controller. No additional software shall be required to perform this function.

The field electrical loading for flash operation shall be wired through the transfer relays such that the load on the 2-circuit flasher is as balanced as possible within the limitations of the signal phasing.

Electrical filtering/surge protection shall be supplied and installed in each cabinet in accordance with ATCC 5301 v02 requirements and the manufacturer's recommendations. At a minimum, surge suppression shall be provided for incoming electric utility power conductors, all signal control circuits, vehicle detection, and pedestrian detection terminations.

All equipment inputs, outputs, and terminals shall be identified by the phase designations shown on the plans.

The reliability of the equipment shall be demonstrated by test performance detailed in 718.08 that will confirm that the controller unit, fully wired cabinet, and auxiliary equipment meet the operational and functional requirements of the plans and specifications.

Each traffic controller unit, flasher and all other current interrupting devices shall be equipped with a suitable radio interference suppressor installed at the input power point. Interference suppressors shall be designed to minimize interference in both broadcast and aircraft frequencies. Suppressors shall be designed for 125 percent of the total connected load and shall meet standards of the UL and the EIA.

The type of controller, auxiliary equipment and other operational features shall be as noted on the plans.

All controllers shall be capable of providing flashing operation of the signal lights, as indicated on the plans. Transfer from flashing operation or to flashing operation shall conform to the MUTCD.

If noted on the plans, hardwire preempt circuits shall be provided for emergency vehicles and/or railroad crossings. The clearance and preempt indications shall be as noted on the plans. Preempt circuits shall function during stop and go and flashing operation unless otherwise noted. The duration of clearance and preempt intervals shall be adjustable over the range noted on the plans and shall be labeled according to function. The railroad preempt circuit shall be designed to operate as a fail-safe loop through a normally made contact on the railroad's control relay in the railroad's control cabinet. Railroad preemption shall have precedence over all preemption intervals for other purposes.

Actuated vehicle phases and actuated pedestrian phases shall be served in that interval of the cycle indicated on the plans. Time for an actuated interval shall be taken from the non-actuated phase(s) as noted on the plans.

Automatic transfer to or from flashing operation shall conform to the MUTCD. Manual advance of the intervals by use of hand cord control shall cause the controller to advance to the next programmed interval only upon pulse signal from the hand cord circuit, interval timing shall hold the interval for the minimum programmed amber and red clearance intervals.

The controller unit shall be enclosed in a sheet metal case with protective painted finish, designed to permit easy access to the interior and removal of printed circuit boards and modules without the use of special tools. All program controls, fuses, and indicator lights shall be mounted on the front panel and shall be clearly and permanently labeled.

When on manual operation, all phases shall be called regardless of vehicle detection and the controller shall be advanced upon pulse from the hand cord circuit, except yellow and red clearance intervals shall be timed for the duration programmed.

An exclusive pedestrian phase shall not extend or recycle until a vehicle phase has been serviced. When on manual operation, all phases shall be called regardless of vehicle detection and the controller shall be advanced upon pulse from the hand cord circuit except yellow and red clearance intervals shall be timed for the duration programmed. Automatic transfer from or to flashing operation shall conform to the MUTCD.

Pedestrian phases shall not be extended by actuations, during the walk or clearance interval. Actuations during the clearance intervals shall be placed in memory.

Each controller supplied shall be the same manufacturer, model and contain the same firmware level and version number.

718.08 Controller Cabinets Traffic signal controller cabinets shall be modified as follows:

Delete all paragraphs in 718.08 and add the following text:

The traffic signal control equipment shall be enclosed within a dust and moisture-proof aluminum housing with an auxiliary door in door feature. The door hinge pins shall be made of stainless steel. There are two cabinet configuration options that are specified for use; a ground mounted cabinet and a side of pole mounted cabinet.

All new controller cabinets, traffic signal or lighting, shall be configured to eliminate arc flash. All electrical equipment will be dead front, no open terminals, busbars, breakers, or exposed terminal strips. The cabinet shall be designed, constructed and installed with all necessary provisions to comply with the latest NFPA 70E requirements. All electrically live parts over 50 volts shall be covered with Lexan or a suitable physical barrier to eliminate the possibility of an arc flash.

The ground mounted cabinet shall be a NEMA "P" size cabinet (44"W x 26"D x 67"H). The cabinet shall be supplied with two side by side, 19" rack cages which shall extend from the bottom to top of the cabinet. The cabinet shall be supplied with four doors; two on the front and two on the back. The doors shall open independently with an independent center post latching for each of the four doors. The cabinet front will provide for user interface to the in-cabinet devices including the front panel of the controller, the cabinet status displays and detection system control interface. The cabinet rear would support cable termination and would not typically be accessed except for installation and the troubleshooting of wiring problems. The left-side rack of the cabinet, relative to facing the cabinet from the front, shall house the control devices such as the controller, Cabinet Monitor Unit (CMU) and Auxiliary Display Unit (ADU), switch packs and power distribution panel. As such, this rack shall be referred to as the "Control" side of the cabinet. The right-side rack of the cabinet, relative to facing the cabinet from the front, shall house the spare card cage assembly and battery back-up devices and communications elements. As such, this rack shall be referred to as the "Power and Auxiliary" side of the cabinet. The ground mounted cabinet shall be supplied with 32 output channels and 48 input channels.

