CDOT Implementation Special Provisions

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# SP-M1 PROJECT MOBILIZATION & LANDSCAPE REPAIRS PER PROJECT LOCATION

1.0 DESCRIPTION

Work covered by this special provision consists of preparatory work and operations including but not limited to those necessary for the movement of personnel, equipment, supplies, and incidentals to individual project sites necessary for work on the project; removal and disbandment of those personnel, equipment, supplies, and incidentals that were established for the prosecution of the work on the project; and for all other work and operations which must be performed for costs incurred prior to beginning work on the items on various projects.

Item also includes any necessary repair landscaping due to the contractor’s work. All landscape repairs must meet Charlotte-Mecklenburg Land Development Standards or NCDOT Specifications.

2.0 MATERIALS

Work includes all materials necessary to perform work as described. Including but not limited to: traffic control devices, seeding, straw and mulching materials.

3.0 MEASUREMENT AND PAYMENT

Not more than one (1) “Mobilization per project location” will be paid for each project location. A project location will be considered any and all work that is within a one (1) mile radius assigned together as one project.

All work covered by this special provision will be paid for at the contract unit price per each for Project Mobilization. This price has been set by the City at **10% of total task order up to $5000.00 (max) per Project Location**.

Payment will be made under:

Project Mobilization & Landscape Repairs EA

# SP-M2 TRAFFIC CONTROL

1.0 DESCRIPTION

Beginning Work and Street Closings: The Contractor is responsible for notifying the Engineering & Operations Division of the Charlotte Department of Transportation (CDOT: 704-336-4119) in accordance with “Approval and Notification Requirements for Work in the Public Right-Of-Way” Section and “Notifications for complete Roadway Closure” Section of the Work Area Traffic Control Handbook (WATCH) of any work where the number of travel lanes is reduced from normal conditions.

During daily construction work hours, the Contractor will maintain at least one lane of traffic. During periods of construction inactivity, all lanes of traffic will be open unless otherwise shown on the plans or noted in the specifications.

Right-of-Way Use Permit: The Contractor will not be responsible for obtaining the Right-of-Way Use Permit(s) from CDOT for approval to work in the streets rights-of-way in Charlotte. The Project Task Order and Plans will serve as the Right of Way Use Permit(s).

Traffic Control Plan: Traffic control will be performed by the Contractor based upon the Traffic Control Special

Provisions. The Traffic Control Special Provisions may refer to details in the WATCH or plan sheets for major work items, or both.

The Contractor shall be thoroughly familiar with the current edition of the WATCH. All traffic control devices and procedures shall conform to the requirements of the WATCH, the current edition of the Federal Highway Administration (FHWA) Manual on Uniform Traffic Control Devices (MUTCD), the current edition of the North Carolina Department of Transportation (NCDOT) Supplement to the Manual on Uniform Traffic Control Devices for Streets and Highways, the NCDOT Roadway Standard Drawings and the current edition of the NCDOT Standard Specifications for Roads and Structures.

Under no circumstances shall the WATCH requirements be less restrictive than what is required by the MUTCD or NCDOT Supplement to the MUTCD. Any requirements prescribed by the MUTCD or amendments by the NCDOT Supplement to the MUTCD will supersede the requirements of the WATCH should conflict arise.

The Contractor shall maintain the traffic control as described herein unless the Contractor submits an alternate traffic control plan to the Engineer and it is approved by the Engineer. The Engineer may direct the Contractor to modify the traffic control if, in the Engineer’s opinion, traffic is not moving safely or efficiently.

Traffic Control Phasing for this project shall be in accordance with any Traffic Control Plans and the reference diagrams from the WATCH. The contractor shall adhere rigidly to these plans and diagrams. If these diagrams are not typical for field conditions, the diagrams may be combined or altered upon approval of the Engineer. The standards and diagrams are the minimum required. Additional signs, cones, drums, barricades and warning devices may be used, but at no time will less than what is specified on the plans, in the standards, and on diagrams be acceptable.

Maintenance of Traffic: The Contractor shall maintain all travel lanes in accordance with the Traffic Control Plan sheets, and the WATCH diagrams referenced in the Traffic Control Phasing. Construction or maintenance work that involves closure of a lane of traffic will not be allowed during the peak flow

hours as described in Section “Peak Flow Hours” of the WATCH, unless otherwise specified in the Contract Documents.

The Contractor shall use flagger control in accordance with the WATCH diagrams referenced in the Traffic Control Phasing and with “Flagging Procedures”, “Duration of Work”, and Temporary Traffic Control Zone Devices” Sections of the WATCH.

In areas of drop-offs and low shoulders, the Contractor shall backfill up to the edge and elevation of the existing pavement in accordance with “Miscellaneous Considerations, DROP-OFFS AND LOW SHOULDERS” Section of the WATCH.

The Contractor will be required to maintain ingress and egress to all businesses and dwellings, and easy access to fire hydrants in accordance with “Miscellaneous Considerations, INGRESS AND EGRESS” Section of the WATCH.

The Contractor shall not work on both sides of the road simultaneously within the same area.

The Contractor shall mark all hazards within the Project limits with well-maintained signs, barricades, warning and/or channelizing devices.

Traffic Control Devices: The Contractor shall furnish, install, operate, relocate, maintain and remove all temporary traffic control devices necessary for controlling traffic in accordance with the WATCH. The Contractor shall notify CDOT regarding conflicting permanent signs. Only CDOT forces shall install, remove or relocate any permanent signs within the right-of-way. All construction signs and barricades shall remain in place until the appropriate permanent signs and pavement markings are installed.

Pedestrian Considerations: The Contractor shall accommodate the needs of all pedestrians in accordance with Section “Pedestrian Considerations” of the WATCH.

Equipment and Material Storage: During periods of construction inactivity, all construction materials and equipment shall be stored by the Contractor as specified in “Miscellaneous Considerations, STORAGE OF EQUIPMENT AND MATERIALS” Section of the WATCH.

Traffic Signals: The Contractor shall not disturb any traffic signal equipment unless otherwise

noted on the project task order, traffic signal plans or directed to do so by the Engineer.

Excavation and Trenches: Excavations and trenches that cannot be properly backfilled and patched prior to the end of the workday shall be secured as specified in Section “Excavations and Trenches” of the WATCH.

2.0 MEASUREMENT

There will be no separate measurement made for Traffic Control.

3.0 PAYMENT

Traffic Control will be paid at the each price for “Traffic Control” for each project. This payment will be full compensation for all elements of work required to complete the Project as specified. Only one traffic control will be paid per project based on the highest street classification of all streets included in the project as noted on Charlotte Explorer (explore.charlottenc.gov). Arrow boards as required in accordance with any Traffic Control Plans and the reference diagrams from the WATCH for each individual project is not part of this pay item as it is a separate pay item.

Examples of each street classification that may be included in this contract include (but are not limited to) the following:

Major Thoroughfare: Graham Street

Minor Thoroughfare: Glen Eagles Drive

Payment will be made under:

Traffic Control (Major Thoroughfare) ........................................................................................................... EA

Traffic Control (Minor Thoroughfare) ........................................................................................................... EA

# SP-M3 PAVEMENT MARKING MOBILIZATION/TRAFFIC CONTROL

1.0         DESCRIPTION

Work covered by this specification consists of preparatory work and operations including but not limited to those necessary for the movement of personnel, equipment, supplies and incidentals to individual project sites per NCDOT Section 800 for the purpose of performing pavement markings.

Item also includes the necessary traffic control for the duration of the work according to the latest edition of the Work Area Traffic Control Handbook (W.A.T.C.H.) and the NCDOT Standard Specifications for Roads and Structures.

2.0         MATERIAL

Work includes all materials necessary to perform work as described.  Including but not limited to: traffic control devices, marking material incidentals.

3.0         CONSTRUCTION METHODS

Construction methods are as set out in **NCDOT Standard Specifications.**

4.0         MEASUREMENT AND PAYMENT

Pavement Marking Mobilization / Traffic Control will be paid for each project given to the contractor.

Payment will be made under:

Pavement Marking Mobilization / Traffic Control EA

# SP-C1 CONCRETE BASE FOR CONTROLLER CABINET

1.0 DESCRIPTION

The work in this special provision consists of all labor and material necessary to excavate, form, pour concrete, insert and join conduits to construct a foundation for a signal controller cabinet. This unit also includes all labor and material required in the repair and/or replacement of streets, sidewalks, roads, drives, fences, lawns, shrubbery, water mains, pipes, pipelines and contents, underground power and telecommunications facilities, buried sewage and drainage facilities, and any other property damaged during the unit installation. The Contractor shall install a concrete foundation for mounting the traffic signal controller cabinet. This cabinet foundation should be dimensioned to accept the correct sized signal cabinet as directed by the engineer.

See CDOT Supplemental Drawings Type “M” 1751.01-3-CDOT and Type “P” 1751.01-4-CDOT

Do not install foundations over uncompacted fill or muck, and ensure ground is level. Concrete shall be poured a minimum of 4” above and 4” below finish grade. Give cabinet foundation a broom finish. Conduits turned up in the slab shall be inside the “conduit window”. All 90 degree elbows shall be a sweeping radius not standard 90. Conduits shall be stubbed 4 inches above the ground or slab, turned up flush with and follow the vertical alignment of utility poles, capped without glue prior to placing concrete near them, and all joints cleaned and glued. Use 3600 psi concrete with standard gravel and 2% maximum calcium chloride.

2.0 MEASUREMENT

Installed Controller Cabinet Concrete Base will be measured and paid as the actual number of cabinet bases installed and accepted.

3.0 PAYMENT

Payment will be made under:

CONCRETE BASE FOR CONTROLLER CABINET EA

# SP-C2 COMBINATION METER PEDESTAL AND GROUNDING GRID

1.0 DESCRIPTION

The work in this special provision consists of all labor and material necessary to install one (1) electrical meter service and disconnect combination panel as a standalone pedestal with grounding grid. This shall be in accordance with drawing 1751.01-5-CDOT. This item includes all material necessary to install an electrical service including, combination panel, conduits, disconnect, wire, breakers, attachment structure, grounding hardware and all other incidentals. New services should be mounted on a pedestal unless approved prior by the Engineer. This unit also includes all labor and material required in the repair and/or replacement of streets, sidewalks, roads, drives, fences, lawns, shrubbery, water mains, pipes, pipelines and contents, underground power and telecommunications facilities, buried sewage and drainage facilities, and any other property damaged during the unit installation.

Combination pedestals shall:

1. Be no larger than 60” (H) x 14” (W) x 12” (D), installed (subtract total height from embedment for direct bury)
2. Be listed on Duke Energy’s Meter Equipment Group approved list or have written approval for use from Duke Energy’s Meter Engineering division.
3. Be capable of pad-mount or direct bury installation as applicable.
4. Have no externally visible conduits.
5. Feature a bypass lever in the meter socket.
6. Feature a factory-installed fifth terminal in the meter socket.
7. Feature breakers and breaker knockouts only, no receptacles.

Install a minimum of three grounding rods in accordance with NCDOT Standard Drawing 1700.02 ensuring existing underground facilities are not damaged and test grounding system with approved method ensuring resistance is less than 20 Ohms. All underground bond of grounding electrodes and conductors shall be made using irreversible compression ground connectors. Unless the irreversible compression connectors are designed for use with more than one conductor, only one conductor shall be placed under each irreversible compression ground connector. Ensure all connections are made using a hydraulic, power or ratcheting type crimper with appropriate dies. Use of handheld pliers for crimping is prohibited. For ease of inspection, the top of ground rods shall be no more than 6 inches below finished grade and shall remain exposed until electrical inspection is complete. Detectable burial tape shall be placed directly above all grounding electrodes and conductors and shall be buried at a typical depth of 12”-18. Locate the service equipment near the signal cabinet in a manner that will allow easy access to the service disconnect and does not obstruct motorist sight distance.

For overhead electrical service installations, supply & install wire (3 conductor, 8AWG) between the meter pedestal and point-of-service (at top of the riser/weatherhead with 6 feet coil) under this special provision. Conduit and riser from meter pedestal to pole are separate pay items.

2.0 MEASUREMENT

Installed Combination Meter Pedestal and Grounding Grid will be measured and paid as the actual number of pedestals installed and accepted.

3.0 PAYMENT

Payment will be made under:

COMBINATION METER PEDESTAL AND GROUNDING GRID EA

# SP-C3 INSTALL GROUNDING GRID TO EXISTING CABINET AND CONCRETE BASE

1.0 DESCRIPTION

The work in this special provision consists of all labor and material necessary to install one (1) electrical grounding grid on an existing TS-2 Cabinet and concrete base. This shall be in accordance with drawing 1751.01-5-CDOT. This item includes all material necessary to install a new electrical grounding grid including wire, bonding hardware and all other incidentals. This unit also includes all labor and material required in the repair and/or replacement of streets, sidewalks, roads, drives, fences, lawns, shrubbery, water mains, pipes, pipelines and contents, underground power and telecommunications facilities, buried sewage and drainage facilities, and any other property damaged during the unit installation.

Install a minimum of three grounding rods in accordance with NCDOT Standard Drawing 1700.02 ensuring existing underground facilities are not damaged and test grounding system with approved method ensuring resistance is less than 20 Ohms. All underground bonding of grounding electrodes and conductors shall be made using irreversible compression ground connectors. Unless the irreversible compression connectors are designed for use with more than one conductor, only one conductor shall be placed under each irreversible compression ground connector. Ensure all connections are made using a hydraulic, power or ratcheting type crimper with appropriate dies. Use of handheld pliers for crimping is prohibited. For ease of inspection, the top of ground rods shall be no more than 6 inches below finished grade and shall remain exposed until electrical inspection is complete. Detectable burial tape shall be placed directly above all grounding electrodes and conductors and shall be buried at a typical depth of 12”-18. Locate the service equipment near the signal cabinet in a manner that will allow easy access to the service disconnect and does not obstruct motorist sight distance.

For overhead service installations, supply & install wire between the meter pedestal and point-of-service under this special provision. Conduit and riser from meter pedestal to pole are separate pay items.

2.0 MEASUREMENT

Installed Electrical Grounding Grid to Existing Cabinet and Concrete Base will be measured and paid as the actual number of pedestals installed and accepted.

3.0 PAYMENT

Payment will be made under:

Install Grounding Grid to Existing Cabinet and Concrete Base EA

# SP-C4 CONTROLLER CABINET

1.0 DESCRIPTION

The work in this special provision consists of all labor and material necessary for the Contractor to supply and install a controller cabinet and to connect to a meter service. This unit does not include labor and material necessary to install a concrete foundation, combination meter pedestal or grounding grid as those are separate pay items.

The controller cabinet supplied by the contractor should meet the current CDOT specifications for a controller cabinet (See below).

**Rev. 11.18.2020**

**1.1 TS 2 CABINET ASSEMBLY**

1.1 This specification describes the minimum acceptable requirements for a TS 2 Type 1 cabinet assembly to house a NEMA TS 2 Type 1or 2070L solid-state full‑actuated traffic signal controller. The assembly shall include the cabinet, flasher, detector card rack, bus user interfaces (BIUs) to fill all positions, shelf-mount power supply, and six flash transfer relays. The cabinet assembly shall be of Configuration #4 (16-position). The assembly shall include ten load switches and eight load switch jumpers.

**1.2 Cabinet Design Requirements**

1.2.1 The cabinet shall be constructed using unpainted sheet aluminum on the outside with a minimum thickness of 3.2 mm. Inside of the cabinet shall be painted gloss white. No wood, wood fiber products, or other flammable material shall be used in the cabinet. All continuous welds shall be neat and of uniform consistency.

1.2.2 The size of the cabinet shall be Size 6 as defined by TS 2 of the NEMA Standard Publication TS 2 - 1992, as specified by the plans. The load bay shall be configuration 4 (16 position) as defined by TS 2 of the NEMA Standard Publication TS 2 - 1992, as specified by the plans. The vehicle detector rack shall be Configuration #2 as defined by TS 2 of the NEMA Standard Publication TS 2 – 1992.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Size of Cabinet | Backpanel Configuration –  Size of Load Bay | Detector Rack Size |
|  | Base Mount – Size 6  (55”H x 44”W x 26”D) | Type 1 Configuration # 4 16-position (1-8 vehicle, 9-12 ped, 13-16 overlap) load bay with two BIU rack positions | Configuration #2 with 8-position  4-channel and two BIU rack positions |

1.2.3 Vertical shelf support channels shall be provided to permit adjustment of shelf location in the field. The channels shall have a single continuous slot to allow shelves to be placed at any height within the cabinet. Channels with **fixed notches** or **holes** are **not acceptable**.

1.2.4 Each cabinet shall be equipped with an extra set of unistrut channels on either side of the front section of the cabinet to permit the purchaser to mount additional equipment as necessary.

1.2.5 Shelves shall be at least 330 mm deep and be located in the cabinet to provide a minimum 25 mm clearance between the back of the shelf and the back of the cabinet. A 38 mm minimum height drawer shall be provided in the cabinet, mounted directly beneath the bottom shelf. The top shelf shall be vented with slots so that air can pass through this shelf. The drawer shall have a hinged top cover and shall be capable of storing documents and miscellaneous equipment. This drawer shall support to 22.5 kg in weight when fully extended. The drawer shall open and close smoothly. Drawer dimensions shall make maximum use of available depth offered by the controller shelf and be a minimum of 600 mm. Drawer must positioned so that it does not hinder the ability to work on, remove or access any other component in the cabinet.

1.2.6 Two shelves shall be provided in the cabinet and shall be at minimum 305 mm apart in height. There shall be sufficient shelf space to accommodate a controller unit 330 mm high, an MMU, one 8-position card rack and external power supply. An additional space at least 305 mm high, 325 mm wide, and 305 mm deep shall be provided. The shelves shall be placed in such a manner that sufficient ventilation is provided to all electrical components and full access is provided for installation, removal, and maintenance of all internal components from both front door and back door.

1.2.7 The cabinet shall be vented and cooled by **two** thermostatically controlled fans. The fans shall be a commercially available model with a capacity of at least 2.7 m3/min. The thermostats shall have a minimum adjustable range of 70°F to 110°F and shall be preset to turn on at 95°F.

1.2.8 The cabinet shall be provided with a unique serial number with date of manufacture that shall be stamped directly on the cabinet or engraved on a metal or metalized mylar plate epoxied to the cabinet. The digits shall be at least 5 mm in height and located on the upper right sidewall of the cabinet near the front.

1.2.9 All labeling inside of the cabinet shall be black and shall not be blocked by wiring or internal components.

**1.3 Cabinet Door**

1.3.1 The cabinet shall be provided with one door in front that will provide access to the cabinet. The door shall be provided with a full-length piano hinge with stainless steel pins spot welded at the top of the hinge. The hinges shall be mounted so that it is not possible to remove them from the door or cabinet without first opening the door. The bottom of the door opening shall extend at least to the bottom level of the back panel. The door and hinges shall be braced to withstand a 74 kg per vertical meter of door height load applied to the outer edge of the door standing open. There shall be no permanent deformation or impairment of any of the door or the cabinet body when the load is removed.

An additional back door shall be provided with all base-mounted cabinets. The front door specification shall apply to all back door applications with the exception of an auxiliary police door.

1.3.2 The cabinet door shall be fitted with a Number 2 Corbin lock and a stainless steel handle with a 16 mm (minimum) diameter shaft (or equivalent cross-sectional area for a square shaft) and a three-point latch. The lock and latch design shall be such that the handle cannot be released until the lock is released. Two keys shall be provided for each cabinet. A gasket shall be provided to act as a permanent dust and weather resistant seal at the controller cabinet door facing. The gasket material shall be of a nonabsorbent material and shall maintain its resiliency after long-term exposure to the outdoor environment. The gasket shall have a minimum thickness of 6.25 mm. The gasket shall be located in a channel provided on the cabinet or on the door(s). An “L” bracket is acceptable in lieu of this channel if the gasket is fitted snugly against the bracket to insure a uniform dust and weather resistant seal around the entire door facing. Any other method is subject to purchaser approval during inspection of an order.

