I-390 INTERCHANGE IMPROVEMENTS
AT I-490, STAGES 3 AND 4

PIN 4390.54, Contract D900046

DB CONTRACT DOCUMENTS
PART 8

SPECIAL SPECIFICATIONS

FINAL March 7, 2019
This Part 8 – Special Specifications provides access to, and details the Project-specific requirements for the use of, the following documents:

1. NYSDOT Standard Specifications and Construction Materials
2. NYSDOT Engineering Information Issuances
3. NYSDOT Special Specifications.

NYSDOT Standard Specifications and Construction Materials


The NYSDOT Standard Specifications Construction Materials can be accessed at the following internet link:


NYSDOT Engineering Information Issuances

The Design-BUILDER shall use the relevant NYSDOT engineering information issuances, which include:

1. Engineering Instructions (EI);
2. Engineering Bulletins (EB);
3. Engineering Directives (ED).

The above listed engineering information issuances can be accessed at the following internet link:


NYSDOT Special Specifications

The Design-BUILDER may use NYSDOT Special Specifications which are listed in the Electronic Pay Item Catalog (e-PIC) and which have received General Approval, and shall use any NYSDOT Special Specifications which are referenced in this Part 8 or elsewhere in the Contract Documents. Delete and ignore sections in the NYSDOT Special Specifications titled Method of Measurement and Basis of Payment from the NYSDOT Special Specifications.

NYSDOT Special Specifications can be accessed at the following internet link:


The NYSDOT e-PIC may be accessed at the following internet link:

https://www.dot.ny.gov/pic
The following Special Specifications are attached herein:

ITEM 557.11010003 – INTEGRAL PRECAST CONCRETE BARRIER
ITEM 557.21030016 – FIELD CAST UHPC JOINTS BETWEEN PRECAST CONCRETE UNITS (LENGTH)
ITEM 557.6001004 – FULL DIAMOND GRINDING OF STRUCTURAL SLAB AND STRUCTURAL APPROACH SLAB WITH SLURRY REMOVAL
ITEM 557.64010103 – PRECAST CONCRETE DECK – TYPE 01 FRICITION
ITEM 557.66010101 – PRECAST BRIDGE SYSTEM WITH EMBEDDED STRUCTURAL STEEL
ITEM 563.00010002 – NORTHEAST EXTREME TEE – NEXT BEAM TYPE D
ITEM 563.06010016 – PRESTRESSED CONCRETE DECK BULB TEES
ITEM 607.96000008 – REMOVE AND DISPOSE OF EXISTING FENCE
ITEM 608.01020005 – COLORED AND IMPRINTED PORTLAND CEMENT CONCRETE SIDEWALK
ITEM 608.01040005 – IMPRINTED PORTALND CEMENT CONCRETE SIDEWALK
ITEM 610.14000011 – STRUCTURAL SOIL MIX
ITEM 610.16XXNN24 – TURF ESTABLISHMENT – SEED MIX AS SPECIFIED
ITEM 611.190X0024 – POST-PLANTING CARE WITH REPLACEMENT
ITEM 619.24000004 – NIGHTTIME OPERATIONS (WITH BALLOON LIGHTING REQUIREMENTS FOR MOVING OPERATIONS)
ITEM 634.99010017 – BUILDING CONDITION SURVEY
ITEM 643.99010004 – PRECAST CONCRETE NOISE BARRIER SYSTEM
ITEM 662.60010004 – FURNISHING ELECTRICAL DEVICE
ITEM 663.01NN0009 – DRY STANDPIPE SYSTEM
ITEM 663.95000004 – FIRE ACCESS PIPE AND LOCATION SIGN
ITEM 680.51100010 – CLEAN EXISTING PULLBOX
ITEM 680.53010010 – CLEAN EXISTING CONDUIT
ITEM 680.58801108 – WIRELESS VEHICLE DETECTION SYSTEM PAVEMENT SENSOR
ITEM 680.58801208 – WIRELESS VEHICLE DETECTION BASE STATION
ITEM 680.58801308 – WIRELESS VEHICLE DETECTION ACCESS POINT
ITEM 680.58801408 – WIRELESS VEHICLE DETECTION SYSTEM CONTACT CLOSURE CARD
ITEM 680.62YYXX10 – MAST ARM TRAFFIC SIGNAL POLE-MAST ARM LENGTH 51 FT TO 75 FT FATIGUE DESIGN
ITEM 680.78010005 – ALTER PULLBOX FOR CONDUITS
ITEM 680.80324515 – INSTALL MICROCOMPUTER CABINET
ITEM 680.81310209 – ACCESSIBLE PEDESTRIAN SIGNAL (APS) WITHOUT POLE
ITEM 680.81320009 – INFRARED PROGRAMMING DEVICE
ITEM 680.81500010 – PEDESTRIAN COUNT-DOWN TIMBER MODULE
ITEM 680.81990003 – TRAFFIC SIGNAL BACKPLATES WITH YELLOW REFLECTIVE TAPE
ITEM 680.82250101 – REMOVE PEDESTRIAN PUSHBUTTON AND SIGN ASSEMBLY
ITEM 680.92111208 – FIBER OPTIC SIGNAL CALBE – 12 FIBERS
ITEM 680.94998008 – INSTALL ELECTRICAL DISCONNECT GENERATOR TRANSFER SWITCH – STATE SUPPLIED
ITEM 680.950X0615 – SERVICE CABLE X CONDUCTOR, NO. 06 AWG
ITEM 680.95600004 – ELECTRICAL METER PAN
ITEM 680.96030404 – FIBER OPTIC CABLE PATCH PANEL – FIELD EQUIPMENT
ITEM 683.40020004 – WIRELESS ETHERNET TRANSCEIVER
ITEM 683.84401004 – NETWORK SWITCH – FIELD EQUIPMENT, 8-PORT, SFP
ITEM 683.92150010 – FIBER OPTIC DROP CABLE
ITEM 683.95060104 – SMALL FORM-FACTOR PLUGGABLE (SPF) TRANSCEIVERS-TYPE 1GB
ITEM 685.20010004 – WHITE EPOXY TRAFFIC PAINT WITH WHITE WET-NIGHT REFLECTIVE ELEMENTS – 20 MILS (GROOVED PAVEMENT METHOD)
ITEM 800.01000015 – DESIGN BUILD – DESIGN SERVICES
ITEM 800.02000015 – DESIGN BUILD – CONSTRUCTION INSPECTION SERVICES
ITEM 800.03000015 – DESIGN BUILD – QUALITY CONTROL SERVICES
ITEM 800.04000015 – DESIGN BUILD – FORCE ACCOUNT WORK
ITEM 800.05000015 – DESIGN BUILD – SITE MOBILIZATION
ITEM 800.06000015 – DESIGN BUILD – CONSTRUCTION WORK

In the event of a discrepancy between the version of any Special Specification attached herein and the version available from the NYSDOT web site listed above, the version included in these Contract Documents shall apply.
DESCRIPTION.

Furnish and place precast concrete deck, precast concrete approach slab and integral precast concrete barrier with ultra high performance concrete (UHPC) joints. The maturity method shall be used to estimate the in-place UHPC strength. The time required before removal of the forms and loading of the structure will be determined based on the estimated in-place UHPC strength. “Panels” refers to both the concrete deck and to the approach slab.

XX = Friction Type
- 01 - Type 1 Friction
- 02 - Type 2 Friction
- 03 - Type 3 Friction
- 09 - Type 9 Friction

MATERIALS

PRECAST CONCRETE PANELS: Materials used in this work shall conform to the NYSDOT Prestressed Concrete Construction Manual (PCCM)-Current Edition and the following:

STEEL EMBEDMENTS. Steel embedments for the panel leveling devices and hold down devices shall be installed in the shop based upon the locations shown on the shop drawings.

- Leveling Bolts ASTM F568M, Class 4.6

CONCRETE

- 28 Day Compressive Strength 5000 psi (Minimum)
- Lifting Strength 3000 psi (Minimum)
- Epoxy Coated Bar Reinforcement 709-04
- Mechanical Connectors 709-10
- Water §712-01
- Aggregates (Friction Type) 501-202.B

PRECAST CONCRETE APPROACH SLAB

The supplier must demonstrate a system to place the approach slab using a grout bed such that the approach slab is fully supported at the proper line and grade.