The side of pole mounted cabinet shall be a Model 336S cabinet (24" W x 20" D x 46" H). The cabinet shall be supplied with a 19" rack cage which shall extend from the bottom to top of the cabinet. The cabinet front will provide for user interface to the in-cabinet devices including the front panel of the controller, the cabinet status displays and detection system control interface. The cabinet rear would support cable termination and would not typically be accessed except for installation and the troubleshooting of wiring problems. The side of pole mounted cabinet shall be supplied with 16 output channels and 24 input channels.

Both the ground mount and side of pole mount cabinets shall be configured to provide the following output/input channel assignments:

| Channel | Input | Output |
|---------|-------------------------------|--------------------------|
| 1-8 | Vehicle Phase Call 1-8 | Vehicle Phase 1-8 |
| 9-12 | Pedestrian Phase Call 2,4,6,8 | Pedestrian Phase 2,4,6,8 |
| 13-16 | - | Overlap A, B, C, D |
| 17+ | Special Functions | - |

The ground mount cabinet shall be supplied with a spare equipment card cage assembly. This card cage assembly will not be wired to any cabinet device, but rather used to store spare rack mounted cabinet devices such as switch packs, SIU's, CMU's and phases selectors. This spare rack assembly shall be located at the top of the power rack.

The cabinet shall be supplied with a GPS system to provide an accurate time reference for the cabinet. The antenna shall be mounted at the top of the cabinet in the back-left corner of the enclosure. The antenna shall be mounted such that it provides a waterproof seal; eliminating any possibility for water penetration into the cabinet. The GPS system cable shall be connected and integrated into the controller.

The cabinet shall be supplied with a police door panel located in the middle area of the front door for both cabinet types. The switches shall be mounted in the police panel and labelled as to function. Four switches shall be supplied as follows:

1. Power On/Off
2. Signal On/Off
3. Signal/Flash
4. Manual/Auto with cord

The manual control cord shall be a coiled type, sealed weather proof covered hand switch extending to six feet when fully stretched. The cord shall be fastened to the cabinet via a compression type connector to provide strain relief for the cord's electrical connections. The police door panel shall be of sufficient size so as to store the manual control cord when panel door is closed.

The cabinet shall be supplied with a technician's panel mounted on the back of the police panel. This panel shall be supplied with the following switches:

1. Controller On/Off
2. Flash/Auto (Allows the controller to cycle while flashing)
3. Signals On/Off (Allows the controller to cycle with signal displays being dark)
4. Stop Time Normal/On (Provides the ability to manually activate a controller stop time input)

The cabinet shall be supplied with white LED light panels which shall automatically illuminate via a door open switch whenever one of the four main cabinet doors are opened for the ground mount cabinet or two main doors for the side of pole cabinet. The LED panels shall produce a minimum of 1,000 lumens on the Control side of the cabinet and 1,000 lumens on

the Power/Auxiliary side of the cabinet and be protected by a clear shatterproof shield. The ground mount cabinet shall contain four light panels; two at the top of each rack assembly and two at the bottom portion of each rack assembly. The side of pole mounted cabinet shall contain two light panels; one at the top of the rack assembly and one at the bottom rack assembly. A second door open status switch per door shall activate a controller input to log a report event that one of the doors was opened. All door open status switches shall be connected to the same controller input. For the ground mount cabinet, there shall be two switches on each of the four main doors. For the side of pole mount cabinet, there shall be two switches on each of the two main doors.

All cabinets shall be provided with a thermostatically controlled ventilating fan and throwaway glass fiber air filters. The electric fan shall have ball or roller bearings and shall have a capacity of 100 ft³ per minute. The fans shall be rated for continuous duty with a minimum service life of 3 years. The fan blades shall be supplied with a safety screen to prevent accident contact with the blades. The ventilating system shall be designed to prevent the entrance of rain, snow, dust, and insects. The fan and vents shall be arranged in such a manner that the air intake is at the cabinet bottom and the exhaust is at the cabinet top. The air intake shall be rain tight and covered with a removable filter. There shall be vents at the bottom of both front doors for a ground mount cabinet and a vent at the bottom of the single front door for the side of pole mount cabinets. The removable air filter shall be firmly held in place such that cracks and openings are eliminated to ensure that all air is filtered. The ground mounted cabinet shall contain two fans while the side of pole mounted cabinet shall contain one fan. The thermostat shall be mounted on the top interior of the cabinet and user adjustable to allow for temperature settings from a minimum of 70°F to 140°F and capable of activating the fans within plus or minus five degrees of the set temperature. The intake vent shall be rain tight and located on the bottom half of the cabinet, covered with a removable air filter. There shall be two intake vents provided with the ground mount cabinet and one intake vent supplied with the side of pole mount cabinet.

The cabinet shall contain a pull-out drawer, 19" wide with sufficient strength to hold a laptop computer. The top of the drawer shall be covered with a non-conductive, non-skid material and hinged such that a storage space is available to store cabinet documentation or small parts. The pull-out shelf shall be located in the rack space directly under the controller unit. The back of the control side front door shall contain a resealable, heavy-duty opaque plastic envelope with two grommets that provide mounting to two integrated hooks installed on the back side of the front cabinet door. The heavy-duty plastic envelope will be used to store cabinet wiring diagrams and operations manuals that cannot be accommodated in the pull-out draw storage tray.

The side of pole cabinet shall accommodate all control equipment including temperature control equipment. It shall be designed to be attached to the type of pole indicated in the contract plans. If the controller cabinet is to be ground mounted, details of the installation will be shown on the plans. Piano type hinges on cabinet doors shall be fabricated of stainless steel with a stainless-steel hinge pin. The cabinet shall be supplied with reinforcing plates where the cabinet is supported by the pole hangers.