1.3.3 A locking auxiliary police door shall be provided in the door of the cabinet to provide access to a panel that shall contain a signal shutdown switch, a signal flash switch, a manual‑automatic switch, and a manual advance push-button switch on a six foot plugable/removable, retractable cord. Manual control of the controller unit from the police door shall override any external control (external logic, etc.) in effect when the Manual‑Automatic switch is in the manual position. Each actuation of the manual advance push-button switch shall advance the controller to the next interval. Manual control shall not override any calls for preemption. The police door shall be gasketed to prevent entry of moisture or dust and the lock shall be provided with one brass key. Switches shall be labeled for each operation.

1.3.4 The intake for the vent system shall be filtered with a permanent air filter. The filter should consist of a removable metal frame, 14x20x1 inch thick with replaceable fiberglass mesh filter. The filter shall be securely mounted so that any air entering the cabinet must pass through the filter. The cabinet opening for intake of air shall be large enough to use the entire filter. The air intake and exhaust vent shall be screened to prevent entry of insects. The screen shall have opening no larger than 8.1 mm2. The total free air opening of the exhaust vent shall be large enough to prevent excessive backpressure on the fan.

**1.4 Wiring**

1.4.1 All wiring within the cabinet shall be neat and routed such that opening and closing the door or raising or lowering the back panel will not twist or crimp the wiring. All wiring harnesses shall be either sheathed in nylon mesh sleeving or jacketed with PVC or polyethylene insulation. Wiring leading to the cabinet door shall be sheathed in nylon mesh sleeving or be PVC jacketed cable only. All SDLC cabling shall be Belden #7203A or equivalent.

1.4.2 Size

A. All conductors between the main power circuit breakers and the signal power bus shall be a minimum size 10 AWG stranded copper. All conductors carrying individual signal lamp current shall be a minimum size 16 AWG stranded copper. All AC service lines shall be of sufficient size to carry the maximum current of the circuit or circuits they are provided for. Minimum cabinet conductor wire size shall be 22 AWG stranded copper. All wiring and insulation shall be rated for 600 V or greater.

1. Conductors for AC common shall be white. Conductors for equipment grounding shall be green. All other conductors shall be a color different than the foregoing.
2. No P.C. boards will be allowed on the back panel of the cabinet. All wiring must be done from the BIUs to the Load Switches using standard 19-gauge wiring.
3. Conflict monitor wires shall be colored as to correspond with the output being monitored (example: green wire for green output, yellow wire for yellow output, and red wire for red output) or labeled to identify the output that is being monitored.

1.4.3 A barrier terminal block with a minimum of three compression fitting terminals designed to accept up to a #4 AWG stranded wire shall be provided for connection of the AC power lines. The block shall be rated at 50 Amperes.

1.4.4 All terminals shall be permanently identified in accordance with the cabinet wiring diagram using an anodized silk screening process on the aluminum panel. Where through‑panel solder lugs or other suitable connectors are used, both sides of the panel shall have the terminals properly identified. Identification shall be placed as close to the terminal strip as possible.

A. Each controller input and output function shall be distinctly identified with no obstructions, at each terminal point in the cabinet, with both a number and the function designation. The same identification must be used consistently on the cabinet wiring diagrams.

B. Each load switch socket shall be identified by phase number, overlap number, and pedestrian phase number as applicable. No cabinet equipment, including the load switches themselves, may obstruct these identifications.

C. Each flash transfer base and power relay base shall be properly identified with no possible obstructions.

D. Each harness within the cabinet shall be distinctly identified by function on the connector end.

E. The flasher socket shall be distinctly identified with no possible obstruction.

F. All other sockets needed within the cabinet to fulfill the minimum requirements of the Invitation to Bid, or attachments thereof, shall be distinctly identified.

1.4.5 The ten-pin controller unit harness (A plug Type 1) shall be long enough to reach any point 600 mm above the controller shelf. The A plug Type 1 and the SDLC cable for the controller shall come from the back of the shelf for use with 2070 controller. The A plug and SDLC cable shall be placed in such a way that the 2070 controller will be on the top shelf. The conflict monitor harness and any required auxiliary harness shall reach 600 mm from the conflict monitor shelf.

The conflict monitor harness and SDLC cable shall be placed in such a way that the conflict monitor will be on the top shelf.

1.4.6 {Intentionally left blank}

1.4.7 Copper bus bars shall be provided for both the power supply neutral (common) and chassis ground. Each bus bar must provide a minimum of ten unused terminals with 8‑32 X 5/16" or larger screws. All copper bus bar screw heads shall be accessible with a screw driver. Wires shall enter the bus bars from the bottom and the screw heads shall be accessed horizontally.

Copper bus bars shall be located at the bottom of the detector panel, below the loadbay, and near the barrier terminal block mentioned in section 1.4.3 for chassis ground . Tie all ground bar connections in a single loop with #6 AWG wire. Bond detector racks and any panels mounted with uni-struts to the grounding loop. Uni-struts are not acceptable as ground conductors.

Copper bus bars shall be located below the loadbay for AC neutral. The AC neutral and chassis ground buses shall be tied together with a removable jumper that is a minimum #10 AWG wire.

1.4.8 A 20 Ampere and a 50 Ampere thermal type circuit breaker shall be mounted and wired in the cabinet. The 20 ampere breaker shall protect the base light, trouble light, GFCI receptacle, modem duplex receptacles, and fans. The 20 Ampere breaker shall be powered from the 50 Ampere breaker. The 50 ampere breaker shall protect the signal load circuits, controller circuits, conflict monitor, flasher, and card rack detector power supply.

1.4.9 The circuit breakers shall be equipped with solderless connectors and installed on the right side wall (facing the cabinet) or lower right hand side of the back panel inside the cabinet. The breakers shall be easily accessible. The breakers shall be positioned so that the rating markings are visible.

1.4.10 A Ground Fault Circuit Interruption (GFCI) type duplex receptacle shall be mounted and wired in the lower right side wall of the cabinet. Four additional duplex receptacles (for use with communications modems) shall be mounted and wired; two in the upper left side of the cabinet and two in the upper right. These receptacles shall be wired on the load side of the 20 Amp circuit breaker. These receptacles shall be easily accessible and unobstructed by any other components.

1.4.11 {Intentionally left blank}

1.4.12 The load side of the main circuit breaker shall be protected by a primary and secondary surge suppressor, the Atlantic Scientific Zone Defender Pro (#16700) and Atlantic Scientific Zone Guardian TS (#41003), or engineer approved equivalent.

1.4.13 {Intentionally left blank}

1.4.14 The suppresser shall be connected to the line filter as recommended by the manufacturer. Number 10 AWG or larger wire shall be used for connections to the suppressor, line filter and load switch bus.

1.4.15 An LED light and door switch shall be installed in the cabinet and placed in such a way that it illuminates the entire cabinet. This light shall be turned on when the cabinet door is opened, and turn off when the cabinet door is closed. A metal oxide varistor (MOV) or other such transient suppression device shall be placed across the AC power input to the light.

1.4.16 A radio frequency interference (RFI) suppresser (line filter) shall be provided and installed on the load side of the signal circuit breaker and shall be protected by the surge protector. This filter shall be rated at 50 amperes and shall provide a minimum attenuation of 50 decibels over the frequency range of 200 Kilohertz to 75 Megahertz.

1.4.17 Transient suppression devices shall be placed on the coil side of all relays in the cabinet. DC relay coils shall have, as a minimum, a reversed biased diode across the coil. AC relays shall have MOV's or equivalent suppression across their coils. RC networks are acceptable. One suppression device shall be supplied for each relay.

1.4.18 Except where soldered, all wires shall be provided with lugs or other approved terminal fittings for attachment to binding posts. Insulation parts and wire insulation shall be insulated for a minimum of 600 volts.

1.4.19 The outgoing traffic control signal circuits shall be of the same polarity as the line side of the power source.

1.4.20 Two switches shall be provided on the inside face of the cabinet door that shall be labeled Test Normal-Flash and Controller On-Off. When the Test switch is in the Flash position, call for flashing operation shall transfer the traffic signal circuits from the outputs of the load switch to the output(s) of a flasher relay. When the Test switch is in the Normal position, the call for flashing operation shall permit the controller unit to continue to run so that its normal operation can be observed. The Controller On-Off switch (located near the Test Normal-Flash switch) will cause the controller unit and any auxiliary equipment to be deactivated. The Test and Controller switches should have some type of guard to protect against accidental activation. There should be ample clearance provided between switch guard and controller face when door is closed.

1.4.21 {Intentionally left blank)

1.4.22 The cabinet shall be wired so that activation of the conflict monitor will cause the controller unit, and any auxiliary equipment, to stop timing.

1.4.23 Conflict and manual flash for vehicle and overlap phases shall be prewired for all red.

1.4.24 The cabinet shall be designed and equipped with eight transfer relay positions for the 16-position cabinet and six transfer relays for the 12-position cabinet. The purchaser should be able to change flash color using simple tools to move the wires. Wires for the flash circuit shall be color coded for each output of the corresponding channel (example: green for green output, yellow for yellow output, and red for red output). Between the back plane and loadbay terminals, flash circuit wires and conflict monitor wires for each channel will be isolated by channel and not bundled or tie wrapped with any other wires. The flash circuit shall be easy to change without having to remove any components (example: load switch or transfer relay). Flash circuit shall be easily accessible and free of any obstructions.

1.4.25 Transfer relays shall be the plug‑in type manufactured by Reno A&E (Part No. TR-200) or Struthers-Dunn (Part No. 21XBXPL), or equivalent with LED indication. The relays shall have contacts a minimum of 3/8" diameter in size and shall be rated at a minimum of 30 Amps 102/240 VAC, 20 Amps 28 VDC.

1.4.26 A 75 Amp, solid-state relay shall be wired between the RFI filter output and the load switch power bus. The relay shall be controlled by the signal shutdown switch and the flash switch. The relay shall be mounted to a heat sink designed to allow maximum current flow at 74 C without damaging the relay.

1.4.27 All exposed AC wiring points, including the RFI filter, surge suppresser, and solid state relay shall be covered with a clear non-conductive plastic cover mounted to prevent accidental contact. Unless otherwise noted in this specification, wiring at terminal strips is exempt from this requirement.

1.4.28 The load switch outputs shall be brought out to posted 10‑32 X 5/16" binder head screw terminals. An MOV or approved equivalent suppression device shall be installed on each load switch output. These devices shall be located on the front side of the load bay for easy access and replacement. Field wiring for the signal heads shall be connected at this terminal strip. Compression connections are not acceptable. All terminal strips for PEDs, overlaps, and vehicle phases shall all be placed on the same plane, horizontally at the bottom of the loadbay.

1.4.29 An SDLC Hub Assembly shall include a minimum of eight D-Subminiature Female 15 pin (DB15) connectors that are wired in series. Provide one (1) extra SDLC cable capable of reaching both shelves.

**2.0** **DETECTOR PANEL AND CARD RACK**

* 1. The cabinet shall have a loop detector panel mounted on the left side of the cabinet. This panel shall provide for all connections between loops at the street and the detector cards as described in the following sections.

2.2 **Detector Card Rack**

* + 1. The vehicle detector card rack for the Size 5 Modified (12-position backpanel) cabinets shall be TS 2 detector rack Configuration #1 and shall accommodate a minimum of eight 2-channel or four 4-channel TS 2 detector units, one BIU and two additional slots for rack mount optical preemption wired 4-channel dominate. The vehicle detector card rack the Size 6 (16-position backpanel) cabinet shall be TS 2 detector rack Configuration #2 and shall accommodate a minimum of eight 4-channel TS 2 detector units, two BIUs and two additional slots for rack mount optical preemption wired 4-channel dominate. Bond detector rack to the grounding loop.

2.2.2 The detector card rack shall have a rigid frame with labels and shall be fabricated from aluminum and shall have slots set in a modular fashion such that the detector card edge connectors shall plug into a socket while sliding between top and bottom card guides for each module. Mounting flanges shall be provided and be turned outward for ease of access. The detector card rack shall be bolted to a cabinet shelf. It shall be possible to unbolt the rack using simple tools. Wiring harnesses to the detector rack shall have connections that are pluggable and do not require any soldering or de-soldering to change out the detector rack.

2.2.3 All wiring to the rack shall be labeled and neatly run to other parts of the cabinet and detector termination panel.

2.2.4 The slots shall be numbered 1 to 8, left to right when viewed from the front of the rack. A flange shall be provided on the top and the bottom of the rack to label each individual channel.

2.2.5 The detector DC supply shall be bussed to a common point and wired to the detector panel.

2.2.6 The chassis ground shall be bussed to a common point and wired to the detector panel.

2.2.7 The logic ground shall be bussed to a common point and wired to the detector panel.

2.2.8 The data address for the detector BIUs shall be according to TS 2.

**2.3 Detector Panel**

2.3.1 The Detector Panel shall provide all connections between the detector loops and the detector cards. All detector loop input connections shall be easily accessible and free of any obstructions.

2.3.2 The panel shall be constructed of 3.2 mm aluminum.

2.3.3 The panel shall contain a 76 mm horizontal slot in each corner to accommodate 6.3 mm mounting bolts.

2.3.4 All inputs from the loops shall be brought through posted 10-32 X 5/16” binder screw terminals or 8-32 X 5/16” binder screw terminals.

2.3.5 Each loop pair shall be protected by lightning surge suppresser. The suppressers must be easily accessible and mounted so that they can be replaced without removing the detector panel. Suppressers shall not obstruct terminal strips making it difficult to connect loops.

* + 1. Each detector will have a test switch such that when the switch is closed, a call is placed upon that detector input. The test switch will have three positions; no effect, permanently on, and momentarily on.

2.3.7 The detector panel for cabinet Configurations #1, #2 and #3 (12-position) shall provide the following connection points as a minimum for sixteen (16) detectors:

|  |  |
| --- | --- |
| **CONNECTION POINT** | **NO. OF CONNECTION POINTS** |
| EXTERNAL 24V POWER SUPPLY | 1 |
| LOOP INPUTS | 16 |
| LOGIC GROUND | 1 |
| SPARES | 6 |
| CHASSIS GROUND BUS | 1 BUS |

The detector panel for cabinet Configuration #4 (16-position) shall provide the following connection points as a minimum for thirty-two (32) detectors:

|  |  |
| --- | --- |
| **CONNECTION POINT** | **NO. OF CONNECTION POINTS** |
| EXTERNAL 24V POWER SUPPLY | 1 |
| LOOP INPUTS | 32 |
| LOGIC GROUND | 1 |
| SPARES | 6 |
| CHASSIS GROUND BUS | 1 BUS |

2.3.8 A chassis ground bus bar shall be provided on the panel and connected to the cabinet by a copper ground strap. The strap shall be bonded to the grounding loop.

2.3.9 The cabinet shall be wired and labeled for eight (8) pedestrian pushbutton inputs. The detector panel shall have all eight (8) pedestrian test pushbutton inputs.

2.3.10 Cabinet shall have replaceable pedestrian pushbutton isolator PCB that isolates all eight inputs. These shall be able to be replaced without removal of existing equipment and without putting the intersection into FLASH.

**3.0 PREEMPT PANEL**

3.1 A preempt panel shall be provided that contains all interface circuits and wiring for preemption and communication functions. The panel shall be located on the left side of the cabinet interior. Bond panel to grounding loop.

3.2 Three momentary test switches, one for each preempt circuit, shall be provided on the preempt panel. The operator shall not be exposed to hazardous voltages during operation of the test switches.

3.3 All necessary interconnection cables, relays and mounting hardware shall be provided.

3.4 There shall be a switch on the preempt/communication panel, which shall release the local controller to operate in an isolated, full‑actuated manner, when necessary for maintenance purposes. The switch positions shall be labeled “SYSTEM” and “FREE”.

3.5 {Intentionally left blank}

3.6 Preempt panel shall have a 12-volt AC relay prewired for preempt input 1.

3.7 All inputs and terminals shall be labeled.

**4.0 Power Supply**

4.1 The power supply shall be a shelf mounted, enclosed, 24 VDC power supply in accordance to Clause 5.3.5 of the NEMA Standards Publication TS 2-1992.

4.2 One power supply cable per power supply shall be furnished and installed in each cabinet. The wires shall be terminated to bus bars, terminals on the front of the backpanel, detector panels, or connector as appropriate. The connections shall be with forked spade lugs or otherwise as needed. Each individual wire shall be cut to the length required to reach the point at which it is to be connected.

**5.0** **TWO CIRCUIT SOLID STATE FLASHER**

5.1 The solid state, two-circuit flasher shall meet the electrical and physical characteristics described in Clause 6.3 of the NEMA Standards Publication TS 2‑1992. The flasher shall be Type III (dual circuit rated at 15 Amps per circuit) unit and so constructed that each component may be readily replaced if needed.

5.2 The two-circuit flasher shall be of solid-state design with LED indicator lights for each circuit and shall contain no electro-mechanical devices.

**6.0 LOAD SWITCHES**

6.1 The solid-state load switches shall meet the requirements set forth in Clause 6.2 of the NEMA Standards Publication TS 2‑1992, and shall be "Triple‑Signal Load Switch" type. Load switches shall be PDC model SSS-86 I/O load switch with LED on front, or equivalent.

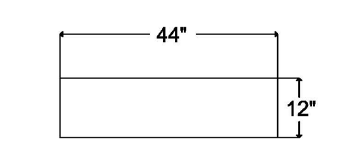
6.2 An indicator light for each circuit shall be provided in each load switch. The indicator light shall be on when a "Low Voltage Active" input to the load switch is present as well as high voltage output.

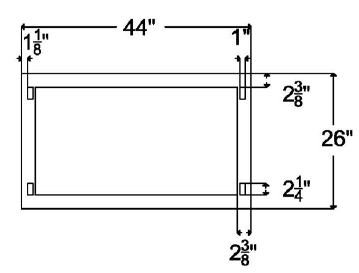
**7.0 GENERATOR TRANSFER SWITCH**

7.1The base mount cabinets shall contain an internal generator plug accessible from the outside by locking auxiliary door. The auxiliary door shall be gasketed to prevent entry of moisture or dust. The switch must be equipped with a Cooper CWL530P male generator plug. During a power outage, the transfer switch will isolate the emergency circuits from the utility line allowing for efficient operation of the cabinet and generator without back feeding onto the utility. The generator plug and transfer switch shall be mounted below the lowest shelf so as not to block usable space on shelves or block access to any equipment in the cabinet including copper bus bars.

**8.0 CABINET RISER**

8.1 Cabinet riser is for a Type-P Size 6 base mount cabinet. Riser is to be constructed of .125” thick 5052 H-32 aluminum. Riser is to be constructed using continuously welded seams. Riser is 12’ in height.





The contractor shall supply all necessary cabinet hardware for configuration and testing (“burn-in”) to the Electronics Lab facility at 537 Spratt Street at least 14 days prior to requiring the cabinet be available for field installation – including, but not limited to: cabinet, controller, conflict monitor, jumper card & detection cards. Supplied equipment should meet all current CDOT standards and requirements. The City will perform all testing of the cabinet, controller, conflict monitor and permissive jumper card. The controller cabinet shall be picked up at the CDOT Traffic Signals facility at 537 Spratt Street. The Contractor shall notify either Travis Stewart or Steve Phifer at (704) 336-3919 at least 48 hours in advance of picking up any materials.

The Contractor shall install the controller cabinet on a concrete foundation. Use a minimum of four 3/8” diameter expanding type anchor bolts to secure cabinet to foundation. Unless otherwise specified, install the cabinet using a 12” riser at its base. Seal space between cabinet and foundation with permanent, flexible, waterproof sealing material.

Termination of field wires will be performed by the contractor and will be attached to the load bay using uninsulated fork wire connectors. Termination of low voltage field wires will be performed by the contractor and attached appropriately within the cabinet using insulated fork wire connectors.