INTEGRAL PRECAST CONCRETE BARRIER: The requirements of the PCCM and the following shall apply.

Tolerances:

1) Bar Reinforcement Cover -0, + ½ inch
2) Width of Unit at the top -0, + ¼ inch
3) Width of Unit at the bottom -0, + ½ inch
4) Surface deviation from theoretical centerline ½ inch in 20 feet
5) Vertical Alignment (deviation from a line parallel to theoretical grade) ½ inch in 20 feet
6) Horizontal and Vertical Alignment (between adjacent units) 3/16 inch
JOINT MATERIAL UHPC: The material shall be Ultra High Performance Concrete, all components supplied by one manufacturer. Materials commonly used in UHPC are:

- Fine aggregate
- Cementitious material
- Super plasticizer
- Accelerator
- Steel Fibers

UHPC material shall meet the following, 28 days unless otherwise noted:

**Minimum Compressive Strength (ASTM C39)**
- High Heat-Treated* 
  \[
  \geq 25 \text{ ksi}
  \]
- Medium Heat-Treated 12 hours**
  \[
  \geq 12 \text{ ksi}
  \]
- Not Heat-Treated 14 days***
  \[
  \geq 21 \text{ ksi}
  \]

**Prism Flexural Tensile toughness (ASTM C1018; 12 in. span)**
  \[
  I_{30} \geq 48
  \]

**Long-Term Shrinkage (ASTM C157; initial reading after set)**
  \[
  \leq 766 \text{ microstrain}
  \]

**Chloride Ion Penetrability (ASTM C1202)**
  \[
  \leq 250 \text{ coulombs}
  \]

**Chloride Ion Penetrability (AASHTO T259; \( \frac{1}{2} \) in. depth)**
  \[
  < 0.07 \text{ oz/ft}^3
  \]

**Scaling Resistance (ASTM C672)**
  \[
  y < 3
  \]

**Abrasion Resistance (ASTM C944 2x weight; ground surface)**
  \[
  < 0.025 \text{ oz. lost}
  \]

**Freeze-Thaw Resistance (ASTM C666A; 600 cycles)**
  \[
  \text{RDM} > 96\%
  \]

**Alkali-Silica Reaction (ASTM C1260; tested for 28 days)**
  \[
  \text{Innocuous}
  \]

* High Heat-Treated - According to manufacturer’s recommendation, temperature not to exceed 250°F.
** Medium Heat Treated temperatures not to exceed 120°F
*** Not Heat Treated temperature not to exceed 70°F

Results of all the tests above, conducted by an AASHTO accredited testing lab shall be submitted to the DCES along with the installation drawings. Provide to the DCES a list of bridge projects in which the proposed UHPC material has been used as joint fill between precast concrete elements (within or outside the USA). The DCES reserves the right to reject a proposed UHPC material which lacks a proven track record in precast concrete joint filling in bridge applications.

**Storage:** The contractor shall assure the proper storage of premix, fibers and additives as required by the supplier's specifications in order to protect materials against loss of physical and mechanical properties.

**Acceptance Testing:** Note: acceptance testing will be waived if the same material from the same supplier has already been tested according to this standard. The Contractor shall complete the testing of the UHPC a minimum of one month before placement of the joint. The testing sequence will include the submission of a plan for casting and testing procedures to the DCES for review and approval followed by casting and testing according to the approved plan.

Casting and testing must include the following:

- A minimum of 12 cylinders 3in. x 6 in. shall be cast.

The temperature during curing shall be as per heat treatment temperature limits established in this specification. 2 cylinders shall be tested each testing interval. Testing intervals are at 10 hours, 12 hours, 14 hours, and 24 hours. The compressive strength shall be measured by ASTM C39. Only a concrete mix design that passes these tests may be used to form the joint.
Pullout Test: Cast 6 additional cylinders 12 in. diameter and 7.5 in. deep. Each cylinder shall have one 32 in. long epoxy-coated reinforcing bar cast in the center of the circular face. The axis of the bar shall be perpendicular to the formed surface. 3 of the bars shall be #6 bars embedded 5 in. deep and 3 of the bars shall be #4 bars embedded 3 in. deep. These cylinders will be kept wet for four days then delivered to the Materials Bureau for testing according to Test Method No. NY 701-14 E. Contact the Materials Bureau prior to casting for specific instructions on preparing the test specimens. The test will be performed as soon as practical after the corresponding compressive strength samples reach 12 ksi. Acceptance criteria for pullout testing shall be when there is complete tensile failure of the reinforcing bar, prior to pullout from the concrete or failure of the concrete.