The ground mounted cabinet shall be supplied with a 6" minimum high riser aluminum base that elevates the cabinet above the cabinet foundation.

All manual control switches, push button control, flashing switch, signal switch and any other specified switches shall be located to be accessible within the outside door, without exposing the controller mechanism.

The cabinet shall be supplied with detector test switch panel. This panel shall be rack mounted and located above the controller. There shall be a total of 12 switches to allow for the manual placement of detector calls into the controller. Each switch shall be clearly labelled as to input channel and function. Each switch position shall correspond to the same controller input; switch one is for controller input channel one, switch two is for controller input channel 2, etc. Switches 1-8 shall correspond to phase 1-8 vehicle calls. Switches 9-12 shall correspond to pedestrian calls 2, 4, 6 and 8. The switch labels shall define the corresponding vehicle or pedestrian phase called and switch position function. Detector switches shall be three position and function as follows:

- Up Position = Provides a constant call
- Center Position = Normal operation (Phase receives call from detectors)
- Down Position = Provides a momentary call

The cabinet shall be supplied with a laminated door sticker. This sticker shall be permanently affixed to the inside front control side of the cabinet door for the ground mount cabinet and the inside front side of the side of pole mount cabinets. At a minimum, the sticker shall contain the following information:

- Vehicle detection information including detector channel assignment, phase assigned, approach and cabinet termination points.
- If applicable, network communications information for all in-cabinet devices. This includes IP addresses, subnet mask and MAC address.
- Per approach preemption information including channel, approach/direction and termination points.
- Field termination chart showing per approach/per phase numbering of all signal circuits.
- Signal phasing and signal plan with intersection geometry and signal head designations.

The locks for the switch compartment door of the cabinet shall unlock with a skeleton style (#1) key. The locks for the main doors of the cabinet shall unlock with a Corbin #2 key. Two sets of two keys (main door/switch door) shall be furnished with each cabinet.

The cabinet shall be supplied with a permanent label mounted on the upper portion of the inside front main door which contains the name of the cabinet manufacturer, controller manufacturer, model/part number and year/month of assembly.

All traffic signal controller cabinets shall be supplied with a GFCI duplex outlet, as well as a multi-outlet strip.

The cabinet shall be supplied with a generator panel. The generator panel shall consist of a manual transfer switch and a twist-lock connector for generator hookup. The transfer switch knob and twist-lock connector shall be located inside a generator access panel with a separate lockable door mounted on the lower left, exterior of the control side wall of the ground mount cabinet and on the lower left side of the side of pole mounted cabinet. The door shall be equipped tamper resistant hinge. The generator panel assembly shall be housed in a heavy-duty, vandal resistant, weatherproof, dustproof enclosure designed for exterior applications. The generator access panel door shall have a moveable plate to cover an opening for the generator cable. The connection to an external generator shall be a waterproof, secure connection. The connection shall allow authorized personnel; to access, connect and secure an external electrical source to the cabinet for power restoration. The generator panel door shall contain a weather proof seal and supplied with a lock accessed with a skeleton style (#1) key.

The cabinet main doors shall be provided with a stop to limit door opening to both 90° and 180° ±10°. The door stop bar shall be a captive type mechanism that serves to keep the bar in contact with the cabinet at both stop bar ends and provided with a catch that can be operated when the door reaches these 2 positions and will hold the door open securely until released. The cabinet shall be supplied with a three-point draw roller latching system consisting of the following latching points:

- Center of the cabinet (lock)
- Top of the cabinet – controlled by door handle
- Bottom of the cabinet – controlled by door handle

The latching points on the top and bottom of the cabinet door shall remain in the locked position until the door lock is disengaged. The locking mechanism shall be equipped with nylon rollers to secure the top and bottom of the door.

The cabinet shall be supplied with a ¾” diameter shank, stainless steel latching handle for each door. The latching handle shall have a provision for padlocking the door in a closed position.

Controller cabinets designated on the plans to be ground mounted shall have a pliable seal composed of caulking compound or mastic placed between the cabinet base and the concrete foundation to prevent dust and dirt from entering the cabinet.

A Cabinet Monitor Unit (CMU) and Auxiliary Display Unit (ADU) shall be supplied and installed in each cabinet. The CMU and ADU shall conform to requirements defined in the Advanced Transportation Controller Cabinet (ATCC) 5301 v02 standard. The CMU/ADU units supplied and installed as part of this project shall support 32 channels. All configuration programming shall be resident in a non-volatile Datakey device. Each CMU shall be supplied with a Datakey programmer and associated software. The Datakey programming software shall include a set-up wizard which shall assist the user with the initial set up of the device. The

Contractor shall program the Datakey with data entries appropriate for each intersection. All programing resident on the Datakey shall be included in the hardcopy.

The Contractor shall reconfigure the default user name and passwords on all communications / control equipment within the ATC Controller and Cabinet. This includes but is not limited to the ATC traffic controller, ATC ancillary equipment, video detection equipment, Ethernet switches, and routers. The new user name and passwords shall be created in coordination with the MaineDOT IT staff and or as directed by the engineer; no manufacture default level passwords shall be allowed. The Contractor shall utilize network communications encryption settings on all forms of wired Ethernet data paths. No “in the clear” communications shall be allowed. At a minimum all wired Ethernet connections shall meet 802.1AE standards. The Contractor shall supply and configure a Cyber Intrusion and Prevention Device (CIPD) in each ATC cabinet. The CIPD shall prevent any unauthorized access / connections to the traffic control system. Upon detection of unauthorized attempts, the CIPD shall notify the agency via SMS message and or email and log the event. The CIPD shall be installed prior to any remote access device. The Contractor shall coordinate with the agencies Information Technology and Operational Technology (IT/OT) staff and or the engineer for finale configuration of the CIPD. No direct access to the traffic system shall be allowed without the installation of a CIPD and or Router/Firewall.