The contractor should assume that it will take up to 10 days for a State Electrical Inspector to arrive on site to inspect a new service, and 7 days for a power company to install a new electrical service. Additional days will NOT be granted if these time periods are shorter.

Activation of New Traffic Signals\*:

1. When the Contractor is ready to activate the traffic signals necessary for the traffic control phase they shall contact CDOT Traffic Signals (Travis Stewart or Steve Phifer, 704-336-3919) to schedule activating the new signal equipment. A minimum of 48 hours advanced notice is required.
2. Any new traffic signals must flash before being put into full operation. Signals shall flash for a period of 7 days before being activated, unless otherwise approved by The Engineer. Signals shall not be activated on Friday. Signals should be flashed a minimum of three (3) working days and shall not flash for longer than 10 days.
3. The Contractor shall uncover the new signals and shall remain at the site until installation is complete, the new signals are activated and a CDOT Traffic Signals representative has determined that they are functioning as designed.
4. The contractor shall remove any existing STOP signs at the project location immediately following full activation of a full traffic signal, upon the direction of The Engineer, and their associated supports.

*\*Pedestrian Hybrid Beacons are exempt from a flashing period as they rest in dark.*

2.0 MEASUREMENT

Installed Controller Cabinets will be measured and paid as the actual number of cabinets that are supplied, installed, activated and accepted.

3.0 PAYMENT

Payment will be made under:

Supply, Install & Activate Controller Cabinet EA

# SP-C5 CONTROLLER CABINET INSTALLATION & ACTIVATION (CITY SUPPLIED)

1.0 DESCRIPTION

The work in this special provision consists of all labor and material necessary to install a controller cabinet and to connect to an existing concrete base and meter service. This unit does not include labor and material necessary to install a concrete foundation, combination meter pedestal or grounding grid as those are separate pay items.

The controller cabinet shall be picked up at the CDOT Traffic Signals facility at 537 Spratt Street. The City will perform all pre-installation wiring and testing (“burn-in”). The Contractor shall notify either Travis Stewart or Steve Phifer at (704) 336-3919 at least 14 days prior to requiring the cabinet be available for field installation – including, but not limited to: cabinet, controller, conflict monitor, jumper card & detection cards.

The Contractor shall install the controller cabinet on a concrete foundation. Use a minimum of four 3/8” diameter expanding type anchor bolts to secure cabinet to foundation. Unless otherwise specified, install the cabinet using a 12” riser at its base. Seal space between cabinet and foundation with permanent, flexible, waterproof sealing material.

Termination of field wires will be performed by the contractor and will be attached to the load bay using uninsulated fork wire connectors. Termination of low voltage field wires will be performed by the contractor and attached appropriately within the cabinet using insulated fork wire connectors.

The contractor should assume that it will take up to 10 days for a State Electrical Inspector to arrive on site to inspect a new service, and 7 days for a power company to install a new electrical service. Additional days will NOT be granted if these time periods are shorter.

Activation of New Traffic Signals\*:

1. When the Contractor is ready to activate the traffic signals necessary for the traffic control phase they shall contact CDOT Traffic Signals (Travis Stewart or Steve Phifer, 704-336-3919) to schedule activating the new signal equipment. A minimum of 48 hours advanced notice is required.
2. Any new traffic signals must flash before being put into full operation. Signals shall flash for a period of 7 days before being activated, unless otherwise approved by The Engineer. Signals shall not be activated on Friday. Signals should be flashed a minimum of three (3) working days and shall not flash for longer than 10 days.
3. The Contractor shall uncover the new signals and shall remain at the site until installation is complete, the new signals are activated and a CDOT Traffic Signals representative has determined that they are functioning as designed.
4. The contractor shall remove any existing STOP signs at the project location immediately following full activation of a full traffic signal, upon the direction of The Engineer, and their associated supports.

*\*Pedestrian Hybrid Beacons are exempt from a flashing period as they rest in dark.*

2.0 MEASUREMENT

Installed Controller Cabinets will be measured and paid as the actual number of cabinets that are installed, activated and accepted.

3.0 PAYMENT

Payment will be made under:

Install & Activate Controller Cabinet (City Supplied) EA

# SP-C6 2070LX CONTROLLER w/ 1C CPU, MODULES AND ACCESSORIES

1.0 DESCRIPTION

This specification sets forth the minimum requirements for a 2070-1C CPU designed according to the Caltrans TEES 2009 specification and the ATC Standard V. 6.25. The 2070-1C module consists of an ATC Engine Board paired with a 2070-1C Host Board.

1.1 ATC Engine Board

The Engine Board shall meet the following requirements:

The board shall be fully compliant with the ATC Standard version 6.25.

Microprocessor - The board shall include a Freescale MPC83XX PowerPC processor with QUICC engine.

DRAM Memory (DDR2) - The board shall contain a 128Mbytes of DDR2 DRAM memory for application and OS program execution.

Flash Memory - The board shall contain 64 Mbytes of NOR type FLASH for storage of OS Software and user applications.

Static RAM (SRAM) - The board shall contain 2MB of SRAM memory for non-volatile parameter storage.

Standby Power - The board shall provide the Standby Power (VSTANDBY) required for supporting the SRAM and RTC.

Real-Time Clock (RTC) - The board shall be provided with a software settable, hardware RTC that meets the requirements of the ATC Standard except that in the absence of VPRIMARY, the RTC shall operate from VSTANDBY.

CPU Reset - A software-driven CPU Reset Signal (Active Low) shall be provided to reset other system devices and shall be accessible by application programs as well as by the command line as “cpureset”. CPU Reset shall be executed when the Controller starts up or is rebooted using the reboot command.

USB - The board shall provide one USB 2.0 compliant port and provide hot-plug auto-mount.

Ethernet- The board shall provide three 10/100 auto-negotiating Ethernet ports.

1.2 2070-1C Host Board

The Host Board shall be a single board module meeting Caltrans 2X WIDE board requirements. It shall provide two DIN sockets and mounting standoffs for the connection of the 2070-1C Engine Board, a 96-Pin DIN connector for interfacing with the 2070 Serial Mother Board and all required EIA-485 interface circuitry. Additionally:

Ethernet Switches- The board shall provide two Ethernet switches used to route the ENET1 and ENET2 signals from the Engine Board to the front panel RJ-45 connectors and Serial Motherboard connector. The switches shall be managed and provide packet Broadcast Storm protection.

Datakey Receptacle- The board shall provide a single Datakey Receptacle capable of hosting 3.3VDC Datakeys.

USB- The board shall route the USB signals from the Engine Board to a three port USB hub chip.

SD Card Support - The board shall be provided with an industry standard SD Card socket mounted to the host board. The SD Card socket shall be supported by the USB hub. The SD Card socket shall not be accessible from the front panel.

1.3 Front Panel

The front of the 2070-1C CPU Module shall consist of a panel with a USB port, three Ethernet ports with integrated LEDs, a Datakey receptacle, and a 25 pin C13S connector with TX/RX LEDS. It shall only be necessary to remove the module during maintenance of the electronics or for accessing the SD Card.

USB Port - The TYPE 2070-1C CPU Module shall include a USB port compliant to the ATC Standard 6.25 with the exception that USB shall conform to the appropriate sections of the USB v2.0 specification for both hardware and software operations. The USB shall be brought out from the Host Board USB hub to the front panel USB connector.

Ethernet Ports - Three ETHERNET ports from the Ethernet switches on the Host Board shall be brought out on RJ-45 connectors mounted on the 2070-1C front panel. These Ethernet ports shall support ENET1 and ENET 2 from the Engine Board.

Datakey - A Datakey Keyceptacle™ shall be mounted on the CPU module front panel. The controller shall be supplied with an 8MB Memory Size Datakey with each 1C CPU module unless specified otherwise. The Datakey shall be temperature rated for –40 °C to +85 °C (–40°F to 185 °F) operation, shall be blue in color. The datakey shall operate on 3.3 VDC. Power shall not be applied to the receptacle if the key is not present. The CPU shall support from a 2 through 32MB Datakey.

C13S Port – The front panel shall provide a DB-25 connector that supports the SP8 circuitry on the Host Module.

1.4 Operating System

The 2070-1C CPU Module shall be supplied with Linux 3.12.x or later kernel and Board Support Package (BSP).

Linux Drivers - All Linux Drivers provided in the Model 2070-1C CPU shall be compliant to ATC Standard V. 6.25 Annex B specifications.

Startup Procedure - The Linux boot image shall startup as described in the ATC Standard V. 6.25 Section 5.3.5.1. The boot up process shall be completed within 4.5 seconds. Linux startup shall be configured to auto run scripts or execute Linux binaries residing in the USB Memory upon power up or during normal operation with USB Memory inserted.

ATC API – Provide compiled libraries and applications for the 5401 Standard for Applications Programming Interface with Reference Implementation (APIRI).

1.5 Electronics

All printed circuit boards shall meet the requirements of the NEMA Standard plus the following requirements to enhance reliability:

All plated-through holes and exposed circuit traces shall be plated with solder.

Both sides of the printed circuit board shall be covered with a solder mask material.

The circuit reference designation for all components and the polarity of all capacitors and diodes shall be clearly marked adjacent to the component. Pin 1 for all integrated circuit packages shall be designated on both sides of all printed circuit boards.

All printed circuit board assemblies shall be coated on both sides with a clear moisture-proof and fungus-proof sealant.

The controller shall include an option that allows updating software using a Windows based computer or USB memory stick. This option shall allow updating the controller software via Ethernet port or USB port.

The controller shall include an option that supports remotely updating the controller software from the Central Server while keeping the intersection in an all-red condition.

2.0 MEASUREMENT

2070LX CONTROLLER w/ 1C CPU, MODULES AND ACCESSORIES will be measured and paid as the actual number of controllers that are supplied, installed, activated and accepted.

3.0 PAYMENT

Payment will be made under:

2070LX CONTROLLER w/ 1C CPU, MODULES AND ACCESSORIES …………………………EA

# SP-C7 CORE DRILL CONCRETE CABINET FOUNDATIONS

1.0 DESCRIPTION

Where approved by the Engineer, install conduit entrances into existing foundations in accordance with the plans and specifications.

2.0 MATERIALS

Comply with the NCDOT Standard Specifications in section 1750.

3.0 CONSTRUCTION METHODS

Install Conduit Entrances into existing cabinet foundations by core drilling foundations to install additional conduit.

Maintain a minimum of 3 inches of horizontal clearance between new conduit and edge of foundation. Maintain minimum clearances of 1 inch from the flange of the base adapter and 2 inches from existing conduits. Avoid damaging existing conduit, conductors, and anchor bolts. Repair all such damages. When possible, maintain traffic signal operations while drilling is performed.

After installation of conduit, place grout to seal around conduit, and return the foundation to normal appearance.

4.0 MEASUREMENT AND PAYMENT

Actual number of conduit entrances drilled into existing cabinet foundations furnished, installed, and accepted.

Payment will be made under:

CORE DRILL CONCRETE CABINET FOUNDATION EA

# SP-C8 GREEN UNINTERUPTIBLE POWER SUPPLY

1.0 DESCRIPTION

This specification defines the requirements of a green uninterruptible power supply (UPS) battery backup system.

1.1 DEFINITIONS

UPS – Uninterruptible Power Supply

GUI – Graphical User Interface

NiZn - Nickel-Zinc

SNMP - Simple Network Management Protocol

SMTP - Simple Mail Transfer Protocol

TCP/IP - Transmission Control Protocol/Internet Protocol

1.2 REQUIREMENTS

Compatibility

The UPS shall be compatible with the agency’s current traffic controller cabinet, controller and cabinet components, including the safety monitor, for full time operation. The UPS shall include all necessary cables to connect the UPS and batteries.

Run-time

The UPS shall be configured with batteries to provide a 2-amp cabinet load a to support a range of run time from a minimum of four (4) hours to a maximum of ninety (90) hours of operation at ambient temperature of 25°C

Output Capacity

UPS must provide a range of continuous active output capacity from a minimum of 1000W to 1500W, with a 90% typical inverter efficiency while running in battery backup mode. The UPS must have surge output capability of 2000W.

Output Voltage

When under battery power, the UPS output voltage shall be 120 VAC, ±3%, pure sine wave output, with <2% total harmonic distortion (THD), and frequency of 60 Hz ±0.5%.

Transfer Time

The maximum transfer time allowed, from disruption of utility line voltage to stabilized inverter line voltage from batteries shall be thirty- three (33) milliseconds max. The maximum transfer time when switching from inverter line voltage to utility line voltage after the line-qualifying period shall be thirty-three (33) milliseconds max. The UPS shall be capable of allowing the user to program the line qualifying period as three (3), ten (10) or thirty (30) seconds.

Operating Environment

Operating temperature for the UPS and Power Interface Module (PIM) shall be -35°F to +165°F (-37° to +74°C).

Certifications

The UPS battery cells shall be recognized UL-2054, CSA 22.2 No. 60950-1

Power & Control Connections

Power Interface Module (PIM)

The UPS shall utilize a Power Interface Module (PIM) to connect utility AC input to the UPS and batteries as well as routing UPS output power to the cabinet load.

AC Connection

The AC input and output shall be separate panel mounted plug/receptacles that allow no possibility of accidental exposure to dangerous voltages.

Battery Connections

The batteries shall have digital battery bus connections to the UPS with locking connectors with provision for six battery ports. There shall be AC power connections from the Power Interface Module to the batteries that are separate from the digital battery bus connections.

The UPS must offer six (6) battery ports that can accommodate a mix of any form-factor NiZn batteries compatible with the UPS system.

The UPS must be capable of accepting batteries of different capacities at once, giving the user the ability to utilize different battery sizes to achieve required run-times.

The UPS must allow the user to ‘Hot Swap’ any of the battery form-factors while on utility power and/or battery backup power.

Battery

The standard and extended run time (XRT) UPS batteries must utilize a Sealed Nickel-Zinc (NiZn) battery technology. Lead-Acid or Lithium battery technologies will not be accepted.

The standard run-time battery panel(s) must incorporate a bendable design, which allows the battery panel(s) to flex or bend for installation between the 19” EIA rack and the sidewall of the 33X cabinet .

The standard run-time module(s) must have the capability of being installed on/under a shelf or be rack mountable within the 19” EIA rack.

XRT battery solutions shall come with an intelligent management system that consolidates all battery connections to the UPS and manages the battery string.

The charging/battery monitoring circuitry shall be incorporated within the panel, module or extended run time battery solutions.

Charge

The UPS must be able to recharge standard panel and module batteries from 0% to 100% state of charge (full capacity) within four and one half (4.5) hours of complete discharge at 25°C when AC utility line voltage is available. Extended run time batteries shall be able to recharge batteries from 0% to 100% state of charge (full capacity) within ten (9) hours of complete discharge at 25°C when AC utility line voltage is available. The number of batteries connected to the UPS shall have NO effect on the recharge time. The batteries must be able to charge at up to 50°C ambient temperature. The UPS must not require trickle/float charging.

Wall Charging - The UPS panel, module and extended run time batteries shall be able to be charged using a 120VAC, 15A wall outlet (20A for extended run time) without need of a UPS inverter/controller, battery charger or battery tender.

Unit failure

The UPS must have a fail-safe utility tie feature (bypass mode) with a visual indicator that automatically cuts back to the utility line in the event of a UPS or battery failure, or complete battery discharge.

Operating Modes

The UPS shall have intelligent two-stage operation defined as:

Stage One: Line Attenuator, Waveform Monitoring and Switchover to Battery Backup

Stage Two: Waveform Monitoring, Return to AC Power

Oscilloscope Function

The UPS shall have an oscilloscope function continuously monitoring the incoming utility AC waveform. The oscilloscope function shall continuously evaluate three (3) measures of the incoming utility AC waveform:

Voltage: A continuous RMS measurement with user programmable AC voltage thresholds.

Waveform Anomalies: Oscilloscope enhanced sensitivity mode compares incoming utility waveform to a mathematically pure sine wave reference waveform.

Frequency: Continuously measured with frequency deviation detected as quickly as 1 cycle and a default threshold of 60Hz +6Hz.

1.3 Functionality and Operational Requirements

LCD Display

The UPS shall have a 64 x 128 Pixels LCD display with white LED backlight. From the main screen, the LCD display shall provide the following information;

Utility line voltage

UPS status

Cabinet consumption in watts

Most recent AC power outage duration

Battery capacity State of Charge percentage

LCD Display Menu

The LCD Display Menu shall provide the user the ability to program and monitor all UPS parameters;

Local User Interface

The UPS shall include a navigational dial to allow users the ability to navigate the menu to setup the UPS.

Voltage Thresholds

The UPS shall allow the user to set high and low AC line voltage thresholds to determine parameters to transfer from utility line power to battery backup power.

The UPS shall bypass utility line power if the utility line voltage is outside of the set high and low voltage parameters.

The UPS shall have a programmable utility AC qualification time after restoration of utility AC power to within specified voltage thresholds with choices of 3, 10 or 30 seconds.

Notifications

All alarm functions shall be available on SNMP, SMTP and Programmable Relay.

Programmable Relays

The UPS Inverter/Controller shall include eight (8) Class 2 programmable relays, which can be triggered by power line conditions, and user selected settings of the UPS. Each relay shall have the ability to trigger by multiple conditions simultaneously. The programming options are as follows;

Power Fail without delay / Power fail with delay

Time of Day

Battery Capacity

System Fault

Event Log

The UPS shall provide an event log with a 1000 event capacity, which will allow the user to view the event type, date, time and duration of a given event. UPS configuration changes shall also be defined as an event and captured in the event log. The data shall be recorded in a FIFO format, so the oldest event is purged as the newest is entered.

Automatic Bypass Switch

The UPS shall have an automatic bypass function with a visual indicator to bypass the UPS and allow the utility line voltage through to the cabinet.

Circuit Breakers

The UPS system shall include a Power Interface Module (PIM) equipped with a 20A circuit breaker and automatic bypass capability.

Cold Start

The UPS shall be equipped with “Cold Start” capabilities, which provides the user the ability to turn the UPS on and supply battery backup power when no utility line voltage is available. This allows the user the ability to install a UPS and provide backup AC power at an intersection that has no utility line voltage available.

Audible Indicators

The UPS shall have audible indicators for the following parameters:

System Startup

Cold Start

Inverter On/Off

Inverter Output Over Current

AC Mis-wire

Rotating Navigation Dial with Press to Select and Back Button use

UPS Fault

Maintenance

There shall be no battery maintenance requirements for the life of the batteries including no battery rotation, maintenance discharge or cell balancing.

Visual Indicators

The UPS shall have visual indicators on its front panel for the following:

Red indicator - UPS Fault

Solid Green indicator - Backup Mode On

Flashing Green indicator - Batteries are below 10% capacity

Yellow - Relay Triggered

The batteries shall have the following visual indicators through a multi-color LED providing battery status and alarms

Green = Backup Mode

Blue = Charging Mode

Red = Battery Fault

White Blinking = Charged, battery at rest

1.4 Communication

The UPS must have the capability to provide Ethernet and IP addressing communications with the capability for remote monitoring and programming as well as remote firmware updating capability. This capability must be provided through embedded webserver software within the UPS.

The UPS shall be equipped with an Ethernet port. The Ethernet port shall be an RJ45, EIA 568B pin out type connector. The Ethernet port shall be 10/100Mbps, TCP/IP capable.

1.5 Graphical User Interface

The embedded webserver will provide a Graphical User Interface (GUI) that shall be password protected and require a user ID, password and the UPS IP address to access.

The GUI shall have a status area that details the UPS status, location, available AC line voltage status and real-time cabinet power consumption. When in backup mode, the GUI shall display the most recent power failure duration. The status area must be displayed on every page.