EQUIPMENT FOR MATURITY TESTING:

Use a Maturity Meter and thermocouples that can:

$ Provide a maturity value based on the Equivalent Age or Temperature Time Method as detailed in ASTM C 1074-11.

$ Continuously log and store maturity data.

$ Accurate to within +/- 1 ˚F when the meter is calibrated as per the manufacturer's instructions.

$ Take readings every half hour for the first 48 hours and every hour after that at a minimum.

$ Print data and/or download it into a spreadsheet.

METHODOLOGY FOR MATURITY TESTING:

The procedure for utilizing the maturity method to determine in-place UHPC strengths includes three steps: development of the strength-maturity relationship, monitoring the maturity of the placement, and regular validation of the strength maturity relationship. Any changes in the mix design, its components, or proportions will require that a new strength-maturity relationship be developed. The strength-maturity relationship shall be developed one month prior to construction. Continue data collection for the strength-maturity relationship after acceptance of the maturity value until the strength reaches 21 ksi.

A procedure to develop the strength-maturity relationship shall be submitted to the DCES for review and approval along with the shop drawings. The submitted procedure shall include all necessary information for the development of the strength maturity relationship. All necessary testing included in the procedure shall be conducted by an AAHSTO accredited testing lab.

CONSTRUCTION

DRAWINGS FOR PRECAST CONCRETE PANELS AND BARRIER

Shop drawings and installation drawings shall be prepared and submitted as per the requirements of the Prestressed Concrete Construction Manual, (PCCM), and the following:

The submitted drawings shall include details of lifting and handling of panels in the production facility and their storage, transportation, handling and storage at the construction site. Lifting holes will not be
permitted. The proposed handling and lifting shall be such that the maximum tensile stress in concrete due to handling and erection loads shall not exceed 0.15(f’ci)1/2, where f’ci is the concrete compressive strength at the time being considered. Calculations showing actual concrete stresses based upon the proposed support locations and expected dynamic loading of the panels during handling, storage and transportation of the panels shall be prepared by a Professional Engineer and shall be submitted along with the drawings. These drawings and calculations shall be stamped and signed by a Professional Engineer.

Integral precast concrete barrier shall be cast integrally with the precast concrete deck prior to shipping. Proposed procedures for the casting, handling, and shipping shall be included in the drawings for the precast concrete panels.

The proposed method of mixing, placing, and curing the UHPC joints shall be shown on the installation drawings. The Contractor shall perform qualification testing using maturity method and the results shall be shown on the installation drawing to demonstrate that the proposed method of curing will achieve the required strength at the required time.

**FABRICATION OF PRECAST CONCRETE PANELS**

Fabrication shall meet the requirements of the PCCM and the following:

**Fabrication Tolerances**

1. **Width (transverse direction of the bridge):** +1/8, -1/8 in.
2. **Length (longitudinal direction of the bridge):** +1/8, -1/8 in.
3. **Depth (overall):** +1/8, -0 in.
4. **Bulkhead alignment (deviation from square or designated skew)**
   - Vertical: ¼ in.
   - Horizontal: ¼ in.
5. **Horizontal alignment (deviation from straight line parallel to centerline of unit):**
   - ¼ in. for 40 ft length
   - 3/8 in. for 40 ft to 60 ft length
   - 1/2 in. for greater than 60 ft length

Welding of steel shall comply with the requirements of the New York State Steel Construction Manual.

**Placing Concrete, Curing and Finishing**

All requirements stipulated in PCCM shall apply except for the following:

After curing, all form release material and all other forming material adhering to the shear keyway and block out concrete shall be removed. Shear key faces shall be roughened and blast cleaned.