A cabinet power supply shall be supplied with each cabinet. The cabinet power supply shall comply with ATCC 5301 v02 (EDI Model 2216-2412-HV or equivalent).

A full complement of switch packs shall be supplied with each cabinet. Switch packs shall comply with ATCC 5301 v02.

A full complement of flashers shall be supplied with each cabinet. Flashers shall comply with ATCC 5301 v02.

A full complement of SIUs shall be supplied with each cabinet. The Serial Interface Units (SIU) shall comply with ATCC 5301 v02.

A full complement of flash transfer relays shall be supplied with each cabinet. Flash transfer relays shall comply with ATCC 5301 v02.

In addition to the full complement of switch packs, flashers, SIU’s and flash transfers relays, two additional SIU’s shall be supplied. All spare equipment required to be supplied with the ground mounted cabinet shall be store in the spare equipment rack. Spare equipment required to be supplied with the side of pole cabinet shall be delivered to MaineDOT.

The field electrical loading for flash operation shall be wired through the transfer relays such that the load on the 2-circuit flasher is as balanced as possible within the limitations of the signal phasing.

Electrical filtering/surge protection shall be supplied and installed in each cabinet in accordance with ATCC 5301 v02 requirements and the manufacturer’s recommendations. At a

minimum, surge suppression shall be provided for incoming electric utility power conductors, all signal control circuits, vehicle detection, pedestrian detection, communications and preemption system terminations.

Three copies of the database programming for all in cabinet devices shall be provided with each cabinet. The database programming sheets shall reflect as-built programming resident in each unit at the time of acceptance.

The cabinet monitor unit shall be connected to the field terminals of the signal light circuit to provide protection against conflicting green, yellow or walk indications being simultaneously energized as a result of controller failure, relay or solid-state switch failure, short circuited field wiring or other failures.

When a conflict is detected, the cabinet monitor unit shall cause the signal system to commence flashing operation; energize the stop-timing circuit of the controller while controller power shall remain on; lock-in flashing operation until manual actuation of the momentary contact reset push button resident on the cabinet monitor unit.

The cabinet shall be equipped with a thermostatically controller fan; two fans shall be supplied and installed for the ground mount cabinet and one fan shall be supplied and installed for the side of pole mounted cabinet. The fans shall be rated for continuous duty with a minimum service life of 3 years. The fan blades shall be supplied with a safety screen to prevent accident contact with the blades.

The cabinet shall be supplied with a GFI outlet to be installed on the upper left, exterior of the control side wall of the ground mount cabinet and the upper left side of the side of pole cabinet. The electrical outlet will be GRCI protected, house in a locked access enclosure. The GFI outlet shall be supplied via its own 15-amp circuit breaker. The GFI outlet assembly shall be housed in a heavy-duty vandal resistant, weatherproof, dustproof enclosure designed for exterior applications. The GFI enclosure door shall contain a weather proof seal and supplied with a lock accessed with a skeleton style (#1) key.

The main cabinet circuit breaker shall be rated at 30 amps. Circuit breakers shall be approved and listed by the UL. The operating mechanism shall be enclosed and shall be trip-free from operating handle under load and shall be trip-indicating. All circuit breakers shall be quick-make, quick-break on either automatic or manual operation. Contacts shall be silver alloy enclosed in an arc quenching chamber. Overload tripping of breakers shall not be influenced by an ambient temperature range of from 0 to +158°F.

The testing process is required to ensure that the controller and cabinet assembly perform properly and meet all requirements described and required as part of this project have been met. This includes testing of all hardware and all software supplied and installed as part of this project. All tests shall be conducted in accordance with the approved test procedures developed by the Contractor. The Contractor shall submit test procedures and forms/checklists for review and approval to the Engineer.

All components of the controller and cabinet shall be bench tested for a minimum of 72 continuous hours by the Contractor at the Contractor's facility prior to delivery to the project. Testing shall be performed by an IMSA, level 3 (Field or Bench) Certified Signal Technician using a test board and in conformance with the design loads, phasing, timing and auxiliary equipment such as pre-emption. Upon completion of satisfactory bench testing, a written approval will be supplied to the Contractor by the Engineer. This approval does not relieve the Contractor from ensuring proper operation of the equipment. The approval shall accompany the cabinet and controller when delivered to the project.

At a minimum, the test plan developed by the Contractor shall contain the following sampling of test items:

- (a) Installation of all the equipment into the cabinet as required per the plans and specifications.
- (b) Setting of the phase timings of the controller in accordance with plans.
- (c) Checking all of the wiring connections for physical tightness.
- (d) Observing the sequences, timings and operations of the controller to verify conformance to the plans and specifications.
- (e) Test the police panel switches installed in the panel.
- (f) Test Pre-emption and/or Priority operation - Optical Detector - with the receivers wired in the cabinet and using an emitter, test each pre-emption or priority run as per the plans. Hard Wired - Attach a temporary push button as per the plans and test each pre-emption or priority run as per the plans.
- (g) Check exhaust fan controls by applying heat from a 100-watt lamp on an extension cord to the thermostat.
- (h) Check heat lamp controls by cooling the thermostat.
- (i) Check cabinet monitor unit by testing for any conflicting Greens or Yellows by the use of a jumper wire attached to a displayed Green or Yellow and to the other non-parent Greens or Yellows to ascertain that conflicting colors are not present. Test all possible combinations of conflicting displays.