The GUI shall have a Home screen with clickable icons and tabs, which will allow the user to navigate the GUI with ease. The home screen shall allow the user to view real-time graphical charts of the cabinet power consumption and AC line voltage status. The home screen must allow the user the ability to view a live waveform from the AC utility line in the cabinet.

The GUI shall have an Event Log page to allow the user to view the event type, date, time and duration of a given event. The GUI must provide the user the capability of viewing the waveform of the given event.

The GUI shall have a relay Configuration page to allow the user to program the relay contacts.

The GUI shall have a System Configuration page that allows the user to configure all the setup parameters of the UPS.

The GUI shall communicate notification and alerts through SNMP and SMTP protocols.

1.6 Warranty

The UPS, as a complete system including batteries, must be warranted to be free from defects in material and workmanship for a minimum of 5 years for the battery cells and 2 years for the electronics from the date of shipment.

2.0 MEASUREMENT

GREEN UNINTERUPTIBLE POWER SUPPLY (UPS) will be measured and paid as the actual number of UPS that are supplied, installed, activated and accepted.

3.0 PAYMENT

Payment will be made under:

GREEN UNINTERUPTIBLE POWER SUPPLY (UPS)……………………………………………………..…EA

# SP-S1 VEHICLE SIGNAL HEADS (1705 MODIFIED)

1.0 DESCRIPTION

Description is as set out in **NCDOT Standard Specification 1705.**

2.0 MATERIAL

Materials are as set out in **NCDOT Standard Specification 1705** with the addition of:

All vehicle LED signal heads must have yellow polycarbonate housings, black polycarbonate hoods and internal hinges for access doors.

3.0 CONSTRUCTION METHODS

Construction methods are as set out in **NCDOT Standard Specification 1705.**

4.0 MEASUREMENT AND PAYMENT

Measurement and payment are as set out in **NCDOT Standard Specification 1705.**

# SP-S2 PEDESTRIAN SIGNAL HEADS

1.0 DESCRIPTION

Furnish and install pedestrian LED signal heads, visors, interconnecting brackets, wire entrance fittings, mounting assemblies, signal cable, lashing wire, pedestrian signal signs, grounding systems and all necessary hardware.

Bag new pedestrian signal heads with burlap bags or bags made of non-ripping material specifically designed for covering signal heads until signal heads are placed in operation. Do not use trash bags of any type.

When new signal heads are placed into operation, immediately bag and remove signals heads that are not to be reused.

Adjust each signal head vertically and horizontally so that light output will be of maximum effectiveness for traffic and pedestrians. Do not tilt signal heads forward. Reposition signal heads as required for various construction phases.

All LED pedestrian signal head modules must be 16” x 18” LED module with full display man and hand with count down. All LED pedestrian signal heads must have 16” X 18” cast aluminum housing, powder-­‐coated federal yellow, cast aluminum door, painted flat black with visor type (z-­‐crate, waffle, mesh, vantage) (See picture 1). Door shall have stainless steel hinge pins that are removable without using tools (See picture 2 & 3). All hardware shall be stainless steel. Housing shall be drilled on one side for clamshell mounting hardware (see picture 4). 3 Position terminal block mounted in housing (see picture5). Front door 16” hinged top or bottom. The door is attached with stainless steel clevis or roll pins and eye bolt/wing nut assemblies. Two equally spaced mounting lugs, integrally cast into the top and bottom of the 16” and the sides of the 12”, allow the doors to hinge from either direction. All interior mounting locations on the 16” housing are symmetrically positioned, allowing the rotation of components when using the clamshell bracket to mount to the right or left side. Clamshell mounting bracket should NOT BE MOUNTED to housing. They are to be boxed separately with closure bolt and 2-­‐part mounting assembly symmetrical mounting holes allow for left or right mount neoprene gasket provides a weather tight seal 3-­‐position, 2-­‐row terminal block mounted in the upper half of the signal mounted portion; one side with fast-­‐on terminals, the other side with screw terminals 28” wire leads (3) provided to wire clamshell terminal block to pedestrian signal terminal block field wiring is terminated on clamshell terminal block flathead 3/16” hex socket closure bolt.



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2.0 MEASUREMENT

Pedestrian Signal Heads will be measured and paid as the actual number of signal heads of each type listed below furnished, installed and accepted.

16” PEDESTRIAN SIGNAL HEAD

3.0 PAYMENT

Payment will be made under:

16” PEDESTRIAL SIGNAL HEAD EA

# SP-S3 PEDESTRIAN POLES AND BASES

1.0 DESCRIPTION

The Contractor shall supply concrete, anchor bolts and forms necessary for constructing proposed or relocated pedestrian pole bases. The Contractor shall supply all material necessary to install a complete pedestrian pole assembly. Pedestals shall be installed in conformance with drawings 1743.04-1-CDOT and 1743.04-2-CDOT.

The contractor shall supply and install 10-ft or 15-ft aluminum pedestrian signal poles with square bellhousing and cap as specified in the plans.

2.0 MEASUREMENT

Pedestrian Pole Bases and Foundations will be measured and paid as the actual number of each type listed below furnished, installed and accepted.

10FT. Metal Base/Pole/Cap for pedestrian signal

Concrete foundation for 10FT. Metal Base/Pole/Cap for pedestrian signal

15FT. Metal Base/Pole/Cap for pedestrian signal

Concrete foundation for 15FT. Metal Base/Pole/Cap for pedestrian signal

3.0 PAYMENT

Payment will be made under:

10FT. METAL BASE/POLE/CAP FOR PEDESTRIAN SIGNAL EA

CONCRETE FOUNDATION FOR 10FT. METAL BASE/POLE/CAP FOR PEDESTRIAN SIGNAL EA

15FT. METAL BASE/POLE/CAP FOR PEDESTRIAN SIGNAL EA

CONCRETE FOUNDATION FOR 15FT. METAL BASE/POLE/CAP FOR PEDESTRIAN SIGNAL EA

# SP-S4 APS PEDESTRIAN PUSHBUTTON DETECTOR, SIGN & 3-WIRE CONTROL BOARD

1.0 DESCRIPTION

This item includes the labor, equipment, and any necessary hardware to supply and install one APS Pedestrian Pushbutton Detector & Sign and 3-wire control board. Installation should be in compliance with Section 1705-3 (C) of the NCDOT Standard Specifications.

2.0 MEASUREMENT

APS Pedestrian Pushbutton Detector & Sign and 3-wire control board will be measured and paid as the actual number of APS Detectors & Signs and control boards installed and accepted. A Sign, control board and corresponding detector shall be considered one unit.

3.0 PAYMENT

Payment will be made under:

Supply & Install APS Pedestrian Pushbutton Detector, Sign & 3-Wire Control Board EA

# SP-S5 INSTALL APS PEDESTRIAN PUSH BUTTON (CITY SUPPLIED)

1.0 DESCRIPTION

This item includes the labor and any necessary hardware to install one APS Pedestrian Pushbutton Detector & Sign as supplied by the City. Installation should be in compliance with Section 1705-3 (C) of the NCDOT Standard Specifications.

2.0 MEASUREMENT

APS Pedestrian Pushbutton Detector & Sign will be measured and paid as the actual number of APS Detectors & Signs installed and accepted. A Sign and corresponding detector shall be considered one unit.

3.0 PAYMENT

Payment will be made under:

INSTALL APS PEDESTRIAN PUSHBUTTON DETECTOR & SIGN (CITY SUPPLIED) EA

# SP-S6 LEAD-IN CABLE (1726 MODIFIED)

1.0 DESCRIPTION

Description is as set out in **NCDOT Standard Specification 1726.**

2.0 MATERIAL

Materials are as set out in **NCDOT Standard Specification 1726** with the exception that all lead-in cable must consist of four 18AWG conductors in two pairs of two conductors.

3.0 CONSTRUCTION METHODS

Construction methods are as set out in **NCDOT Standard Specification 1726.**

4.0 MEASUREMENT AND PAYMENT

Measurement and payment are as set out in **NCDOT Standard Specification 1726.**

# SP-S7 STANDOFF BRACKET ASSEMBLY

1.0          DESCRIPTION

Provide Aluminum 24” H-Bar, 1/2” 4-way bar, Conduit Standoff Bracket and T-Slot, to mount 2” conduits with adjustability. Pole mounting hardware must mount on 3 5/8" centers using 5/8" through bolts and 1/2" lag bolts. Conduit Straps must include T-Slot shapes to secure conduit to standoff bracket with two 1/2" x 1 1/4" hex head bolts, lock washers and hex nuts. The standoff bracket H-bar shall hold the conduits a minimum of 6” from the pole and shall be able to hold up to six 2” Schedule 80 PVC risers, four in front and two in back of the bracket for ITS and signal cables. There should be two standoff brackets for each 10’ section of riser. Standoff brackets must be installed at 3’from the ground and at 5’ intervals to the top of the riser (four brackets required for 20’ riser).

*Example: Hubbell Power Systems, Inc. Part #BASOCL6-24FW and part #CSTK2*

2.0          MEASUREMENT

The standoff brackets will be measured and paid as the actual number of standoff bracket assemblies furnished, installed and accepted. Schedule 80 PVC Risers will be paid separately under the Riser Assembly Unit. No measurement will be made of pole attachment fittings as these will be incidental to furnishing and installing standoff brackets.

3.0          PAYMENT

Payment will be made under:

STAND OFF BRACKET ASSEMBLY                                                                                       EA

# SP-S8 RISER ASSEMBLIES (1722 MODIFIED)

1.0 DESCRIPTION

Furnish and install riser assemblies with Sch. 80 PVC conduit, Sch. 80 PVC weatherheads, galvanized pole attachment fittings and all necessary hardware.

2.0 MATERIAL

Materials are as set out in **NCDOT Standard Specification 1722** with the addition of:

Use only Schedule 80 PVC conduit and weatherheads unless otherwise approved by the Engineer.

3.0 CONSTRUCTION METHODS

Construction methods are as set out in **NCDOT Standard Specification 1722.**

4.0 MEASUREMENT AND PAYMENT

Measurement and payment are as set out in **NCDOT Standard Specification 1722.**

# SP-S9 AERIAL SIGNS INSTALLED FOR SIGNALS (1745 MODIFIED)

1.0 DESCRIPTION

The city will furnish signs. The contractor will provide remaining hardware and accessories for the installation of the signs.

2.0 MATERIAL

Materials are as set out in **NCDOT Standard Specification 1745.**

3.0 CONSTRUCTION METHODS

Construction methods are as set out in **NCDOT Standard Specification 1745.**

4.0 MEASUREMENT AND PAYMENT

*Install Sign for Signals* will be measured and paid for as the actual number of signs for signals, regardless of

mounting method, installed and accepted.

Removal of existing signs for signals with associated hardware, including but not limited to the signs, cable

hangers, rigid sign mounting brackets, will be considered incidental to the installation of the new signs for signals.

Payment will be made under:

AERIAL SIGN INSTALLED FOR SIGNALS (CITY SUPPLIED) EA

# SP-S10 GROUND SIGN ERECTION (903 & 904 MODIFIED)

1.0 DESCRIPTION

The city will furnish signs. The contractor will provide remaining hardware, posts and accessories for the installation of the ground/post mounted signs.

2.0 MATERIAL

Materials are as set out in **NCDOT Standard Specification 903 & 904.**

3.0 CONSTRUCTION METHODS

Construction methods are as set out in **NCDOT Standard Specification 903 & 904.**

4.0 MEASUREMENT AND PAYMENT

*Sign Erection* will be measured and paid for as the actual number of ground mounted signs installed and accepted.

Payment will be made under:

GROUND SIGN ERECTION (CITY SUPPLIED) EA

# SP-S11 LED BLANKOUT SIGN (1747 MODIFIED)

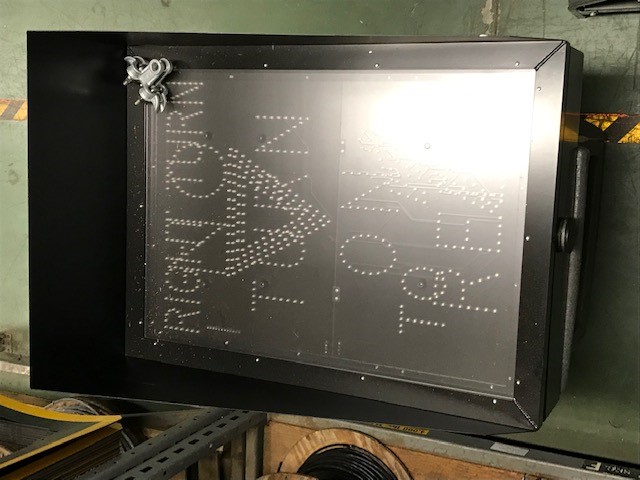
1.0 DESCRIPTION

Furnish and install Light Emitting Diode (LED) blankout signs with all necessary hardware as set forth in the plans and specifications. Fabricate the signs with the ability to display messages as detailed in the plans. Fabricate the sign to be 28 inches wide, 38 inches high and approximately 8 inches deep.

Blankout signs shall feature:

* Black external housing
* A hot-swappable modular controller
* A one-piece, self-contained display face and door module that can be removed from the housing in less than thirty minutes
* A photosensor capable of automatically reducing the light intensity on each display by 25% based on ambient light
* Manual dimming control capable of manually dimming the display to 25%
* The ability to simultaneously dim the display via the manual control and automatic photosensor
* Up to two display messages each. They shall be capable of displaying [OFF], [SIGN 1], [SIGN 2] as shown in the plans.

For dual-message blankout signs shown in the plans as “NO TURN ON RED” AND “RIGHT TURN [YIELD SYMBOL] TO [PEDESTRIAN SYMBOL]”, configure the displays as shown below.

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**Pictures 1 & 2- Dual message blankout sign with hood**

Example:

Blankout signs manufactured by Orange Traffic meet these specifications.

2.0 MATERIAL

Materials are as set out in **NCDOT Standard Specification 1747.**

3.0 CONSTRUCTION METHODS

Construction methods are as set out in **NCDOT Standard Specification 1747.**

4.0 MEASUREMENT AND PAYMENT

Measurement and payment are as set out in **NCDOT Standard Specification 1747.**

# SP-S12 INSTALL CITY SUPPLIED LED BLANKOUT SIGN (1747 MODIFIED)

1.0 DESCRIPTION

The city will furnish the LED blankout sign. The contractor will install the Light Emitting Diode (LED) blankout sign with all necessary hardware as set forth in the plans and specifications.

2.0 MATERIAL

Materials are as set out in **NCDOT Standard Specification 1747.**

3.0 CONSTRUCTION METHODS

Construction methods are as set out in **NCDOT Standard Specification 1747.**

4.0 MEASUREMENT AND PAYMENT

*Install City Supplied LED Blankout Sign* will be measured and paid for as the actual number of blankout signs installed and accepted.

Payment will be made under:

INSTALL LED BLANKOUT SIGN (CITY SUPPLIED) EA

# SP-S13 SIGNAL HEAD COVERS

1.0 DESCRIPTION

The Contractor shall supply and install signal head covers for each signal, until the signals are activated. The signal head covers shall be black in color with the words "OUT OF SERVICE" on the face of the cover. Covers shall be made out of outdoor fabric, solution dyed with urethane finish. The fabric must be weather resistant and treated to withstand mildew. The color shall also be fade resistant. The face of the cover besides the main fabric must consist of a strip in the middle made from see through material only visible when the signal head/pedestrian signal is on for testing. This part must also be made from weather and mildew resistant material. The front facing portion material of the cover shall be doubled. Extra inner layer must be added in black for two purposes: Not to let light through, but only through the perforated portion and to make the cover thicker and firmer. The siding shall have the same color fabric attached all around the "facing" which shall cover the height of all visors with the cord­-elastic inserted at the open end to attach around all visors to create more stability and fitness. Siding is not required to have the inner layer. The elastic cord used around the side of the cover must help it stay on more secure and stable. The cord must be made sturdy and strong for industrial purposes. The cord elastic shall not be exposed but placed inside the cover. Straps shall be used for more stabilizing of the covers on the signal heads against unexpected weather. The one-inch wide straps shall be placed on both sides of the covers such that they could be fastened by one-inch buckles around the back of the signal heads. The strap material shall be weather, mildew and fade resistant. The number of straps to be used per signal head: 2-3 Section Head -2 sets (each set consist of two pieces) 1-Section Head -1 set. The signal covers shall be removed once the signal is activated and shall be turned over to the City as City property.

2.0 MEASUREMENT

Signal Head Covers will be measured and paid as the actual number of signal head covers of each type listed below furnished, installed, removed and returned to the city:

3 SECTION 12" SIGNAL HEAD COVER

4 SECTION 12" SIGNAL HEAD COVER

5 SECTION 12" SIGNAL HEAD COVER

PEDESTRIAN SIGNAL COVER

3.0 PAYMENT

Payment will be made under:

3 SECTION 12" SIGNAL HEAD COVER EA

4 SECTION 12" SIGNAL HEAD COVER EA

5 SECTION 12" SIGNAL HEAD COVER EA

PEDESTRIAN SIGNAL COVER EA

# SP-S14 ADJUST/RELOCATE CDOT PULL BOXES/VAULTS

1.0 DESCRIPTION

Work covered by this special provision includes adjusting and relocating existing CDOT Traffic Signal Pull Boxes and vaults in accordance with the current edition of the North Carolina Department of Transportation Traffic Signal Specifications and the provisions of these specifications.

2.0 MATERIALS

Adjustment and relocating of existing pull boxes. Additional necessary conduit needs to be captured in SP-S.

3.0 MEASUREMENT

The quantity of pull boxes to be paid for will be the actual number of pull boxes and/or vaults adjusted and accepted for payment per each.

4.0 PAYMENT

The quantity of adjusted and relocated pull boxes, measured as provided above, will be paid for at the contract unit price per each for:13” x 24” x 12”, 17” x 30” x 24”, 24” x 36” x 24” CDOT Pull Boxes and 36” x 36” x 12” CDOT vaults. Payment will be full compensation for all work covered by this special provision, including but not limited to adjusting pull boxes, excavation, backfill, compaction; and stone bedding.

Payment will be made under:

ADJUST EXISTING 13”x 24"x 12” CDOT PULL BOX EA

ADJUST EXISTING 17”x 30”x 24" CDOT PULL BOX EA

ADJUST EXISTING 24”x 36"x 24” CDOT PULL BOX EA

ADJUST EXISTING 36”x 36"x 12” CDOT VAULT EA

RELOCATING EXISTING CDOT PULL BOX EA

# SP-S15 RELOCATE/ADJUST CONDUIT TO EXISTING PULLBOX

1.0 DESCRIPTION

The work covered by this special provision consists of all labor and equipment necessary to install new conduit and/or cable into an existing hand-hole or pull-box in accordance with the manufacturer’s specifications and the Charlotte Department of Transportation Traffic Signal Manual. Installation should be in compliance with NCDOT Standard Specifications.

2.0 MATERIAL

No new material for this item unless the CONTRACTOR damages the existing pull-box or conduit while performing this work. Any new material required, such as conduit or pull box, should be paid under section 1715 or 1716.

3.0 CONSTRUCTION METHODS

Construction methods are as set out in **NCDOT Standard Specifications**

4.0 MEASUREMENT AND PAYMENT

This work shall be measured by each new conduit that a CONTRACTOR installs per NCDOT Standards into an existing pullbox.

Payment will be made under:

RELOCATE/ADJUST CONDUIT TO EXISTING PULLBOX EA

# SP-S16 INSTALL VIDEO DETECTION CAMERA (CITY SUPPLIED)

1.0 DESCRIPTION

Consists of all labor and materials to install one (1) Video Detection Camera per the manufacturer’s specifications. This unit is not considered complete until the camera is fully functioning.

2.0 MATERIAL

The CONTRACTOR shall provide all attachment hardware and incidentals necessary for this item and the CITY shall supply the video detection camera. The contractor shall connect the supplied camera using 4- or 7- conductor Signal Cable installed and paid for as a separate line item.