**Shipping and Handling of Precast Panels and Precast Concrete Barrier.** Shall be as per approved drawings.

**Loading of Panels.** Equipment weighing more than 2500 pounds shall not be permitted on the precast units between the initial set of the UHPC and the time the UHPC has reached a minimum strength of 10 ksi.

**Mixing and Placing UHPC Joints and Haunches.** Specifications in the PCCM and the following:
Thoroughly and continuously wet the concrete contact area for 24 hours prior to placing of UHPC, keep wet and remove all surface water just prior to UHPC placement.

**INSTALLATION REQUIREMENTS FOR DECK SLABS**
Installation shall meet the requirements of the PCCM and the following:

1. Prior to installing panels, the supporting steel surfaces in contact with the panels or field placed concrete shall be cleaned, including removal of free water, to the satisfaction of the engineer.

2. Installation tolerances shall be as per the approved installation drawings. It is the responsibility of the contractor to develop appropriate controls during the fabrication and installation of the panels so that proper cross slopes and grades are achieved after the diamond grinding operation. Installation drawing shall show the details of the proposed controls.

**INSTALLATION REQUIREMENTS FOR APPROACH SLABS**
Bed and level slabs in accordance with the system designer’s instructions such that the vertical differential across any joint is ¼ in. or less. Slabs shall be placed on grade and have grout pumped underneath to ensure that they are completely supported.

**INSTALLATION REQUIREMENTS FOR UHPC**
The contractor shall arrange for a representative of the UHPC supplier to be on site during the placement of the joints until the Contractor’s own staff has become well-trained in the use of the material. The representative shall be knowledgeable in the supply, mixing, delivery, placement, and curing of the UHPC material.

**GROUTING OF HAUNCHES**
Grouting shall meet the requirements of the PCCM, except that the requirement related to post-tensioning shall not apply. Details of grouting ports, vents, method of pumping the grout, equipment with necessary back up shall be shown on the installation drawing. Required QC for the grouting also shall be listed on the drawings.

**PRE-INSTALLATION MEETING:** Convene a preplacement meeting 7 to 14 calendar days before the planned start of slab installation. The contractor shall arrange for an on site meeting with representatives from the UHPC and the precast system suppliers. The contractor’s staff and the NYSDOT Engineer and Inspectors shall attend the site meeting. The objective of the meeting will be to clearly outline the procedures for placing and leveling the precast concrete panels and for mixing, transporting, finishing and curing of the UHPC material.

**Form Work, Batching and Curing**
The design and fabrication of forms shall follow approved installation drawings and shall follow the recommendations of the manufacturer. All the forms for UHPC shall be constructed from plywood or approved equal. The forms shall be coated to prevent absorption of water using a form release agent from the Department’s Approved List of Materials.

The contractor shall follow the batching sequence as specified by the supplier and approved by the DCES. The surface of the UHPC field joints shall be filled as shown on the approved drawings.
The UHPC in the form shall be cured according to Manufacturer’s recommendations to attain the required strength shown on the contract documents.

Quality Control
The contractor shall measure the slump flow on each batch of UHPC. The slump flow will be conducted using a mini-slump cone. The flow for each batch shall be between 7 in. and 10 in. The slump flow for each batch shall be recorded in the QA/QC log. A copy of the log shall be given to the Engineer.

Estimation of In-Place Strength:
1. Two thermocouples per each UHPC joints, one at each end, shall be installed. The locations of these installations shall be shown on the installation drawings. These locations shall be revised if directed by the DCES. The thermocouple wiring may be connected to reinforcing steel, but probe endings may not be in direct contact with the steel. Consider structural or exposure conditions when placing thermocouples.

2. Listed actions are allowed when the maturity value of all the thermocouples reaches the corresponding strength values listed below.

<table>
<thead>
<tr>
<th>Action</th>
<th>Strength Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Removal of top forms</td>
<td>10 ksi</td>
</tr>
<tr>
<td>Open Bridge deck to Traffic</td>
<td>12 ksi</td>
</tr>
</tbody>
</table>

3. Record and save the maturity data from the meter until the strength reaches 21 ksi. Disconnect the meter and clip all wires flush with the concrete surface.