Upon completion of the project, a print out of the databases contained in the controller, CMU, Preemption, Video Detection or any other equipment shall be provided to the Engineer. The databases shall be provided either via a hard copy printout or on a "thumb drive."

Tests shall be conducted by the Contractor, witnessed by the Engineer, at the Contractor's facility. The test facility shall be located in the State of Maine and be clean, heated/air conditioned and have provisions for the simultaneous testing of at least three (3) controller

and cabinet assemblies. The controller and cabinet assembly shall be wired and programmed to provide the signal phasing, timing and operations shown on the design plans for that particular location. A test light board and a manual detector call panel shall be connected to each cabinet assembly to verify display outputs and vehicle/pedestrian input calls.

This test plan, when approved and executed, must demonstrate that the controller and cabinet assembly meet all of the requirements contained in the project Plans and Specifications.

The Contractor shall propose testing plans and submit the test plan(s) and procedures as detailed herein to the Resident and Design Engineers for approval prior to testing. Each of the test plans shall contain the following elements:

- Proposed date, time, and location of the testing
- Names of the Contractor personnel who will be conducting the testing
- Descriptive overview of the proposed test procedure
- List of test equipment required to perform the testing
- Test cases and test logging forms which detail every step of the test procedure:

Test logging forms shall be presented in tabular format, with separate columns for each of the following:

- Test case description detailing the test step to be performed.
- Expected result
- Actual result
- Pass/fail
- Comments

The Contractor shall supply separate test logging forms at the time of testing for each test plan, and for each device location. The test logging forms shall show the device location, date, and the start and end times of the test.

At the end of each test logging form, there shall be signature and date locations for each of the following:

- Contractor personnel conducting the test
- MaineDOT representative witness
- Engineer witness

Signatures on the test logging form will signify only that the test was performed and witnessed, not that it passed or failed.

The detailed Test Plans shall be submitted to the Engineer no later than thirty (30) days prior to the beginning of each test phase.

The Contractor shall have approved test plans prior to submitting a request to schedule the start of any test activities. The Contractor shall notify the Engineer no less than fourteen (14) days prior to the beginning of any equipment or systems testing.

Testing shall provide verification and documentation that all requirements included in the Contract Documents are met. The Test Plans shall be developed by the Contractor to provide a mechanism that ensures that all contract requirements have been tested fully and verified.

If any deviations or changes to the approved Test Plans arise, it shall be resubmitted by the Contractor for review and approval by the Engineer at least fourteen (14) calendar days prior to any planned test activity stage. No tests shall be conducted until the Engineer have approved the test plan.

A summary of all tests shall be produced at the completion of each testing phase of the project to ensure that all requirements defined by the system are satisfied.

MaineDOT reserves the right to examine and test or retest any or all materials furnished by the Contractor for the project to determine if they meet the requirements specified within the Contract Documents.

If MaineDOT decides that any material used in the construction of this project is defective or otherwise unsuitable, and the workmanship does not conform to the requirements of this Contract, the Contractor shall replace such defective parts and material at no cost to the Project.

The times and dates of the tests shall be approved by the Engineer. The Contractor shall conduct all tests in the presence of the Engineer. Testing shall take place only on weekdays, which are official working days, unless the Engineer allows the test to be conducted and/or continued on weekends and non-working days. The Contractor shall make a request in writing at least fourteen (14) days prior to the proposed testing, and schedule tests only if permission is granted by MaineDOT in writing.

The Contractor shall be responsible for the conduct and documentation of the results of these tests that will be countersigned by the Engineers at the end of each test. The signature of the Engineer implies only proof of presence. Test results shall be packaged and submitted to the Engineer within one week of test completion. No test phase shall begin until all prior test phases have been completed, and test results have been approved by the Engineer.

The Contractor shall utilize vendor supplied or any test specific software for testing, as needed, at no additional cost.

718.13 Field Monitoring Unit (FMU) This item of work shall conform to this specification. This item shall consist of furnishing and installing a Field Monitoring Unit (FMU) and software, as well as all needed accessories required for a full and complete installation, including but not limited to power adapters, Ethernet cables, and interface cables, as described herein.

MATERIALS: The materials for this work shall conform to the following requirements:

1. The work under this item specifies the requirements for the FMU. The FMU shall operate independent of the brand/type of intersection controller deployed in the ATC traffic cabinet.
2. The FMU shall conform to the following requirements:
 - 2.1 The FMU shall function correctly between -34 degrees C and +74 degrees C.
 - 2.2 The FMU shall be provided with appropriately rated connectors that allows the FMU to be exchanged by unplugging connectors, without tools.
 - 2.3 The FMU shall monitor and log all ATC Controller and ATC cabinet faults and or alarms.
 - 2.4 The FMU shall be wired directly to the ATC cabinet.
 - 2.5 The FMU shall have an internal cellular modem running at 4G LTE.
 - 2.5.1 The Cellular modem shall be designed to be replaced / upgraded to 5G service when available.
 - 2.6 The FMU shall incorporate an integrated GPS and cell modem.
 - 2.7 The configuration of the FMU shall be accomplished by accessing the internal web server with a browser. It shall be possible to configure the FMU without any special software.
 - 2.8 The FMU shall be powered via a standard 120V input power.
 - 2.9 The FMU shall allow for the routing of the controller configuration packets to and from the controller (either by Ethernet or serial communications) for any type of controller utilized by the MaineDOT. In this way it shall be possible to configure the controller and utilize the controller specific software to interrogate the controller, and the FMU shall provide the communications pipe which allows this to be accomplished.
 - 2.10 The FMU shall, within the size limitations above, include a battery and battery charging/monitoring circuit, to allow the FMU to function correctly even when all power to the intersection has failed. The battery shall continue to power the FMU for a minimum of 5 hours after all power has failed to the intersection.
 - 2.11 The FMU shall incorporate an integrated GPS which will allow the FMU to geo-locate itself on the FMU management software map, without configuration.
 - 2.12 The FMU shall operate without requiring a static IP address. The only configuration required at the FMU is to enter the URL of where the FMU management software is hosted.