3.0 CONSTRUCTION METHODS

The video detection system hardware shall be designed for flexible, fast, and easy installation and setup.

4.1. It shall be possible to mount the video sensor on an intersection pole, mast arm, or luminaire arm.

4.2. No special tools or extra equipment, other than a laptop for configuration, will be required.

4.3. Once all hardware is installed, connected and functional, it shall be possible to configure the video

detection system for a typical 4-approach, 8-phase intersection in 15 minutes or less.

4.0 MEASUREMENT AND PAYMENT

Labor, equipment, and materials to install video detection camera will be measured and paid as the actual number of City Supplied video detection cameras installed and accepted.

Payment will be made under:

INSTALL VIDEO DETECTION CAMERA (CITY SUPPLIED) EA

# SP-S17 VIDEO DETECTION CAMERA AND COMM MANAGER

1. DESCRIPTION

This specification sets forth the minimum requirements for a video detection system that detects vehicles, bicycles, and motorcycles on a roadway by processing video images and that provides vehicle presence, traffic flow data, event alarms, and full-motion video for real-time traffic control and management systems.

**1. System Hardware**

The video detection system shall be comprised of two major hardware components: a video sensor and a communications interface panel. An optional wired input/output card shall be available for certain cabinet types.

**1.1. Video Sensor**

The video detection system shall include a video sensor that integrates a high-definition (HD) camera with an embedded processor for analyzing the video and performing detection.

**1.1.1. Camera and Processor**

1.1.1.1. The camera shall be a color CMOS imaging array.

1.1.1.2. The camera shall have HD resolution of at least 720p (1280x720 pixels).

1.1.1.3. The camera shall include a minimum 10X optical zoom.

1.1.1.3.1. It shall be possible to zoom the lens as required to satisfy across-the-intersection detection objectives, including stop line and advance detection.

1.1.1.3.2. It shall be possible to zoom the lens remotely from the TMC for temporary traffic surveillance operations or to inspect the cleanliness of the faceplate.

1.1.1.4. The camera shall have direct, real-time iris and shutter speed control by the integrated processor.

1.1.1.5. The processor shall support H.264 video compression for streaming output.

**1.1.2. Video Sensor Enclosure Assembly**

1.1.2.1. The camera and processor shall be housed in a sealed IP-67 enclosure.

1.1.2.1.1. The faceplate of the enclosure shall be glass and shall have hydrophilic coating on the exterior surface to reduce debris accumulation and maintenance.

1.1.2.1.2. The faceplate shall have a thermostatically-controlled indium tin oxide (ITO) heater applied directly on the interior surface to keep the faceplate clear of condensation, snow, ice and frost.

1.1.2.2. An adjustable aluminum visor shall shield the faceplate from the sun and extraneous light sources.

1.1.2.3. An integral aiming sight shall assist in aiming the camera for the detection objectives.

1.1.2.4. A removable rear cap and cable strain relief shall seal the power connection.

1.1.2.4.1. The rear cap shall be tethered to the enclosure to avoid dropping the cap during installation.

1.1.2.4.2. The rear cap shall be fastened to the body of the video sensor with a single, captive bolt.

1.1.2.5. The rear cap and enclosure shall include Gore breathers to equalize internal and external pressure.

1.1.2.6. The sensor shall be self-supporting on manufacturer’s mounting brackets for easier fastening during installation.

1.1.2.6.1. It shall be possible to rotate the field-of-view 360° without changing the angle of the visor.

**1.1.3. Power and Communications**

1.1.3.1. Power and communications for the video sensor shall be carried over a single three-conductor cable.

1.1.3.1.1. Termination of the three-conductor cable shall be inside the rear cap of the enclosure on a three-position, removable Phoenix terminal block. Each conductor shall be attached to the Phoenix plug via a screw connection.

1.1.3.2. The video sensor shall operate normally over an input voltage range of 89 to 265 VAC at 50 or 60 Hz.

1.1.3.3. Power consumption shall be no more than 16 watts typical.

1.1.3.4. No supplemental surge suppression shall be required outside the cabinet.

1.1.3.5. All communications to the video sensor shall be broadband-over-power via the same three-conductor cable that powers the unit. Coaxial cable shall not be required.

**1.2. Communications Interface Panel**

The video detection system shall include an interface panel in the traffic cabinet that manages communications between the video sensors, the traffic management center, a maintenance technician, and the traffic cabinet itself.

**1.2.1. Video Sensor Connection**

1.2.1.1. The communications interface panel shall provide connection points for four video sensors.

1.2.1.1.1. Each sensor connection shall be a 3-pole terminal block, which supplies power and broadband-over-power communications to the sensor.

1.2.1.1.2. The broadband-over-power communications shall provide a throughput of 70 to 90 Mbps.

1.2.1.1.3. The broadband-over-power connection shall support at least 1,000 feet of cabling to the video sensor.

1.2.1.1.4. Each video sensor connection shall include a power switch.

1.2.1.1.5. There shall be an LED for each video sensor to indicate the state of the power to the sensor and an LED for each video sensor to indicate the status of communications.

1.2.1.1.6. Each video sensor connection shall contain a resettable fuse.

1.2.1.1.7. Each video sensor connection shall provide high-energy transient protection.

**1.2.2. Traffic Management Center (TMC) Communications**

1.2.2.1. An Ethernet port shall be provided to connect to a remote Traffic Management Center (TMC).

1.2.2.1.1. The TMC connection shall support 10/100/1000 Mbps Ethernet communication.

1.2.2.1.2. The communications interface panel shall proxy all network requests that arrive on the TMC connection to avoid unwanted network traffic from reaching the broadband-over-power network between the communications interface panel and the video sensors.

1.2.2.1.3. All communications to the video detection system through the TMC connection shall be to a single IP address.

**1.2.3. Local User Communications**

1.2.3.1. A wired Ethernet port shall be provided to connect the technician at the cabinet to the video detection system for setup and maintenance purposes.

1.2.3.1.1. The maintenance port shall support 10/100/1000 Mbps Ethernet communication.

1.2.3.1.2. All communications to the video detection system through the maintenance port shall be to a single IP address.

1.2.3.1.3. The maintenance port shall support DHCP to automatically assign an IP address to the user’s computer, if desired.

1.2.3.2. An 802.11g Wi-Fi access point shall allow wireless connection to the video detection system at the cabinet for setup and maintenance purposes.

1.2.3.2.1. All communications to the video detection system through the Wi-Fi access point shall be to a single IP Address.

1.2.3.2.2. The Wi-Fi access point shall support DHCP to automatically assign an IP Address to the user’s computer.

1.2.3.2.3. The Wi-Fi access point shall include a dipole, omnidirectional antenna.

1.2.3.2.4. A momentary pushbutton shall allow the user to turn the Wi-Fi access point on or off.

1.2.3.2.5. The Wi-Fi access point shall turn itself off automatically after a period of inactivity from connected devices.

1.2.3.2.6. An LED shall indicate when the Wi-Fi access point is enabled.

1.2.3.2.7. The Wi-Fi access point shall operate simultaneously with the wired maintenance port and with the TMC connection.

**1.2.4. Traffic Controller Connection**

The communications interface panel shall provide one connection to communicate to the traffic controller through the cabinet.

1.2.4.1. The traffic controller connection shall support a TS2 Type 1 compatible SDLC interface. 1.2.4.1.1. The traffic controller connector shall be a 15-pin female metal shell D sub-miniature type connector to support a standard NEMA TS2 or TEES SDLC cable.

1.2.4.1.2. The traffic controller connection shall support a protocol interface to SDLC-capable traffic controllers (NEMA or TEES).

1.2.4.1.3. The traffic controller connection shall support the NEMA TS2 SDLC protocol to include up to 64 detector outputs and 32 inputs.

1.2.4.2. The traffic controller connection shall be able to connect to a wired input/output card, which supports wired I/O in cabinets without a SDLC-capable controller. 1.2.4.2.1. The wired I/O data communications link shall support at least 24 outputs and 16 inputs.

1.2.4.3. It shall be possible to connect and use both SDLC communications and communication to the wired input/output card simultaneously.

**1.2.5. USB Ports**

1.2.5.1. The communications interface panel shall include two USB 2.0 ports.

1.2.5.1.1. If a communications interface panel fails to start and run due to a software or operating system failure, it shall be possible to reinstall all system and application software from a USB memory stick without necessitating removal of the communications interface panel from the cabinet.

**1.2.6. Power**

1.2.6.1. The communications interface panel shall accept input voltage in the range of 89-265 VAC, 50/60 Hz power from the transient-protected side of the cabinet.

1.2.6.2. The communications interface panel shall be protected by two slow blow fuses. Spares shall be attached to the panel.

**2. System Software**

The video detection system shall include management software for configuration, monitoring and data collection purposes.

**2.1. Management Software**

2.1.1. Management software shall be a Windows-based application.

2.1.1.1. The software shall be compatible with Windows 7 and Windows 10 operating systems.

2.1.1.2. The software shall communicate with the video detection system via Ethernet.

2.1.2. The management software shall automatically determine all video sensors and communications interface panels available on the local network and populate a list of all devices.

2.1.3. The management software shall provide the user a means to name individual video sensors and communications interface panels.

2.1.4. The management software shall provide a means for the user to zoom the camera optics while viewing a live video stream.

2.1.5. The management software shall provide a means for the user to calibrate distances in the field of view.

2.1.6. The management software shall provide the user a means to create 4-sided detection zones in the field of view using either a still snapshot or live video.

2.1.6.1. The management software will overlay an outline of each detection zone over the background image.

2.1.6.2. It shall be possible for the user to place detection zones anywhere in the field of view for stop line detection and/or advance detection.

2.1.6.3. It shall be possible for the user to set the desired color of both the on and off states of the detection zone overlay.

2.1.6.4. It shall be possible for the user to alter the size and shape of any previously created zone.

2.1.6.5. It shall be possible for the user to overlap zones, either partially or fully.

2.1.6.6. It shall be possible for the user to name each zone uniquely.

2.1.6.7. It shall be possible for the user to assign each zone to detect vehicles, to detect bicycles, or to detect both, and to specify different outputs for each type.

2.1.6.8. It shall be possible for the user to assign the same output to multiple zones such that the output will be on if any of the zones are detecting a vehicle or bicycle.

2.1.6.9. It shall be possible for the user to assign a single zone to more than one output such that if a vehicle or bicycle is detected, all the assigned outputs shall be turned on.

2.1.6.10. The management software shall be capable of creating at least 99 detection zones per video sensor.

2.1.7. It shall be possible for the management software to retrieve all configuration parameters from video sensors or communications interface panels.

2.1.7.1. It shall be possible for the user to save all the settings for a video sensor or a communications interface panel to a laptop file.

2.1.7.2. The management software shall provide a means to read or import all the settings from a previously saved configuration file for a video sensor or a communications interface panel.

2.1.8. The management software shall be able to download a new version of the application software into a communications interface panel and its attached video sensors.

2.1.9. The management software shall provide a screen to monitor operation of a video sensor. 2.1.9.1. The monitoring screen shall include a live video stream from the video sensor with at least HD 1280x720 pixel resolution.

2.1.9.2. The monitoring screen shall show indications of detection in real time by changing the color of the detection zone.

2.1.9.3. It shall be possible for the user to configure different indications for vehicle detections vs. bicycle detections when both are configured for the same zone.

2.1.9.4. The monitoring screen shall include the following optional, configurable objects. It shall be possible for the user to size and position them anywhere on the screen and to change the color and size of text.

2.1.9.4.1. An indication of when an output is on or off, along with a user-configurable name for that indicator.

2.1.9.4.2. The current time in the video sensor.

2.1.9.4.3. A user-configurable title or name.

2.1.9.4.4. The version number of the video sensor software.

2.1.9.5. It shall be possible for the user to turn the overlay graphics on or off with a single setting.

2.1.10. The management software shall provide a screen to monitor operation of the intersection with a quad-view video stream from the communications interface panel. 2.1.10.1. The quad-view video stream shall have a resolution of at least HD 1280x720 pixels, where each of the sensor videos comprising the quad-view shall be at least 640x360 pixels.

2.1.10.2. It shall be possible for the user to configure the order that the sensor videos appear in the quad-view.

2.1.10.3. The real-time quad-view video stream shall be capable of displaying the overlay graphics for all four sensors simultaneously.

2.1.11. While monitoring the video of a single video sensor or of the quad-view, it shall be possible for the user to request a “snapshot” or single-frame image to save to a named file on a laptop.

2.1.12. While monitoring the video of a single video sensor or of the quad-view, it shall be possible for the user to record a period of the video to save to a named file on a laptop.

**3. System Functionality**

The video detection system shall provide the following features and functionality.

**3.1. Detection Performance**

3.1.1. The video detection system shall detect the presence of vehicles in defined zones and turn on the assigned output when the vehicle is present in the zone.

3.1.1.1. Stop Line Detection

3.1.1.1.1. For detection zones placed at the stop line, the probability of not detecting the presence of a vehicle shall be 1% or less under all operating conditions when the video sensor is installed and configured properly.

3.1.1.1.2. For detection zones placed at the stop line, the probability of falsely detecting a vehicle that is not present shall be 3% or less under all operating conditions when the video sensor is installed and configured properly.

3.1.1.2. Advance Detection

3.1.1.2.1. It shall be possible to place advance detector zones such that the farthest point of the zone is up to 600 feet from the video sensor. Advance detector zone placement shall include 2-3 car lengths of field-of-view beyond the farthest point of the zone.

3.1.2. To ensure statistical significance for the above detection performance specifications, the data shall be collected over 24-hour time intervals (so as to avoid a single lighting condition) and will contain a minimum of one hundred (100) vehicles per lane. The calculations of detection performance will not include turning movements where vehicles do not pass through the detectors, vehicle lane-change anomalies, or where they stop short or stop beyond the combined detection zones.

**3.2. Failsafe Mode**

3.2.1. The video detection system shall provide a failsafe mode for each video sensor. If the failsafe mode is enabled, all programmed presence detection outputs for the video sensor shall be turned on, thus placing constant calls to the controller. When failsafe mode is disabled, all outputs revert to normal on/off operations.

3.2.2. The video sensor shall continuously monitor the overall contrast in the video. If the overall contrast falls below a preset level (such as caused by dirty faceplate, severe glare, extreme fog, or temporary ice/snow on the faceplate), the sensor shall enable the failsafe mode. When sufficient contrast is restored in the video, the sensor will disable the failsafe mode.

3.2.3. The communications interface panel shall continuously monitor the connectivity status of the attached video sensors. If any video sensor goes offline due to either electrical failure or internal software failure, the communications interface panel shall enable the failsafe mode for that video sensor. If the video sensor comes back online, failsafe mode shall be disabled.

**3.3. Data Collection**

3.3.1. The video detection system shall automatically collect and store traffic flow data in non-volatile memory for later retrieval and analysis. No additional hardware or software shall be necessary. The data shall include:

3.3.1.1. Vehicle counts.

3.3.1.2. Vehicle average speeds.

3.3.2. The management software shall be able to retrieve collected data for a specified period of time or for all currently stored data and save into a standard CSV file.

**3.4. Operations Log**

3.4.1. The communications interface panel and each video sensor shall maintain a time-stamped operations log of routine and special events in non-volatile memory for later retrieval and analysis.

**3.5. Time Synchronization**

3.5.1. The video detection system and management software shall provide three methods to synchronize the time of day clocks in the communication interface panel and the video sensors, as follows:

3.5.1.1. Manual time synchronization operation by the user, which sets the time to the current time on the laptop where the management software is running.

3.5.1.2. A configuration setting to allow the communications interface panel to automatically obtain time from the NEMA TS2 protocol on the SDLC channel and broadcast it to the video sensors.

3.5.1.3. A configuration setting to allow the communications interface panel to automatically obtain time from up to five Network Time Protocol (NTP) sources and broadcast it to the video sensors.

**3.6. Video Streaming**

3.6.1. In addition to the ability to view video streams in the management software, it shall be possible to view video from individual sensors or to view the quad-view from the communications interface panel using a third-party video player application on a tablet, smartphone, or laptop computer.

**4. Installation and Setup**

The video detection system hardware shall be designed for flexible, fast, and easy installation and setup.

4.1. It shall be possible to mount the video sensor on an intersection pole, mast arm, or luminaire arm.

4.2. No special tools or extra equipment, other than a laptop for configuration, will be required.

4.3. Once all hardware is installed, connected and functional, it shall be possible to configure the video

detection system for a typical 4-approach, 8-phase intersection in 15 minutes or less.

**5. Warranty, Service and Support**

The video detection system shall be provided with the following warranty, service, and support options.

**5.1. Warranty**

5.1.1. The manufacturer shall warrant the video detection system for a minimum of three (3) years. An option for up to six (6) years of warranty shall be available.

**5.2. Service**

5.2.1. Ongoing software support by the manufacturer will include software updates of the video sensor, communications interface panel, and management software. These updates will be provided free of charge during the warranty period. The manufacturer will maintain a program for technical support and software updates following expiration of the warranty period. This program will be available to the contracting agency in the form of a separate agreement for continuing support.

**5.3. Support**

5.3.1. A quick-start guide, installation guide, application notes, and other materials shall be available from the manufacturer to assist in product installation and setup for various applications. In addition, training online or in person shall be available.

5.3.2. Training shall be available to personnel of the contracting agency in application design, operation, setup, and maintenance of the video detection system.

5.3.3. Manufacturer shall provide a tech support website and an 800 number for technical support.

2.0 MATERIAL

The CONTRACTOR shall provide all materials necessary for this item, including the single three-conductor camera cable.

3.0 CONSTRUCTION METHODS

The video detection system hardware shall be designed for flexible, fast, and easy installation and setup.

4.1. It shall be possible to mount the video sensor on an intersection pole, mast arm, or luminaire arm.

4.2. No special tools or extra equipment, other than a laptop for configuration, will be required.

4.3. Once all hardware is installed, connected and functional, it shall be possible to configure the video

detection system for a typical 4-approach, 8-phase intersection in 15 minutes or less.

4.0 MEASUREMENT AND PAYMENT

Labor, equipment, and materials to install video detection cameras will be measured and paid as the actual number of video detection cameras that are supplied, installed, and accepted.

Payment will be made under:

SUPPLY & INSTALL VIDEO DETECTION CAMERA EA

SUPPLY & INSTALL VIDEO DETECTION CAMERA COMM MANAGER EA

# SP-S18 METAL STRAIN POLES

ALL STEEL STRAIN POLE WORK SHALL MEET THE REQUIREMENTS OF THE NCDOT STANDARD SPECIFICATIONS AND DRAWINGS. THESE DRAWING AND SPECIFICATIONS MAY BE FOUND AT THE NCDOT WEBSITE. THE FOLLOWING LINK IS ATTACHED FOR YOUR CONVIENCE; IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO ENSURE THEY ARE FOLLOWING THE MOST CURRENT SPECIFICATION.

<https://connect.ncdot.gov/resources/safety/pages/ITS-Design-Resources.aspx>

1.0 DESCRIPTION

This item is to supply and install steel strain poles. Fabrication and Installation shall be in compliance with NCDOT Standard Specifications and the attached NCDOT STANDARD DRAWINGS FOR METAL POLES.

2.0 MATERIAL

The CONTRACTOR shall provide steel strain poles designed as noted in attached NCDOT STANDARD DRAWINGS FOR METAL POLES. The CONTRACTOR shall submit shop drawings for approval prior to ordering steel strain poles. Steel strain poles shall be in compliance with NCDOT Standard Specifications for metal poles.