A continuous read thermocouple or thermistor with a data logger can be used to estimate in place strength. The methodology outlined in ASTM C 1074-11 will be used. The maturity function used to estimate strength will be calculated with the same formula that is used by the maturity meter that established the initial strength maturity relationship. Copies of the calculations will be provided to the engineer.

Validation of the Strength-Maturity Relationship:
For each day of placement, perform validation tests by casting 7 cylinders. Equip one of the cylinders with a thermocouple. Test the cylinders as close as possible to the maturity value corresponding to 21 ksi. Record the maturity value immediately prior to testing. All testing shall be conducted by an AASHTO accredited testing lab. Report the results to the DCES.
If the average value of compressive strength of each pair of cylinders is within 10% of the estimated value, the strength-maturity relationship will be validated. If the average cylinder value is more than 10% below the estimated value, the strength maturity relationship will need to be re-established. If the first four cylinders produce acceptable results, the remainder need not be tested.

The Department may perform additional testing for research purposes. Casting and testing in addition to that required in this spec will be performed by NYSDOT personnel.

In case of loss of required data, or non verification of the strength-maturity relationship, use the cylinders cast above, one pair at a time, to verify the strength.
METHOD OF MEASUREMENT. For precast concrete bridge decks and precast concrete approach slabs apply all the provisions of §557-4. For precast concrete bridge barrier apply all the provisions of §569-4.

BASIS OF PAYMENT. For precast concrete bridge decks and precast concrete approach slabs apply all the provisions of §557-5. For precast concrete bridge barrier apply all the provisions of §569-5.
SCOPE
This specification covers field casting of joints for precast concrete units, including batching, transportation, casting and curing.

MATERIAL

High Weight Methyl Methacrylate (used as repair for leaking joint)
The high molecular weight methacrylate (HMWM) resin shall be low viscosity and non-fuming. Acceptance is based on the manufacturer certifying that it conforms to the following, and the contractor forwarding the certification to the DCES:

- **Viscosity**: Less than 25 cps when measured according to ASTM D2849
- **Density**: Greater than 8.4 lb/gal. @ 77° F.
- **Flash Point**: Greater than 200° F.
- **Vapor Pressure**: Less than 1.0 mm Hg @ 77° F. (ASTM D 323)
- **TG (DSC)**: Greater than 136° F (ASTM D3418)
- **Gel Time**: Greater than 40 minutes for a 100 gram mass
- **Percent Solids**: Greater than 90 % by weight
- **Bond Strength**: Greater than 1522.3 psi (ASTM C882)

**Sand**  The sand shall be commercial quality dry blast sand. 95% of the sand shall pass the #8 sieve, and 95% shall be retained on the #30 sieve.

The container shall include the following information: The name of the manufacturer, the brand name of the product, the date of manufacture.

**Water** shall meet the requirements of §712-01.

**UHPC** material shall meet the following, 28 days unless otherwise noted:
- **Minimum Compressive Strength** (ASTM C39)
  - Heat-Treated*: ≥ 25 ksi
  - Not Heat-Treated**: ≥ 20 ksi
  - Not Heat-Treated 3 day**: ≥ 12 ksi
- **Prism Flexural Tensile toughness** (ASTM C1018; 10 in. span): \( I_{30} \geq 48 \)
- **Long-Term Shrinkage** (ASTM C157; initial reading after set): ≤ 766 microstrain
- **Chloride Ion Penetrability** (ASTM C1202): ≤ 250 coulombs
- **Chloride Ion Penetrability** (AASHTO T259; 1/5 in. depth): < 0.07 oz/ft³
- **Scaling Resistance** (ASTM C672): \( y < 3 \)
- **Abrasion Resistance** (ASTM C944 2x weight; ground surface): < 0.025 oz. lost
- **Freeze-Thaw Resistance** (ASTM C666A; 600 cycles): RDM > 96%
- **Alkali-Silica Reaction** (ASTM C1260; tested for 28 days): Innocuous

* Heat-Treated - According to manufacturer’s recommendation, temperature not to exceed 250°F.
** Not Heat-Treated - Cured at a temperature of 50° F ± 3°.