- 2.13 In the event that the cell service is interrupted or is not available, the FMU shall store any events that occur in internal memory and forward these events automatically to the FMU management software when the cell service is restored. In this way, a complete record of events at the device can be maintained even if cell service is interrupted for a period. The system will store 5000 events.
- 2.14 The FMU shall utilize HTTP and HTTPS protocols, and XML data structures, for communication with the FMU management software. In this way the data will be open for future expansion and competition. The use of secret proprietary protocols is not permitted.
- 2.15 The FMU shall include Ethernet communications via an Ethernet Port with RJ45 connector.
- 2.16 The FMU shall include weather proof antennas.

3. Map Display FMU Management Software

- 3.1 The FMU shall include a scrollable, zoomable map display, with the intersections and other monitored devices shown as representative icons on the map. The map shall include the ability to see the intersections using Google Streetview.
- 3.2 The alarm status of the intersection shall be clearly indicated on the icon on the map, so that the user can see at a glance which intersections are in alarm.
- 3.3 The map display shall also include a list of intersections, with the number and priority of alarms indicated on the list. Intersections in high priority alarm shall be moved to the top of the list, followed by medium priority, low priority and then finally by intersections not in alarm.
- 3.4 The icons shall change to be able to clearly indicate if an intersection is offline.
- 3.5 Clicking on the icon on the map shall expose a box with the current parameters of the intersection shown.
- 3.6 The default map display position and zoom shall be configurable by user, so that the user's view will default to show the intersections that the user is responsible for managing.
- 3.7 The map view shall have the ability to show Google traffic overlays on the map.

4. Intersection Detail Display FMU Management Software

- 4.1 It shall be possible to drill down, either from the map icon or from the list, to a device level detail for the intersection, which as a minimum shall display the following parameters:
 - 4.1.1 The alarm status, with priority indicated, and a text description of the alarm (if an alarm is present for this device).
 - 4.1.2 The time since the last communication with the device
 - 4.1.3 The following parameters (real time now values, minimum for the day values, maximum for the day values, and average for the day values)

- 4.1.3.1 The AC mains voltage (value)
- 4.1.3.2 The battery back-up voltage (value)
- 4.1.3.3 The cabinet temperature (value)
- 4.1.3.4 The cabinet humidity (value)
- 4.1.3.5 The presence of AC power (OK or Fail)
- 4.1.3.6 The flashing status of the intersection (OK or Flashing)
- 4.1.3.7 Stop Time status (OK or Stop Time Active)
- 4.1.3.8 The cabinet door status (Open or Closed)
- 4.1.3.9 The intersection fan status (Fan On or Fan off)
- 4.1.4 It shall be possible to view graphs of each of the value parameters in graphical form, over the recent two-week period. This includes real time graphs of:
 - 4.1.4.1 The AC mains voltage
 - 4.1.4.2 The battery back-up voltage
 - 4.1.4.3 The cabinet temperature
 - 4.1.4.4 The cabinet humidity

5. Diagnostics and Log Display FMU Management Software

- 5.1 From the device level detail within the FMU management software, it shall be possible to drill down to get the raw data; the error logs; and the communications logs to allow a technician to fault-find problems.
- 5.2 It shall be possible to filter the logs by Device; by Device Type and/or by Group as well as between dates.
- 5.3 It shall be possible to print these selected logs to a local printer or a PDF file.
- 5.4 It shall be possible to export these logs to Excel on the local computer for further analysis.

6. Alarms FMU Management Software

- 6.1 The FMU management software shall have a comprehensive alarm generation capability
- 6.2 It shall be possible to configure alarms to be generated on any parameter becoming out of tolerance, including analog values, digital values and enumerated values.
- 6.3 Alarms shall be configurable to be of Low, High or Critical Priority.
- 6.4 The alarm priority shall be displayed throughout the FMU management software, on all displays, using color codes such as red-critical; yellow – high; and amber-low to indicate the priority of the alarm.
- 6.5 The current active alarms shall be accessible for view via an expandable window, to see which alarms are active and when the alarm occurred. The highest priority alarms shall rise to the top of the list.

7. Alerts FMU Management Software

- 7.1 The FMU management software shall have comprehensive alerting capability, to enable the response personnel to be notified when an abnormal situation has occurred.
- 7.2 It shall be possible to configure alerts to one or more personnel for each alarm. This will cause, as selected, an SMS and/or an email to be sent to the person when an alarm occurs.
- 7.3 The alert shall be configurable to optionally send via email and/or via SMS a message when an alarm clears.
- 7.4 The intention is that the FMU management software provides the alerts to the user in near real time. The SMS and email shall be issued within 30 seconds of the occurrence of event which results in an alert being issued.