3.0 CONSTRUCTION METHODS

Construction methods are as set out in **NCDOT Standard Specifications**

4.0 MEASUREMENT AND PAYMENT

The metal poles will be measured on a per each basis for each metal pole installed and accepted

Payment will be made under:

SUPPLY AND INSTALL 25’ METAL STRAIN POLES EA

SUPPLY AND INSTALL 30’ METAL STRAIN POLES EA

SUPPLY AND INSTALL 35’ METAL STRAIN POLES EA

# SP-S19 CONCRETE BASE FOR STRAIN POLE FOUNDATION

ALL STEEL STRAIN POLE WORK SHALL MEET THE REQUIREMENTS OF THE NCDOT STANDARD SPECIFICATIONS AND DRAWINGS. THESE DRAWING AND SPECIFICATIONS MAY BE FOUND AT THE NCDOT WEBSITE. THE FOLLOWING LINK IS ATTACHED FOR YOUR CONVIENCE; IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO ENSURE THEY ARE FOLLOWING THE MOST CURRENT SPECIFICATION.

<https://connect.ncdot.gov/resources/safety/pages/ITS-Design-Resources.aspx>

1.0 DESCRIPTION

This item is to supply/install concrete base for steel strain poles. Installation shall be in compliance with NCDOT Standard Specifications and attached NCDOT STANDARD DRAWINGS FOR METAL POLES.

2.0 MATERIAL

The CONTRACTOR shall provide the steel reinforcing and concrete for base foundations for steel strain poles. The concrete base foundation shall be in compliance with NCDOT Standard Specifications and attached NCDOT STANDARD DRAWINGS FOR METAL POLES. The CONTRACTOR shall submit shop drawings for approval prior to construction of concrete foundations for strain pole foundation.

3.0 CONSTRUCTION METHODS

Construction methods are as set out in **NCDOT Standard Specifications**

4.0 MEASUREMENT AND PAYMENT

Payment will be made under:

SUPPLY AND INSTALL CONCRETE BASE FOR STRAIN POLE FOUNDATION EA

# SP-S20 SOIL TEST FOR STRAIN POLE

ALL STEEL STRAIN POLE WORK SHALL MEET THE REQUIREMENTS OF THE NCDOT STANDARD SPECIFICATIONS AND DRAWINGS. THESE DRAWING AND SPECIFICATIONS MAY BE FOUND AT THE NCDOT WEBSITE. THE FOLLOWING LINK IS ATTACHED FOR YOUR CONVIENCE; IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO ENSURE THEY ARE FOLLOWING THE MOST CURRENT SPECIFICATION.

<https://connect.ncdot.gov/resources/safety/pages/ITS-Design-Resources.aspx>

1.0 DESCRIPTION

This item is to test soil for concrete base for steel strain poles. Installation shall be in compliance with NCDOT Standard Specifications for metal poles.

2.0 MATERIAL

The CONTRACTOR shall provide the soil samples for concrete base foundations for steel strain poles. The concrete base foundation shall be TESTED in compliance with NCDOT Standard Specifications for metal poles.

3.0 CONSTRUCTION METHODS

Construction methods are as set out in **NCDOT Standard Specifications**

4.0 MEASUREMENT AND PAYMENT

Soil Test for Strain Pole will be paid for each soil test accepted and approved by the City

Payment will be made under:

SOIL TEST FOR STRAIN POLE EA

# SP-S21 POLE SPAN COLLARS

ALL STEEL STRAIN POLE WORK SHALL MEET THE REQUIREMENTS OF THE NCDOT STANDARD SPECIFICATIONS AND DRAWINGS. THESE DRAWING AND SPECIFICATIONS MAY BE FOUND AT THE NCDOT WEBSITE. THE FOLLOWING LINK IS ATTACHED FOR YOUR CONVIENCE; IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO ENSURE THEY ARE FOLLOWING THE MOST CURRENT SPECIFICATION.

<https://connect.ncdot.gov/resources/safety/pages/ITS-Design-Resources.aspx>

1.0 DESCRIPTION

This item is to supply/install pole span collars for steel strain poles. Installation shall be in compliance with NCDOT Standard Specifications for metal poles.

2.0 MATERIAL

The CONTRACTOR shall provide pole span collars for steel strain poles. The concrete base foundation shall be in compliance with NCDOT Standard Specifications for metal poles.

3.0 CONSTRUCTION METHODS

Construction methods are as set out in **NCDOT Standard Specifications**

4.0 MEASUREMENT AND PAYMENT

Soil Test for Strain Pole will be paid for each POLE SPAN COLLAR accepted and approved.

Payment will be made under:

SUPPLY AND INSTALL POLE SPAN COLLARS EA

# SP-S22 TEMPORARY TRAFFIC SIGNALS

1.0 DESCRIPTION

The City will provide the following equipment to the contractor for temporary signal installation: signal heads, pedestrian signal heads, blank out signs, overhead signs, and traffic controller cabinets. This line item covers all labor, other hardware and equipment necessary to maintain traffic signal operations during construction. This work can be a combination of wiring to existing mast arms, temporary wood poles, spans, signal heads and guys as well as any other temporary equipment necessary to be installed by the contractor.

Temporary traffic signals shall be installed in accordance with Section 1700-3 (D) of the NCDOT Standard Specifications with the exception that all signal cabinets, controllers, detector units, signal heads and accessories are the property of the CITY. All existing material and temporary equipment installed by the contractor such as signal heads, pedestrian signals, overhead signs and street name markers, span wire and copper cables are to be retained by the CITY. These items shall be returned to the Transportation Operations Division located at 3701 Craig Avenue. All wire and cables are to be coiled in 2’ – 3’ diameter coils wrapped with black tape. The Contractor shall notify Mr. Chris Jugis at (704) 336-2315 at least 24 hours in advance of dropping off any materials. Materials can only be dropped off between the hours of 9:00 am and 2:00 pm Monday – Thursday.

The City may provide temporary traffic signal plans in the project plan set. The contractor can determine the optimal location for the temporary wood poles so as not interfere with his operations. The Contractor will be responsible for coordinating with CDOT to establish acceptable locations of temporary wood poles and down guys so that they can be used to provide acceptable signal indications.

If the Contractor proposes any revisions to the existing traffic signals or temporary traffic signals, the Contractor will coordinate with CDOT using the process outlined below. The associated time frames are to allow CDOT to make any signal plan revisions necessary to accommodate a change in field conditions.

* 1. For Temporary Signals Going Live with a New or Relocated Cabinet:
     1. At least 30 days notification prior to needing to work on the signal implemented, the Contractor is to provide a formal request to CDOT. An email putting the request in writing and including the information below will suffice.
     2. The Contractor is to provide a sketch of the intersection including pole locations, lane layout, and stop bar locations for the proposed phase of the traffic control plans as starting point (base map).
     3. CDOT will design a signal plan based on the sketch information. CDOT will request a new power service if needed.

CDOT will include the timing and clearance chart in their final plan.

* + 1. The final approved plan will be issued to the Contractor & Inspection Staff.
    2. A signal pre-construction meeting will be scheduled before work begins.
    3. The Contractor will call CDOT to arrange for traffic signal controller cabinet delivery.
    4. The Contractor is to install the meter can and coordinate inspections with CDOT and the State Electrical inspector in order for Duke to be notified that meter can be set.
    5. The Contractor pulls power, cabling into cabinet and fiber from Joint Duct Bank to cabinet.
    6. CDOT Splicer establishes communications between cabinet and fiber system in Joint Duct Bank and CDOT lab personnel completes wiring / programming inside cabinet.
    7. If a new signal at currently unsignalized intersection, flash for appropriate time prior to operation using CDOT guidelines . If new cabinet location at existing signalized intersection, no flash needed.
  1. Signal Reconfiguration:
     1. At least 14 days prior to desire to reconfigure signal, The Contractor to provide formal request to CDOT. An email putting the request in writing and including the information below will suffice.
     2. Follow steps ii through v above. A pre-construction meeting may not be needed depending upon the nature of the change. No flash needed.

Minor Signal Modifications (used when pavement markings do not change): Shifting heads can be done by the Contractor under direction from the project Inspection Staff.

2.0 MEASUREMENT

The Contractor shall furnish, erect, operate, maintain, relocate and remove all temporary and permanent traffic signal equipment on the Project as necessary in accordance with the Project plans and specifications.

The Contractor shall notify the Implementation Section Manager of CDOT at least 30 calendar days prior to the installation, relocation or removal of traffic signal equipment on the Project. The Contractor shall not disturb any traffic signal equipment without a CDOT representative present, unless otherwise noted on the traffic control plans or directed to do so by the Engineer. Contractor responsibilities include but are not limited to:

* 1. Adjusting existing traffic signals and intersection signs during construction.
  2. Furnishing and setting temporary wooden poles for the purpose of temporary traffic signal installation.
     1. Wood poles shall be structural timber as defined in the NCDOT Standard Specifications. Poles shall be treated with chromated copper arsenate to a minimum of 2 lb/cf. Poles shall be 40 ft, class 5.
     2. A hole that will allow adequate compaction of the earth after placement of the wood pole shall be drilled or augured.
     3. After placement of the pole, the hole shall be backfilled with the excavated material and the material shall be compacted to a density at least equivalent to that of the surrounding material. Compaction shall be performed in lifts that do not exceed 6 inches in depth.
     4. The wood pole shall be installed so that the pole is within 2 degrees of vertical when loaded with the suspension spans, signals and signs shown on the plans.
     5. The pole shall be set at the depth recommended by the manufacturer.
  3. Installing all poles, span wires, guy wires, ground wires, and signal heads and other equipment necessary for an operational temporary traffic signal.
  4. Installing or removing temporary or permanent pavement markings during signal installations or modifications.
  5. Maintaining temporary street lighting during signal installation or modification.
  6. Installing and maintaining traffic control for the intersection, and
  7. Obtaining, protecting, and maintaining any staging areas necessary for the temporary or permanent traffic signal installation.

Traffic signal installation, and installation of associated cabinets, cables, and other appurtenances, shall conform to the current CDOT Traffic Signal Specifications, 2018 NCDOT Standard Specifications, the 2018 NCDOT Standard Drawings, and these specifications. A CDOT representative will be present for all signal installations and modifications. Contractor shall notify CDOT of the intent to install new traffic signal facilities at least 2 weeks before the beginning of work.

City will be responsible for all equipment and wiring within all temporary and final controller cabinets on the project.

3.0 PAYMENT

The items indicated within the payment sectionwill be measured andpaid as the actual number of each item installed and accepted. All subsequent traffic shifts and modifications to the temporary traffic signal are considered incidental to this line item. No separate payment will be made to temporary traffic signal work after the initial temporary traffic signal is installed. Work under these payment items shall include the removal of temporary items as necessary.

Refer to Section 1700-3 (D) of the NCDOT Standard Specifications for other items required to furnish temporary traffic signals.

Payment will be made under:

**SUPPLY/INSTALL/REMOVE TEMPORARY WOOD POLES EA**

**SUPPLY/INSTALL/REMOVE TEMPORARY 10M SIDEWALK DOWN GUYS EA**

**SUPPLY/INSTALL/REMOVE TEMPORARY 10K SCREW ANCHOR EA**

**SUPPLY/INSTALL/REMOVE TEMPORARY 3/8” GALVANIZED SPAN WIRE WITH HARDWARE LF**

**INSTALL/RETURN TEMPORARY 12” 3-SECTION SIGNAL HEAD (CITY SUPPLIED) EA**

**INSTALL/RETURN TEMPORARY 12” 4-SECTION SIGNAL HEAD (CITY SUPPLIED) EA**

**INSTALL/RETURN TEMPORARY 12” 5-SECTION SIGNAL HEAD (CITY SUPPLIED) EA**

**INSTALL/RETURN TEMPORARY 16” PEDESTRIAN SIGNAL HEAD (CITY SUPPLIED) EA**

**INSTALL/RETURN TEMPORARY BLANK OUT SIGN (CITY SUPPLIED) EA**

**INSTALL/RETURN TEMPORARY OVERHEAD SIGN (CITY SUPPLIED) EA**

# SP-S23; SOLAR POWERED RECTANGULAR RAPID FLASHING BEACONS (RRFB)

1.0 GENERAL

A. The work covered by this special provision includes furnishing and installing Rectangular Rapid Flashing Beacons (RRFB) in accordance with the current edition of the North Carolina Department of Transportation (NCDOT) Traffic Signal Specifications, CDOT requirements, and the provisions of these specifications.

B. RRFB assemblies must be attached to a W11-2 (Pedestrian) crossing warning sign with a diagonal downward arrow (W16-7p) plaque, a pedestrian pole with base (SP-S3), and attachment hardware with pushbuttons in the median stop and on each side of the roadway. On multi-lane approaches, RRFB assemblies shall be dual indicated.

C. Equipment must operate on solar power. Solar powered systems must automatically charge batteries and prevent overcharging and over-discharging. Solar powered systems must include a charge indicator and AC/DC battery charger.

2.0 MATERIALS

A. Light Bar Housing and Indications

1. The Light Bar housing shall be constructed of durable, corrosion resistant powder-coated aluminum with stainless steel fasteners.

2. Enclosed components shall be modular in design whereby any component can be easily replaced using common hand tools, without having to remove the housing from the pole.

3. All mounting hardware required for mounting the Light Bar housing shall be provided, and shall be stainless steel.

4. Each of the two vehicle RRFB-XL™ LED indications shall be approximately 7.25" wide x 3" high.

5. A pedestrian LED indication, approximately 0.5" wide x 2.5" high, shall be side-mounted in the Light Bar housing to be directed at and visible to pedestrians in the crosswalk.

6. The LEDs used shall be rated for a minimum 15-year life span.

B. Controller

1. The Controller shall be housed in a NEMA 3R rated aluminum enclosure, intended for indoor or outdoor use, primarily to provide a degree of protection against corrosion, windblown dust and rain, splashing water, hose-directed water, and damage from ice formation.

2. The LED light outputs and flash pattern shall be completely programmable, with the capability to actuate RRFB-XL, RRFB, round LED signal beacons and LED-enhanced signs.

3. The flashing output shall have 70 to 80 periods of flashing per minute, during which one of the yellow indications shall emit two medium pulses of light and the other yellow indication shall emit four short rapid pulses of light followed by a long pulse. The output current shall be maintained as programmed for the duration of the pulse. The flashing output shall be programmable.

4. The Controller shall be reconfigurable if future MUTCD or State guidelines specify a different flash pattern.

5. The Controller shall be capable of storing input count data in preset intervals, with downloadable capabilities using optional Windows based PC software program and standard RS232 programming cable.

6. The Controller shall be, in the unlikely event of failure, replaceable independently of other components.

C. Battery

1. The Battery shall be a 12VDC Absorbed Glass Mat (AGM) sealed lead-acid, maintenance-free battery.

2. The Battery shall be rated at 45AH minimum and shall conform to Battery Council International (BCI) specifications.

3. The Battery shall be solar-charged with a capacity up to 30 days of autonomy without sunlight, varying with ambient temperature and number of activations.

4. The Battery shall be replaceable independently of other components.

5. The Battery shall have a minimum operating temperature range of -76o to 140oF (-60o to 60oC).

D. Wireless Transceiver Radio

1. Radio control shall be solar-powered, operating on a FCC approved 900mhz frequency, hopping spread spectrum network with a normal operating range of 1000 feet.

2. Radios shall provide wireless communication between the Assemblies to integrate the pushbutton activation of indications.

3. To ensure all integral indications consistently flash in unison, the Radio shall synchronize the Controllers to activate the indications within 120msec of one other and remain synchronized throughout the duration of the flashing cycle.

4. Radio systems shall operate from 3.6 VDC to 15 VDC.

5. The Radio shall be, in the unlikely event of failure, replaceable independently of other components.

6. The Radio shall have a minimum operating temperature range of -30oF to 165oF (-34.4o to 73.8oC).

E. Solar Panel

1. The Solar Panel shall provide 55 watts at peak total output.

2. The Solar Panel shall be affixed to an aluminum plate and bracket, adjustable at an angle of 45o - 60o to facilitate adjustment for maximum solar collection and optimal battery strength.

3.0 EXECUTION

A. The light intensity of the vehicle indications shall meet the minimum specifications of Society of Automotive Engineers (SAE) standard J595 (Directional Flashing Optical Warning Devices for Authorized Emergency, Maintenance, and Service Vehicles) dated November 2008. Manufacturer Certification of Compliance shall be provided upon request.

B. When activated, all indications associated with a given crosswalk (including those with an advance crossing sign, if used) shall simultaneously commence operation of their alternating rapid flashing within 120msec, and shall cease operation at a predetermined time after the pedestrian actuation.

C. The Pedestrian indication shall be directed at and visible to pedestrians in the crosswalk, and it shall flash concurrently with the vehicle indications to give confirmation that the RRFB-XL™ is in operation.

D. The system shall include an actuation counter providing data that can be downloaded on-site to a laptop computer using DB9 or USB type cables.

E. Autonomy with a fully charged battery shall be up to 14-28 days without sun, dependent upon ambient temperature and number of activations.

F. Restore any areas impacted by the installation of the crosswalk enhancement assembly to original condition unless otherwise shown in the Plans. Install crosswalk enhancement assembly in accordance with the Americans with Disabilities Act Standards for Transportation Facilities.

G. Ensure the midblock crosswalk enhancement assembly has a manufacturer’s warranty covering defects for two years from the date of final acceptance. Ensure the warranty includes providing replacements within10 calendar days of notification for defective parts and equipment during the warranty period at no cost to the Department or the maintaining agency.

4.0 MEASUREMENT AND PAYMENT

A. RRFBs are intended to operate in pairs. The quantity of RRFBs to be paid for will be the actual number of RRFBs which have been furnished, installed and accepted, measured on a per PAIR basis.

B. The quantity of RRFBs, measured as provided above, will be paid for at the contract unit price per PAIR. Such payment will be full compensation for all work covered by this special provision, including but not limited to all excavation, furnishing and installing the RRFB.

Payment will be made under:

SOLAR POWERED RECTANGULAR RAPID FLASHING BEACON PAIR

# SP-S24 INSTALL RECTANGULAR RAPID FLASHING BEACONS (RRFB) (CITY SUPPLIED)

1.0 DESCRIPTION

This item includes the labor and any necessary hardware to install one PAIR of Rectangular Rapid Flashing Beacons (RRFBs) as supplied by the City. Installation shall be in accordance with SP-S23. This item does not include foundations, poles, signs and installation of pushbuttons as those are separate pay items.

2.0 MEASUREMENT

Install Rectangular Rapid Flashing Beacons (RRFB) (City Supplied) will be measured and paid as the actual number of APS Detectors & Signs installed and accepted. A Sign and corresponding detector shall be considered one unit.

3.0 PAYMENT

Payment will be made under:

INSTALL RECTANGULAR RAPID FLASHING BEACONs (RRFB) (CITY SUPPLIED) PAIR

# SP-S25 SCREW-IN HELICAL FOUNDATION ASSEMBLY (1743 MODIFIED)

1.0 DESCRIPTION

This item includes the labor and any necessary hardware to install one Screw-In Helical Foundation to support the installation of pedestal or camera poles as described in NCDOT Standard Specification 1743. Screw-in foundations are not to be used in concrete sidewalk without prior approval of The Engineer. Appropriate reach to pushbuttons per PROWAG, MUTCD and ADA must be maintained.

2.0 MATERIAL

Materials are as set out in **NCDOT Standard Specification 1743.**

3.0 CONSTRUCTION METHODS

Construction methods are as set out in **NCDOT Standard Specification 1743.**

4.0 MEASUREMENT AND PAYMENT

*Screw-In Helical Foundation Assembly* will be measured and paid for as the actual number of helical foundations installed and accepted.

Payment will be made under:

SCREW-IN HELICAL FOUNDATION ASSEMBLY (TYPE I) EA

SCREW-IN HELICAL FOUNDATION ASSEMBLY (TYPE II) EA

# SP-F1 AERIAL FIBER OPTIC CABLE (WITH HARDWARE)

1.0 DESCRIPTION

Consists of all labor and material necessary to install one (1) foot of aerial dry tube fiber optic cable in place including supporting messenger of ¼ inch diameter 6.6M class A galvanized steel extra high strength grade strand, .045-inch stainless steel lashing wire and hardware, double lashing the cable to the strand, bonding of the shield and strand in accordance with the Construction Sheets. All pole line hardware to be hot dipped galvanized steel. Also included is the placing of a CDOT provided cable identification tag at each pole.

The fiber optic cable will be single mode, low water peak, single jacket, armored, with loose no gel buffer tube and dielectric strength member construction. The number of fibers required is shown on the plans and will not exceed 288-fibers for this unit. The cable will be double window tested at 1310nm and 1550nm with .35db/km and .25db/km attenuation, respectively.

The length of aerial cable measured for compensation purposes includes the sum of the cable distances between supporting structures as indicated by the sequential foot markings.

2.0 MEASUREMENT

Labor, equipment, and materials required in the installation of each item.

1. PAYMENT

Payment will be made under:

24 FIBER AERIAL FIBER OPTIC CABLE (WITH HARDWARE) LF

36 FIBER AERIAL FIBER OPTIC CABLE (WITH HARDWARE) LF

48 FIBER AERIAL FIBER OPTIC CABLE (WITH HARDWARE) LF

72 FIBER AERIAL FIBER OPTIC CABLE (WITH HARDWARE) LF

96 FIBER AERIAL FIBER OPTIC CABLE (WITH HARDWARE) LF

144 FIBER AERIAL FIBER OPTIC CABLE (WITH HARDWARE) LF

288 FIBER AERIAL FIBER OPTIC CABLE (WITH HARDWARE) LF

# SP-F2 UNDERGROUND FIBER OPTIC CABLE

1.0 DESCRIPTION

Consists of all labor and material necessary to install one (1) foot of underground dry tube fiber optic cable in underground conduit and handholes. This unit also consists of setting up the cable within the handhole, providing and placing pull lines, duct seals or plugs, and rodding and cleaning of ducts, all as required in accordance with the plans. The Contractor shall not exceed the maximum pulling tension of the cable as specified by the manufacturer. Also included is the placing of a CDOT provided cable identification tag at each handhole or pullbox.

The fiber optic cable will be single mode, low water peak, single jacket, armored, sunlight resistant, outdoor rated, with loose no gel buffer tube and dielectric strength member construction. The number of fibers required is shown on the plans and shall not exceed 288-fibers for this unit. The cable will be double window tested at 1310nm and 1550nm with .35db/km and .25db/km attenuation, respectively.

2.0 MEASUREMENT

Labor, equipment, and materials required in the installation of each item. The length of underground cable measured for compensation purposes is determined by measuring the distances paralleling the cable plus the vertical lengths of cable installed on supporting structures.

3.0 PAYMENT

Payment will be made under:

24 FIBER UNDERGROUND FIBER OPTIC CABLE LF

36 FIBER UNDERGROUND FIBER OPTIC CABLE LF

48 FIBER UNDERGROUND FIBER OPTIC CABLE LF

72 FIBER UNDERGROUND FIBER OPTIC CABLE LF

96 FIBER UNDERGROUND FIBER OPTIC CABLE LF

144 FIBER UNDERGROUND FIBER OPTIC CABLE LF

288 FIBER UNDERGROUND FIBER OPTIC CABLE LF

# SP-F3 FIBER OPTIC CABLE STUB

1.0 DESCRIPTION

Consists of all labor and material to install one (1) foot of 6-fiber fiber optic cable for a field-terminated patch panel. The fiber cable shall be riser-rated, single-mode, indoor/outdoor, gel-free, all dielectric cable with flame retardant UV-resistant outer jacket, and an attenuation loss not exceeding 0.4db/km @ 1310nm. The attenuation loss for the complete assembly shall not exceed 1.5db. Also, included is the placing of a CDOT-provided cable identification tag at each handhole or pull box. The fiber optic patch panel shall be paid for under the FIBER OPTIC PATCH PANEL unit.

**Example:**

Corning FREEDM® LST™ Cables, Part # 006ESF-T4101D20 (6 fiber, single mode, Gel-free Cable, indoor/outdoor riser, 12 fibers per tube standard, with markings every 4 feet, performance rated for SMFO with no additional special requirements)

2.0 MEASUREMENT

Labor, equipment, and materials required in the installation of each item.

3.0 PAYMENT

Payment will be made under:

6-FIBER CABLE STUB LF

# SP-F4 FIBER OPTIC PATCH PANEL

1.0 DESCRIPTION

Consists of all labor and material to install one (1) field-terminated fiber optic cable patch panel. There shall be 6 ports in the housing, matching 6 fibers in the stub cable. The patch panel shall be equipped with enough ST-type connector ports to accommodate all fibers in the stub and each port shall have a factory-installed fiber jumper of one meter in length. The unit shall be placed on a traffic control box shelf, but not permanently secured. This unit includes the required number of single fusion splices to splice each fiber of the fiber optic stub to the jumpers of the patch panel. The attenuation loss for the complete assembly shall not exceed 1.5db. The position number associated with each port shall be stenciled, at the factory, on the face of the housing. The fiber optic cable shall be paid for under the 6-FIBER CABLE STUB unit.

Example:

Multilink FWM-1X-SP wall-mount enclosure, Part # ML-33-006-B-SM6-T9-001-00-00.

2.0 MEASUREMENT

Labor, equipment, and materials required in the installation of each item.

1. PAYMENT

Payment will be made under:

FIBER OPTIC PATCH PANEL EA

# SP-F5 AERIAL FIBER OPTIC SPLICE ENCLOSURE

1.0 DESCRIPTION

Consists of all labor and material necessary to install a 6.5”x17” or 9.5”x19” aerial fiber optic splice closure with associated aerial hanger assembly in accordance with the manufacturer’s installation instructions. Armored cables are to be bonded together and secured to one bolt on the bulkhead and a ground lug attached to that bolt on the exterior side of the bulkhead. This closure is to be equipped with enough splice trays to accommodate the number of splices shown on the splice detail. The number of splices in each tray shall not exceed the manufacturer’s recommendation. At buffer tube entry points into the splice tray each buffer tube is to be wrapped with felt tape and secured with tie wraps. Fiber cables are to be labeled on the outside of the splice case with the “From” destination and the “To” destination noted on a cable marker tag and secured to the cables. For mid-entry applications, all buffer tubes shall be unwrapped and secured separately in the storage basket. For mid-entry applications, remove 180 inches of outer sheathing and armored jacket and for all other applications remove 90 inches of outer sheathing and armored jacket.

2.0 MEASUREMENT

Labor, equipment, and materials required in the installation of each item.

3.0 PAYMENT

Payment will be made under:

SUPPLY AND INSTALL AERIAL FIBER OPTIC SPLICE ENCLOSURE EA

# SP-F6 UNDERGROUND FIBER OPTIC SPLICE ENCLOSURE

1.0 DESCRIPTION

Consists of all labor and material necessary to install an underground fiber optic splice closure in accordance with the manufacturer’s installation instructions. Armored cables are to be bonded together and secured to one bolt on the bulkhead and a ground lug put on that bolt on the exterior side of the bulkhead. This closure is to be equipped with enough splice trays to accommodate the number of splices shown on the splice detail. The number of splices in each tray shall not exceed the manufacturer’s recommendation. At buffer tube entry points into the splice tray each buffer tube is to be wrapped with felt tape and secured with tie wraps. Fiber cables are to be labeled on the outside of the splice case with the “From” destination and the “To” destination noted on a cable marker tag and secured to the cables. For mid-entry applications, all buffer tubes shall be unwrapped and secured separately in the storage basket. For mid-entry applications, remove 180 inches of outer sheathing and armored jacket and for all other applications remove 90 inches of outer sheathing and armored jacket. The below table should be used to identify splice enclosure design. The part numbers are shown in bold.

*CDOT reserves the right to open any splice enclosure at any time during construction to inspect the workmanship and/or take photos for records.*

Example: **HUO(24)** COYOTE Dome Express 6.5" x 17" (Loose Tube) Splice Case 8006988 with (2) 8003701 grommets included.

2.0 MEASUREMENT

Labor, equipment, and materials required in the installation of each item.

3.0 PAYMENT

Payment will be made under:

SUPPLY AND INSTALL UNDERGROUND FIBER OPTIC SPLICE ENCLOSURE EA

# SP-F7 AERIAL SPLICE ENCLOSURE REARRANGEMENT

1.0 DESCRIPTION

Consists of all labor and material necessary to open and reseal an existing aerial splice closure to add a new cable and/or update splicing. Included is the installation of the necessary splice trays to splice the number of fibers as indicated in the plans. New splice trays must be designed for use with the existing splice case. Upon completion of any splicing the case is to be pressure tested. The Contractor will be compensated for any splicing under the HO-1 unit.

2.0 MEASUREMENT

Labor, equipment, and materials required in the installation of each item.

3.0 PAYMENT

Payment will be made under:

AERIAL SPLICE ENCLOSURE REARRANGEMENT EA

# SP-F8 UNDERGROUND SPLICE ENCLOSURE REARRANGEMENT

1.0 DESCRIPTION

Consists of all labor and material necessary to re-enter an existing underground fiber optic splice closure to add a new cable. Included is the installation of the necessary splice trays to splice the number of fibers as indicated in the plans. New splice trays must be designed for use with the existing splice case. Upon completion of any splicing the case is to be pressure tested. The Contractor will be compensated for any splicing under the HO-1 unit.

2.0 MEASUREMENT

Labor, equipment, and materials required in the installation of each item.

3.0 PAYMENT

Payment will be made under:

UNDERGROUND SPLICE ENCLOSURE REARRANGEMENT EA

# SP-F9 FIBER OPTIC SPLICING ASSEMBLY UNIT

1.0 DESCRIPTION

Consists of all labor and materials necessary to Fusion Splice one (1) glass fiber in any cable in accordance with the various detail drawings. The labor shall include initial measurement, minimizing the attenuation to no more than 0.1db, splicing and stowing the spliced fiber in a fiber organizer. A heat-shrink splice protector is to be applied to each completed fusion splice. The labor and material for the fiber organizer is part of the splice closure unit. Note that cables are not to be cut and unused fibers and buffer tubes are to be expressed through and not cut/spliced as noted in the plans.

Also included in this specification are the attached PDF sheets (CDOT SPLICE ENCLOSURE AND FIBER DISTRIBUTION UNIT STANDARDS)

2.0 MEASUREMENT

Labor, equipment, and materials required in the installation of each item.

3.0 PAYMENT

Payment will be made under:

FIBER OPTIC SPLICING ASSEMBLY UNIT EA

# SP-F10 FIBER OPTICAL POWER LEVEL TEST ASSEMBLY UNIT

1.0 DESCRIPTION

Consists of all labor and material necessary for the Contractor to make optical power level measurements on each terminated fiber including each transmit and receive fiber between the fiber end points at the optical patch terminations. The fibers are to be bi-directional tested at the optical patch terminations. Forms will be provided to record the test results. The optical power level measurements are to be made at both 1310 and 1550nm.

1. MEASUREMENT

Labor, equipment, and materials required in the installation of each item.

3.0 PAYMENT

Payment will be made under:

FIBER OPTIC POWER LEVEL TEST ASSEMBLY UNIT EA

# SP-F11 FIBER OPTIC SPLICE TEST ASSEMBLY UNIT

1.0 DESCRIPTION

Consists of all labor and material necessary for the Contractor to make optical time-domain reflectometer (OTDR) signature traces on all fibers. All non-terminated fibers are to be bi-directional tested and terminated fibers are to be tested in one direction only. The signature traces are to be made at both 1310 and 1550nm. In addition, digital copies of each signature trace shall be furnished to the Engineer on a flash drive.

2.0 MEASUREMENT

Labor, equipment, and materials required in the installation of each item.

3.0 PAYMENT

Payment will be made under:

FIBER OPTIC SPLICE TEST ASSEMBLY UNIT EA

# SP-F12 FIBER CURB MARKER

1.0 DESCRIPTION

Consists of all labor and material necessary to install one circular 2.5-inch diameter, plastic, permanent curb marker, in place, as shown on the construction drawings. The marker is to be installed in accordance with the manufacturer’s directions, utilizing a manufacturer supplied or approved adhesive. The marker is to have an orange background, with a printed message of “CDOT Fiber Optic Cable - 811 Know what’s below. Call before you dig. “ in black letters.

Example:

das Manufacturing Inc., P.N.# 2.5 CDOT-811 with#RS-222-5 adhesive.

2.0 MEASUREMENT

Labor, equipment, and materials required in the installation of each item.

3.0 PAYMENT

Payment will be made under:

SUPPLY AND INSTALL FIBER CURB MARKER EA

# SP-F13 ELECTRONIC BALL MARKER

1.0 DESCRIPTION

Consists of labor and materials to install one electronic ball marker in equipment handholes and splice boxes below finish grad. The electronic ball marker shall be placed inside the handhole or splice box to mark the location as noted in the plans. Ensure that the electronic ball marker is a device specifically manufactured to electronically mark and locate underground facilities. Ensure that the electronic ball marker includes circuitry and an antenna encased in a waterproof polyethylene shell. Ensure that the outer shell is impervious to minerals, chemicals, and temperature extremes normally found underground plant environments. Ensure that the electronic box marker does not require batteries or active components to operate. Ensure that electronic ball markers used to mark fiber optic cable applications are orange in color and operate at 101.4 kHz. When excited by a marker locator, ensure that the electronic ball marker’s passive circuits produce an RF field to direct the marker locator to its position. Ensure that the electronic ball marker has a minimum operating range of 5 feet from the marker locator. Electronic ball markers furnished, installed, and tested shall be measured as each.

Example:

Greenlee Omnimarker #0163-0001-1, 4” Ball Marker, or equivalent to be approved by the Engineer.

2.0 MEASUREMENT

Labor, equipment, and materials required in the installation of each item.

3.0 PAYMENT

Payment will be made under:

SUPPLY AND INSTALL ELECTRONIC BALL MARKER EA

# SP-F14 CABLE RISER GUARD

1.0 DESCRIPTION

Consists of all labor and material necessary to install one (1) 2-inch inside diameter by 8 feet cable steel riser guard with two (2) riser guard straps and four (4) lag screws. All pole line hardware to be hot dipped galvanized steel.

2.0 MEASUREMENT

Labor, equipment, and materials required in the installation of each item.

3.0 PAYMENT

Payment will be made under:

SUPPLY AND INSTALL CABLE RISER GUARD UNIT EA

# SP-F15 FIBER OPTIC CABLE SLACK-STOW

1.0 DESCRIPTION

Consists of all labor and material necessary to install an in-span cable storage system. The number of fibers in the cable shall be indicated in the parentheses. The ONLY materials covered under this unit are the fiber cable and the stainless-steel cable straps. The labor and material for the storage racks and associated hardware are NOT a part of this unit and will be paid under the PM-ELB Unit. This unit specifies that the fiber optic cable be looped back upon itself twice and secured in place every three (3) feet with stainless steel cable straps. The placement of the slack cable shall be limited to a single pole span and the amount of cable to be stored is shown on the Construction Sheets. Only the slack cable to be stowed is a part of this unit, the labor to place the first of the three span lengths shall be paid under the applicable aerial fiber cable unit. Care should be taken when forming the initial and midpoint bends that the fiber cable is not subjected to a bend radius of less than twenty (20) times the diameter of the cable. To be installed in accordance with ‘Slack Stow Units – Alternate Configuration without splice’ detail on drawing “Typical Aerial Fiber Installation with Handhole”.

2.0 MEASUREMENT

Labor, equipment, and materials required in the installation of each item.

3.0 PAYMENT

Payment will be made under:

SUPPLY AND INSTALL FIBER OPTIC CABLE-SLACK STOW LF

# SP-F16 FIBER OPTIC JUMPER

1.0 DESCRIPTION

Consists of all labor and material necessary to install a duplex single fiber, single mode fiber jumper with a 3mm jacket. The length (in meters) of the jumper shall be indicated in the parentheses. The fiber jumper shall be routed between patch panels or equipment in a splice cabinet, traffic control box (TCB), camera control box (CCB) or traffic management center (TMC). The jumper connections are shown in the splice details.

2.0 MEASUREMENT

Labor, equipment, and materials required in the installation of each item.

3.0 PAYMENT

Payment will be made under:

SUPPLY AND INSTALL FIBER OPTIC JUMPER ASSEMBLY EA

# SP-F17 SFP

1.0 DESCRIPTION

Consists of all labor and material necessary to securely install one (1) fiber optic Ethernet Small Form-Factor Pluggable (SFP) port that plugs into the Fast Ethernet port or slot on the Ethernet switch. The type of SFP will be shown in the last set of parentheses. The port shall be compatible with IEEE 802.3ah Draft 3.0 and with standard as specified in IEEE 802.3. The connectors shall be dual LC connectors. The SFP furnished shall be a “hot swappable”, ruggedized, industrial rated transceiver with an operating temperature range of –40 to 85 degrees C and be of the same manufacturer as the FOE(TRX)(ESU) Ethernet switch.

Options designated by the following suffixes apply:

**LX-R** A 1310nm, single-mode, Fast Ethernet, ruggedized, 100Base­-LX10 SFP transceiver with an operating range of 10km and industrial rated with an operating temperature range of -40to 85 degrees C.

Example: Cisco GLC-FE-100LX-RGD

**GLX-R** A 1310nm, single-mode, ruggedized, Gigabit 1000Base-LX/LH SFP transceiver with an operating range of 10km and industrial rated with an operating temperature range of -40 to 85 degrees C.

Example: Cisco GLC-LX-SM-RGD

**GZX-R** A 1550nm, single-mode, ruggedized, Gigabit 1000Base-ZX SFP transceiver with an operating range of 70km and industrial rated with an operating temperature range of -40 to 85 degrees C.

Example: Cisco GLC-ZX-SM-RGD

**GEX-E** A 1310nm, single-mode, non-ruggedized, Gigabit 1000Base-EX SFP transceiver with an operating range of 40km and commercial rated with an operating temperature range of -5 to 85 degrees C. SFP shall support digital optical monitoring (DOM) functions.

Example: Cisco GLC-EX-SMD

**GZX-E** A 1550nm, single-mode, non-ruggedized, Gigabit 1000 Base-ZX SFP transceiver with an operating range of 70km and commercial rated with an operating temperature range of -5 to 85 degrees C. SFP shall support digital optical monitoring (DOM) functions.

Example: Cisco SFP-GE-Z

**GLX-E** A 1310nm, single-mode, non-ruggedized, Gigabit Ethernet 1000Base-LX SFP transceiver with an operating range of 10km and commercial rated with an operating temperature range of -5 to 85 degrees C. SFP shall support digital optical monitoring (DOM) functions.

Example: Cisco SFP-GE-L

**GZX-C** A 1550nm, single-mode, non-ruggedized, Gigabit 1000 Base-ZX SFP transceiver with an operating range of 70km and commercial rated with an operating temperature range of 0 to 70 degrees C. SFP shall support digital optical monitoring (DOM) functions.

Example: Cisco GLC-ZX-SM

2.0 MEASUREMENT

Labor, equipment, and materials required in the installation of each item.

3.0 PAYMENT

Payment will be made under:

SUPPLY AND INSTALL SFP EA

# SP-F18 ETHERNET SWITCH

1.0 DESCRIPTION

Consists of all labor and materials necessary to securely mount one (1) industrial (ruggedized) Ethernet switch in an existing traffic control box. The mounting method must be approved by the Engineer before installation. The unit will be an industrially hardened, fully managed Ethernet switch with a minimum operating temperature range of -40 to 158 degrees F. The unit will have a minimum of eight (8) copper 10/100/1000 Ethernet ports and two (2) Small Form-factor Pluggable (SFP) ports. The provided SFP modules will be single mode, LC type. The contractor is to provide all power supplies, modules, auxiliary equipment, transformers and power cords (4’ minimum) necessary to have a fully functioning 10/100/1000 Ethernet switch that can be powered from a standard 110 VAC 3-pronged outlet.