8. Hosting and Connectivity and Service FMU / FMU Management Software

- 8.1 The contractor shall supply the FMU with the FMU manufacturers 10 year options for Connectivity and Service, as part of the purchase price. The Connectivity and Service agreement shall include at a minimum:
 - 8.1.1 Cellular Connectivity
 - 8.1.2 No cellular overage charges
 - 8.1.3 Extended warranty on the hardware for the period of the Connectivity and Service Agreement
 - 8.1.4 Over-the-air software updates
 - 8.1.5 Over-the-air security updates
 - 8.1.6 Future Connected Vehicles Service

718.14 Remote Detection Device This item of work shall conform to this specification. This item shall consist of furnishing and installing a Remote Detection Device (RDD), as well as all needed accessories required for a full and complete installation, including but not limited to power adapters, Ethernet cables, and interface cables, as described herein. The RDD shall interface with the vehicle detector provided in this item and installed within the pole mounted traffic cabinet as described. The RDD shall provide the transmission path of the vehicle detector output to the ATC cabinets field monitoring unit FMU as shown on the plans.

MATERIALS: The materials for this work shall conform to the following requirements:

1. The work under this item specifies the requirements for the RDD. The RDD shall operate independent of the brand/type of vehicle detector.
2. The RDD shall be programmed to detect stopped vehicles that have not moved for 15 seconds and issue a command to the FMU within the ATC cabinet. The FMU shall issue a Pre-Empt command to flush traffic for four minutes. The Contractor shall verify with the Engineer for final operation and program settings.
3. The RDD shall active exterior cabinet mounted light during request of Pre-Empt operation.
4. The RDD shall automatically upon power up establish a remote VPN connection to the RDD cloud-based system to allow for remote communications to ATC cabinet FMU.
5. The RDD shall conform to the following requirements:
 - 5.1 The RDD shall function correctly between -34 degrees C and +74 degrees C.
 - 5.2 The RDD shall be provided with appropriately rated connectors that allows the RDD to be exchanged by unplugging connectors, without tools.
 - 5.3 The RDD shall monitor and transmit all vehicle detector inputs to the associated ATC traffic cabinet as shown on the plans or as directed by the engineer.
 - 5.4 The RDD shall be wired directly to the vehicle detector.
 - 5.5 The RDD shall have an internal cellular modem running at 4G LTE.
 - 5.5.1 The Cellular modem shall be designed to be replaced / upgraded to 5G service when available.
 - 5.6 The RDD shall incorporate an integrated GPS.
 - 5.7 The configuration of the RDD shall be accomplished by accessing the internal web server with a browser. It shall be possible to configure the RDD without any special software.
 - 5.8 The RDD shall be powered via a standard 120V input power.
 - 5.9 The RDD shall, within the size limitations above, include a battery and battery charging/monitoring circuit, to allow the RDD to function correctly even when all

- power to the vehicle detector has failed. The battery shall continue to power the RDD for a minimum of 5 hours after all power has failed to the vehicle detector.
- 5.10 The RDD shall incorporate an integrated GPS which will allow the RDD to geo-locate itself on the RDD central software map, without configuration.
 - 5.11 The RDD shall operate without requiring a static IP address. The only configuration required at the RDD is to enter the URL of where the RDD central software is hosted.
 - 5.12 In the event that the cell service is interrupted or is not available, the RDD shall store any events that occur in internal memory and forward these events automatically to the RDD central software when the cell service is restored. In this way, a complete record of events at the device can be maintained even if cell service is interrupted for a period. The system will store 5000 events.
 - 5.13 The RDD shall utilize HTTP and HTTPS protocols, and XML data structures, for communication with the RDD central software. In this way the data will be open for future expansion and competition. The use of secret proprietary protocols is not permitted.
 - 5.14 The RDD shall be powder coated aluminum enclosures.
 - 5.15 The RDD shall include weather proof antennas.
 - 5.16 The RDD shall be mounted in the pole mounted cabinet as shown on the plans.
6. The RDD shall be supplied with a thermal or radar vehicle detector device that meets or exceeds the following:
- 6.1 The thermal traffic sensor accepts 12 - 42 VAC/DC power supply
 - 6.2 The thermal traffic sensor has a 160x120 resolution long wave infrared thermal imaging sensor producing thermal images at minimum 7.5 Hz
 - 6.3 The thermal traffic sensor has a 1920 x 1080 FHD visual CMOS sensor for video streaming applications such as traffic monitoring and surveillance.
 - 6.4 The housing is compact, UV-resistant and waterproof to IP67.
 - 6.5 The thermal traffic sensor bracket allows horizontal and vertical mounting and is made of fiber reinforced polyamide (with an aluminum tube)
 - 6.6 The thermal traffic sensor shall be equipped with a detection LED, clearly visible from the ground to allow the status of the thermal traffic sensor (i.e. detection, boot mode, safe status).
 - 6.7 The thermal traffic sensor shall not require any visible or invisible (infrared) illumination or image intensifier to “see” i.e. produce images. The thermal traffic sensor shall be totally passive and does not emit light or energy in any bandwidth.
 - 6.8 The thermal traffic sensor shall have TCP/IP communication and provide a digital video stream. The sensor shall allow advanced integration with 3rd party management systems over TCP/IP communication by providing a HTTP JSON based API interface.