TS-35/7.5 DIN rail mount for mounting the unit and the power supply. See “FOE(TRX)(ESU)CI(3200) IE3200 Ethernet Switch Details” for connection notes.

The unit must be fully compatible and support interoperability with the traffic control network core Cisco 6807 switch. The fiber jumpers routed between the patch panel stub and the transceiver are not part of this unit and will be compensated under the CHO-4() unit.

The Ethernet switch will meet the following specifications:

* IEEE 1588 PTP v2.
* NEMA TS-2 Compliant.
* Customized Industrial Automation Smartport configuration templates.
* DIN-rail, wall, and 19” rack mount options.
* Small Form-factor Pluggable (SFP) options for 100Base-LX, 100Base-FX, 1000Base-SX, 1000Base-LX, and 1000Base-ZX deployments.
* Common Industrial Protocol (CIP) management support.
* Swappable SD flash memory for easy switch replacement.
* Supported by Cisco Prime/DNA Center.

The Ethernet switch will support the following protocol/security features sets:

* Virtual Local Area Networks (VLANs)/Quality of Service (QoS).
* Resilient Ethernet Protocol support for fast convergence (50ms).
* IGMPv3 snooping
* IGMP Filtering
* IEEE 802.1d
* IEEE 802.1x.
* Port Based Access Control Lists for Layer 2 Interfaces.
* MAC Address Filtering.
* Secure Shell (SSH) v2 Protocol.
* SNMPv3.
* TACACS+ and RADIUS authentication.
* MAC address notification.
* DHCP snooping.
* DHCP Interface Tracker (Option 82).
* Port Security.
* Support for up to 512 ACLs with two Profiles:
* Security (384 security ACL entries and 128 QoS Policies).
* QoS (128 Security ACL entries and 384 QoS Policies).
* Configurable up to 8000 MAC addresses
* Configurable up to 255 IGMP groups.
* Configurable maximum transmission unit (MTU) of up to 9000 bytes, with a maximum Ethernet frame size of 9018 bytes (jumbo frames) for bridging on Gigabit Ethernet ports, and up to 1998 bytes for bridging of Multiprotocol Label Switching (MPLS) tagged frames on both 10/100 and 10/100/1000 ports.

Options designated by the following suffix(es) apply:

**(3200)** - Cisco IE-3200; 8-Eight (8) copper 10/100/1000 Ethernet ports

Example:

Model: Cisco IE-3200-8T2S-E   
Mean Well NDR-120-24 5 Amp power supply  
Note: SD Card for Cisco IE3200 will be owner furnished.

2.0 MEASUREMENT

Labor, equipment, and materials required in the installation of each item.

3.0 PAYMENT

Payment will be made under:

SUPPLY AND INSTALL ETHERNET SWITCH EA

# SP-F19 REMOVE EXISTING FIBER CABLE FROM CONDUIT

1.0 DESCRIPTION

Consists of all labor necessary for the removal of one (1) foot of fiber optic cable from conduit, and figure eighting or re-reeling the cable for immediate re-installation of the existing cable in new conduit or new conduit riser to limit system downtime. Number of fibers in cable is shown in last set of parentheses.

This unit does not include labor and material for re-installation of existing cable aerially. The labor and material for those items are provided for in the CABLE RE-LASHING UNIT.

2.0 MEASUREMENT

Labor, equipment, and materials required in the installation of each item.

3.0 PAYMENT

Payment will be made under:

REMOVE EXISTING FIBER CABLE FROM CONDUIT LF

# SP-F20 COMMUNICATION CABLE DE-LASHING

1.0 DESCRIPTION

Consists of all labor and material necessary to de-lash and store for reuse one (1) foot of existing fiber cable or cables from one (1) existing strand and includes the removal of the existing lashing wire. The cable size is shown in the parenthesis. Lashing wire shall be removed and properly disposed of. See Cable Re-lashing unit for re-installation of cable.

2.0 MEASUREMENT

Labor, equipment, and materials required in the removal of each item.

3.0 PAYMENT

Payment will be made under:

COMMUNICATION CABLE DE-LASHING LF

# SP-F21 COMMUNICATION CABLE LASHING

1.0 DESCRIPTION

Consists of all labor and material necessary to lash one (1) foot of existing cable or cables existing strand.

2.0 MEASUREMENT

Labor, equipment, and materials required in the installation of each item.

3.0 PAYMENT

Payment will be made under:

COMMUNICATION CABLE LASHING LF

# SP-F22 INSTALL COPPER INTERCONNECT CABLE

1.0 DESCRIPTION

Consists of all labor and material necessary to install one (1) foot of aerial or underground twisted pair copper communication cable. The number of twisted pairs will be indicated on the signal plan. Also included is the placing of a CDOT provided cable identification tag at each pole for aerial installations.

Lash to strand with .045-inch stainless steel lashing wire and hardware, double lashing the cable to the strand or install in conduit. The cable must be outdoor rated and constructed with 22- or 24-gauge copper wires. The wires shall be in pairs and each pair must have a unique color combination that is not repeated in the cable. The cable must have a copper shield under a polyethylene outer jacket.

This unit does not include labor and material for copper splicing or splice closures. The labor and material for these items are provided for in other units.

2.0 MEASUREMENT

Labor, equipment, and materials required in the installation of each item.

3.0 PAYMENT

Payment will be made under:

INSTALL COPPER INTERCONNECT CABLE EA

# SP-F23 COPPER INTERCONNECT SPLICING

1.0 DESCRIPTION

Consists of all labor and materials necessary to splice one (1) cable pair in any cable, including any non-working pair in an existing cable using mechanical splicing connectors such as 3M Scotchlock or insulated butt-connectors.

2.0 MEASUREMENT

Labor, equipment, and materials required in the installation of each item.

3.0 PAYMENT

Payment will be made under:

COPPER INTERCONNECT SPLICING EA

# SP-F24 COPPER INTERCONNECT SPLICE CLOSURE

1.0 DESCRIPTION

Consists of all labor and material necessary to supply and install one copper splice enclosure in accordance with the manufacturer’s installation instructions. Shielding of the cables are to be bonded together inside of the case. The number of splices will be indicated on the signal plans.

This unit does not include labor and material for copper splicing. The labor and material for this item are provided for in another unit.

2.0 MEASUREMENT

Labor, equipment, and materials required in the installation of each item.

3.0 PAYMENT

Payment will be made under:

SUPPLY AND INSTALL COPPER INTERCONNECT SPLICE ENCLOSURE EA

# SP-F25 OBSERVATION CAMERA

1.0 DESCRIPTION

Consists of all labor and material required to install one (1) Camera Assembly. The camera assembly includes camera, enclosure, High PoE midspan with patch cable, dome camera mounting arm, any other materials necessary to mount the camera per the manufacturer’s specifications. This unit also includes all associated hardware, including stainless steel banding with screw clamps for attaching the pole adapter bracket to the pole. The cable between the Ethernet switch and the PoE midspan, will be a 1 meter long shielded, outdoor-rated CAT5es cable pre-terminated with male RJ45 gold-plated connectors with snagless boots, eight (8) 24 AWG conductors and tested to a minimum of 350 MHz. The camera must be compatible with the Genetec camera control software. This unit is not considered complete until the camera is fully functioning from the camera control panel. The camera shall be provided to CDOT for programming prior to installation.

The Camera must be ONVIF Profiles S & G compliant and meet or exceed the following requirements:

1. Image Sensor: 1/2.8” Progressive Scan CMOS
2. Lens: 4.25-170mm, auto iris and autofocus

Horizontal angle of view: 65.1°-2.00° (1080p)

Vertical angle of view: 39.1°-1.18° (1080p)

1. Day and Night: Automatic removable infrared-cut filter
2. Minimum Illumination/Light Sensitivity (lux):

Color: .1 lux at 30 IRE F1.6

B/W: .002 lux at 30 IRE F1.6

Color: .15 lux at 50 IRE F1.6

B/W: .003 lux at 50 IRE F1.6

1. Shutter Time: Electronic shutter with speed range from

1/11000 second to 1/3 second with 50 Hz

1/11000 second to 1/3 second with 60 Hz

1. Pan/Tilt/Zoon: 40x optical zoom, 12x digital zoom, total 480x zoom, E-flip, 256 preset positions, tour recording (max 10, max duration 16 minutes each), guard tour (max 100), control queue, on-screen directional indicator, adjustable zoom speed
2. Pan: 360° endless, 0.05°-450°/s
3. Tilt: 220°, 0.05°-450°/s
4. Power: Axis High PoE 60 W SPF midspan 1–port: 100–240 V AC, max 74 W Camera consumption: typical 16 W, max 60 W
5. Connectors: RJ45 for 10BASE-T/100BASE-TX PoE, RJ45 Push-pull Connector (IP66) included
6. Operating conditions: With 60 W midspan: -50°C to 50°C (-58 °F to 122 °F)
7. Warranty: Minimum 3-year manufacturer warranty

The Video must meet or exceed the following requirements:

1. Video compression: H.264 (MPEG-4 Part 10/AVC) Baseline

Main and High Profiles Motion JPEG H.265 (MPEG-H Part 2/HEVC)

Motion JPEG

1. Resolution: HDTV 1080p 1920x1080 to 320x180
2. Frame rate: Up to 50/60 fps (50/60 Hz) in HDTV 1080p
3. Video streaming: Multiple, individually configurable streams in H.264 and Motion JPEG
4. Image settings: Manual shutter time, Compression, Color, Brightness, Sharpness, White balance, Exposure control, Exposure zones, Fine tuning of behavior at low light, Rotation: 0°, 180°, Text and image overlay, 32 individual 3D privacy masks, Image freeze on PTZ, Defogging, Backlight compensation, Wide dynamic range (WDR): up to 120 dB depending on scene

The Network and Security must meet or exceed the following requirements:

1. Security: Password protection, IP address filtering, HTTPS encryption, IEEE 802.1X network access control, Digest authentication, User access log, Centralized Certificate Management, Brute force delay protection
2. Network: IPv4, IPv6, QoS Layer 3 DiffServ

**Examples:**

AXIS Q6075-E PTZ Dome Network Camera

AXIS High PoE Midspan, Model T8154

AXIS Wall and Pole Mount, Model T91L61

2.0 MEASUREMENT

Labor, equipment, and materials required in the installation of each item.

3.0 PAYMENT

Payment will be made under:

Supply & Install Observation Camera EA

# SP-F26 OBSERVATION CAMERA ASSEMBLY INSTALLATION

1. DESCRIPTION

Consists of all labor and material required to install one (1) Camera Assembly. The camera assembly includes camera, enclosure, High PoE midspan with patch cable, dome camera mounting arm, any other materials necessary to mount the camera per the manufacturer’s specifications. This unit also includes all associated hardware, including stainless steel banding with screw clamps for attaching the pole adapter bracket to the pole. The cable between the Ethernet switch and the PoE midspan, will be a 1 meter long shielded, outdoor-rated CAT5es cable pre-terminated with male RJ45 gold-plated connectors with snagless boots, eight (8) 24 AWG conductors and tested to a minimum of 350 MHz. The camera must be compatible with the Genetec camera control software. This unit is not considered complete until the camera is fully functioning from the camera control panel.

2.0         MEASUREMENT

Labor, equipment, and materials required in the installation of each item.

3.0         PAYMENT

Payment will be made under:

INSTALL OBSERVATION CAMERA (CITY SUPPLIED)                                                          EA

# SP-F27 AERIAL CAT 6 ETHERNET CABLE FOR OBSERVATION CAMERA

1.0 DESCRIPTION

Consists of all labor and material necessary to install one (1) 300 foot of outdoor rated category 6E Ethernet Cable Assembly in conduit. The cable shall be terminated on both ends with RJ-45 gold-plated connectors with snagless boots. The pin configuration shall follow the TIA-EIA-568B standard. The cable shall be (CMX) Rated, designed for Outdoor, UV and moisture resistant use. The cable shall be Aluminum foil Shielded (STP) with 4 twisted pairs of 23 AWG wire at 600MHz, along with a drain wire and shall support speeds of 10/100/1000Mbps.

The cable shall be routed between the power injector(PoE) located within the traffic control box and the circuit board inside of the Camera mounting arm.

Options designated by the following suffix may be used:

**-IP66 –** Identical to the UF-CAT6ES Unit except the cable shall be terminated on one end with RJ-45 gold-plated connectors with snagless a boot and terminated on the other end with an IP66 connector. The IP66 connector terminates in the top of the dome camera instead of inside the Camera mounting arm.

2.0 MEASUREMENT

Labor, equipment, and materials required in the installation of each item.

3.0 PAYMENT

Payment will be made under:

AERIAL CAT 6 ETHERNET CABLE FOR OBSERVATION CAMERA                                                          EA

# SP-F28 UNDERGOUND CAT6 ETHERNET CABLE FOR OBSERVATION CAMERA

1.0 DESCRIPTION

Consists of all labor and material necessary to install one (1) 300 foot of outdoor rated category 6E Ethernet Cable Assembly. The cable shall be terminated on both ends with RJ-45 gold-plated connectors with snagless boots. The pin configuration shall follow the TIA-EIA-568B standard. The cable shall be (CMX) Rated, designed for Outdoor, UV and moisture resistant use. The cable shall be Aluminum foil Shielded (STP) with 4 twisted pairs of 23 AWG wire at 600MHz, along with a drain wire and shall support speeds of 10/100/1000Mbps.

The cable shall be routed between the power injector(PoE) located within the traffic control box and the circuit board inside of the Camera mounting arm.

2.0 MEASUREMENT

Labor, equipment, and materials required in the installation of each item.

3.0 PAYMENT

Payment will be made under:

UNDERGROUND CAT6 ETHERNET CABLE FOR OBSERVATION CAMERA                                   EA

# SP-F29 POLE GROUND ASSEMBLY UNIT

1.0 DESCRIPTION

Consists of all labor and material necessary to construct and install, using #4 AWG bare copper ground wire, a pole ground assembly. This unit also includes all labor and material required in the repair and/or replacement of streets, sidewalks, roads, drives, fences, lawns, shrubbery, water mains, pipes, pipelines and contents, underground power and telecommunications facilities, buried sewerage and drainage facilities, and any other property damaged during the unit installation. The following items will be required.

* 1 5/8" by 10' copper clad steel ground rod
* 1 ground rod clamp
* #4 AWG bare copper ground wire and ground wire staples as required

Staples on ground wire should be about 18-inches apart. Ground wire should clear all hardware by 2-inches minimum and be stapled to maintain this position. The ground rod should be driven 24 inches from the pole with the ground wire and top of the rod at a minimum 24-inch depth.

2.0 MEASUREMENT

Labor, equipment, and materials required in the installation of each item.

3.0 PAYMENT

Payment will be made under:

POLE GROUND ASSEMBLY UNIT EA

# SP-F30 UNDERGROUND FIBER OPTIC HANDHOLE ASSEMBLY UNIT

1.0 DESCRIPTION

Consists of all labor and material necessary to install a NCDOT approved polymer concrete handhole with a cover embossed “CDOT Fiber Optic” on a 6” deep layer of #57 crushed stone tamped down with a compacting device. Included is a 5/8” by 8’ copper clad steel ground rod placed in the corner of the handhole with a hand coil of #6AWG copper ground wire and an electronic ball marker. Also included is the restoration of the surface around the handhole and the removal and disposal of all excess dirt and debris. This unit also includes all labor and material required in the repair and/or replacement of streets, roads, drives, fences, lawns, shrubbery, water mains, pipes, pipelines and contents, underground power and telecommunications facilities, buried sewerage and drainage facilities, and any other property damaged during the unit installation. This unit also consists of all labor and materials necessary to install one (1) 4-ounce bag of fire ant killer in and/or around the handhole as directed by the Engineer. Fiber optic cable within the handhole shall have a CDOT-provided fiber optic cable tag attached.

2.0 MEASUREMENT

Labor, equipment, and materials required in the installation of each item.

3.0 PAYMENT

Payment will be made under:

UH-1 17”x30”x30” UNDERGROUND FIBER OPTIC HANDHOLE ASSEMBLY UNIT EA

UH-2 24”x36”x30” UNDERGROUND FIBER OPTIC HANDHOLE ASSEMBLY UNIT EA

UH-3 30”x48”x36” UNDERGROUND FIBER OPTIC HANDHOLE ASSEMBLY UNIT EA

# SP-X1 PAVEMENT MARKING REMOVAL BY MEDIA BLASTING (1205 MODIFIED)

1.0 DESCRIPTION

Description is as set out in **NCDOT Standard Specification 1205.**

2.0 MATERIAL

Materials are as set out in **NCDOT Standard Specification 1205.**

3.0 CONSTRUCTION METHODS

Construction methods are as set out in **NCDOT Standard Specification 1205-(I),** with the exception of lines 20-23. Grinding will not be an acceptable method of removing pavement markings. Pavement Markings shall be removed by Dustless Media Blasting in a method which does not degrade the existing pavement condition.

4.0 MEASUREMENT AND PAYMENT

Payment will be made under:

REMOVAL OF PAVEMENT MARKING LINES (MEDIA BLASTING), 4” LF

REMOVAL OF PAVEMENT MARKING LINES (MEDIA BLASTING), 8” LF

REMOVAL OF PAVEMENT MARKING LINES (MEDIA BLASTING), 24” LF

REMOVAL OF PAVEMENT MARKING SYMBOLS (MEDIA BLASTING) EA

REMOVAL OF PAVEMENT MARKING SHEETING (MEDIA BLASTING) SF

# SP-X2 REMOVAL ONLY OF SIGNAL EQUIPMENT

1.0 DESCRIPTION

This Special Provision is not intended to supersede the incidental nature of replacement items which are covered as paid or unpaid items under other Special Provisions, incidental to other Special Provisions, or any NCDOT Standard Specifications including 1700. These pay items are **only** to be paid when the scope of work involved is limited to the removal of an item set forth below.

Removal of an entire traffic signal shall include labor and materials required to remove all city- or state-owned signal equipment at a location, including but not limited to: signal heads, signs, pedestrian signals and poles, span wire, cable, cabinet, cabinet foundation, poles, down guys, anchors, meter service, breaker box, conduit, risers and pull boxes.

Return all unused signal equipment to The City at 3701 Craig Ave, Charlotte, NC.

2.0 MATERIAL

Materials are as set out in **NCDOT Standard Specification 1700.**

3.0 CONSTRUCTION METHODS

Construction methods are as set out in **NCDOT Standard Specification 1700.**

4.0 MEASUREMENT AND PAYMENT

No payment will be made for the return of signal equipment to The City.

Payment will be made under:

Remove Existing Junction Box EA

Remove Existing Wood Pole EA

Remove Existing Down Guy EA

Remove Existing Anchor EA

Remove Pedestrian Signal EA

Remove Push Button EA

Remove Pedestrian Signal Pole Foundation EA

Remove Existing signal, less than 10 vehicular signal heads EA

Remove Existing signal, 11 – 18 vehicular signal heads EA

Remove Existing signal, greater than 19 vehicular signal heads EA

# SP-X3 TREE TRIMMING

1.0 DESCRIPTION

Work covered by this special provision consists of all labor, equipment and materials required for the trimming of foliage and branches from trees growing in or adjacent to the right-of-way to provide an unobstructed view of traffic control or warning devices. Trees, brush, branches, and refuse from the clearing operation shall, without delay, be removed from the vicinity of the right-of-way and disposed of properly by the Contractor. The Contractor shall not remove or trim shade, fruit, or ornamental trees unless directed by the Engineer.  When designated by the Engineer, a tree may be trimmed of its branches with the trunk left extending into the right-of-way.

2.0 MEASUREMENT

Right-of-Way Tree Trimming will be paid per linear foot of tree removal measured along the roadway Right-of-Way and will be considered full payment for all labor, equipment and materials required in the removal and disposal of all trees, foliage and branches as described above.

3.0 PAYMENT

Payment will be made under:

RIGHT-OF-WAY TREE TRIMMING LF