- 6.9 The thermal traffic sensor has powerline communication to reduce cabling complexity.
 - 6.10 The thermal sensor will superimpose the TCP/IP network communication on to the power wires. Inside the traffic controller cabinet, a communication interface will demodulate the powerline signal and provide a TCP/IP connection to the interface of the RDD.
 - 6.11 The interface board can be used for detection and error output generation and verification.
 - 6.12 It shall have connection terminals for up to 4 thermal traffic sensors and allows daisy chaining in serial or parallel for up to 8 thermal traffic sensors.
 - 6.13 The powerline interface shall have an Ethernet connection to communicate over a TCP/IP network e.g. to a PC for configuration.
 - 6.14 Communication between the interface board and the different thermal traffic sensors is established over power lines communication, limiting the number of wires per camera to maximum 3 (+,-, Ground).
 - 6.15 The radar detector shall have an operating frequency of 10.5 – 10.55 GHz (X-Band)
 - 6.16 Radar Bandwidth shall be stable within 1 percent.
 - 6.17 Radar antenna shall a 6dB width of 65 degrees vertical
 - 6.18 Radar antenna shall have a 6db width of 10.5 degrees horizontal.
 - 6.19 The radar detector shall support 8 RF channels
 - 6.20 The radar detector shall be designed for outdoor use.
 - 6.21 The radar detector shall have a transmit bandwidth of 45 MHz
7. The Contractor shall supply with the RDD a bare metal cabinet that shall be 18” x 24” x 36”. The cabinet shall be pole mounted as shown on the plans.
8. The pole mounted cabinet shall be equipped with a confirmation light that shall turn on when preempt request is active or as directed by the engineer.

Hosting and Connectivity Service for RDD

9. The contractor shall supply the RDD with the RDD manufacturers 10-year options for Connectivity and Service, as part of the purchase price. The Connectivity and Service agreement shall include at a minimum:
- 9.1 Cellular Connectivity
 - 9.2 Upgrade the cellular modem if the technology is not supported by the cellular networks.
 - 9.3 Telephone and email support
 - 9.4 No cellular overage charges

- 9.5 Extended warranty on the hardware for the period of the Connectivity and Service Agreement
- 9.6 Over-the-air software updates
- 9.7 Over-the-air security updates
- 9.8 Future Connected Vehicles Service

718.15 Messenger Wire This item of work shall conform to this specification. This item shall consist of furnishing and installing aerial fiber optic messenger wire, and appurtenances at the locations shown on the plans or as indicated by the Engineer.

MATERIALS: The aerial fiber optic messenger wire shall be manufactured for aerial installation of fiber optic cable and shall be double galvanized, seven-strand steel wire cable not less than 0.3 inches in diameter and 6,600 lbf breaking strength, Extra High Strength Grade (EHS).

INSTALLATION: Installation shall meet the following requirements:

1. The Contractor shall calculate the strain and sag for the specific aerial installation as shown on the plans and use the recommended tensions and messenger types per the fiber-optic cable and/or messenger wire manufacturer.
2. The Contractor shall install messenger wire with a sag matching that of existing adjacent cables. Messenger wire shall not sag into or near adjacent cables.
3. All utility relocations and required guying shall be completed prior to the installation of messenger wire.

718.16 Emergency Vehicle Preemption System The emergency vehicle preemption systems shall be installed in the same cabinets as the controllers.

The emergency vehicle preemption control systems shall consist of a data-encoded phase selector to be installed within the traffic control cabinets. Those units will serve to validate, identify, classify, and record the signal from the optical detectors located on support structures at the intersections. Upon receiving a valid signal from the detectors, the phase selectors shall generate a preempt call to the controllers initiating preemption operations as shown on the plans. The phase selectors shall have full ID and logging capabilities and be a rack-mounted plug-in four channel, dual priority devices. The phase selectors shall plug into shelf-mounted single card chasses. Programming the phase selectors shall be via a PC-based computer utilizing unit specific software. One copy of the software shall be supplied and licensed to MaineDOT. A hard copy of final programming data shall be left in the control cabinets. The Contractor shall supply a complete set of interface cables for phase selector to laptop connection in each controller cabinet. The phase selectors shall be connected to the Ethernet Switch in each cabinet, as shown in the Plans, such that the phase selector logs and configuration can be remotely accessed through the communications system. The Contractor shall supply and install any required converters, such as device servers or other devices, to interface the phase selector to the Ethernet switch in each cabinet. The Contractor shall also supply any required cables.

The optical detectors shall be single input, single output units used to control one approach. All traffic signal installations shall be supplied with a single optical detector for each approach to the intersection unless otherwise noted in the major items list or as shown on the plans.

The Contractor shall install the quantity of confirmation strobes at each traffic signal location as shown in the plans or as directed by the Engineer. The confirmation strobe shall serve to validate to the driver of the emergency vehicle that the traffic signal has recognized the preemption call and will initiate the proper preemption sequence. The confirmation strobe shall be illuminated whenever any emergency vehicle preemption green is on. The confirmation strobe shall be a red lens Whelan model 1500 or approved equivalent.

The Contractor shall be responsible for the proper programming of the phase selector, orientation of the optical detectors, and all other work necessary to provide a complete and operating emergency vehicle preemption system. The Contractor may be required to field adjust the location of the optical detectors in the presence of the Engineer and the Town of Holden Fire Department to properly detect preemption calls from approaching vehicles.

The emergency vehicle preemption installed under this project shall be functionally compatible with the proposed traffic signal control system and allow remote access to the phase selectors. In addition, the system shall be setup such that preemption or priority control can be initiated through the Dedicated Short-Range Communications (DSRC) Roadside Unit (RSU) by means of an approaching authorized vehicle with an On Board Unit (OBU).