Casting and testing must include the following (The DCES may waive tests if these tests have been previously performed for material supplied by the manufacturer):

A minimum of 12 cylinders 3 in. X 6 in. shall be cast.
All cylinders shall be cured using the same method of curing proposed to be used in the field. The temperature during curing shall be within 18°F of the low end of the proposed temperature range for curing in the field. 2 cylinders shall be tested each testing day. Testing times are at 4 days, 7 days, 14 days, and 28 days. The compressive strength shall be measured by ASTM C39 and shall meet 12 ksi minimum at 4 days and 21 ksi minimum at 28 days. Only a UHPC mix design that passes these tests may be used to form the joint.

Cast 6 additional cylinders 12 in. diameter and 7 ½ in. deep. Each cylinder shall have one 32 in. long epoxy-coated reinforcing bar cast in the center of the circular face. The axis of the bar shall be perpendicular to the formed surface. 3 of the bars shall be #6 bars embedded 5 inches deep and 3 of the bars shall be #4 bars embedded 3 inches deep. These cylinders will be kept wet for four days then delivered to the Materials Bureau for testing according to Test Method No. NY 701-14 E. Contact the Materials Bureau prior to casting for specific instructions on preparing the test specimens. The test will be performed as soon as practical after the corresponding samples reach 12 ksi.

This test is a pullout test. The samples pass if the bars yield without the UHPC failing and without the bars pulling out of the UHPC.

Results of all the tests above, conducted by an AASHTO accredited testing lab shall be submitted to the DCES for review and approval a minimum of 60 days prior to the use of UHPC in the field. Provide to the DCES a list of bridge projects in which the proposed UHPC material has been used as joint fill between precast concrete elements (within or outside the USA). The DCES reserves the right to reject a proposed UHPC material which lacks a proven track record in precast concrete joint filling in bridge applications.

**CONSTRUCTION**

**Pre-Pour Meeting:** Prior to the initial placement of the UHPC, the contractor shall arrange for an on site meeting with the UHPC representative. The contractor's staff and the NYSDOT Engineer and Inspectors shall attend the site meeting. The objective of the meeting will be to clearly outline the procedures for mixing, transporting, finishing and curing of the UHPC material.

The contractor shall arrange for a representative of the UHPC supplier to be on site during the placement of the joints. The representative shall be knowledgeable in the supply, mixing, delivery, placement, and curing of the UHPC material.

**Storage:** The contractor shall assure the proper storage of premix, fibers and additives as required by the supplier's specifications in order to protect materials against loss of physical and mechanical properties.

**Form Work, Batching and Curing**

The design and fabrication of forms shall follow approved installation drawings and shall follow the recommendations of the manufacturer. All the forms for UHPC shall be constructed from plywood. The forms shall be coated to prevent absorption of water.
The contractor shall follow the batching sequence as specified by the supplier and approved by the DCES. The surface of the UHPC field joints shall be filled to plus 1/4 inch above the surface of the precast units.

The UHPC in the form shall be cured per Manufacturer’s recommendations to attain the required strength shown on the contract documents. A continuous curing temperature of a minimum of 60°F is recommended.

Quality Control
The contractor shall measure the slump flow on each batch of UHPC. The slump flow will be conducted using a mini-slump cone. The flow for each batch shall be between 7 in. and 10in. The slump flow for each batch shall be recorded in the QA/QC log. A copy of the log shall be given to the Engineer.

The contractor shall take four sets of compressive strength test samples for each day of placement. Each set consists of 3 cylinders 3in. X 6in. All sets shall be cured in an environment similar to the material they represent.

The following tests shall be performed:
Compressive strengths shall be per ASTM C 39. The timing of the testing shall be as required by the contract documents. The second set shall be tested at 28 days. The third set will be sent to the Materials Bureau between the 4th day and the 14th day. The fourth set shall be treated as a reserve set.

Surface Finishing
After the joint has set, the UHPC joint shall be ground smooth to be flush with the adjacent surfaces.

Watertight Integrity Test
After the joint has reached the required strength, a watertight integrity test shall be performed in accordance with §567-3.01.H. If leakage occurs the Contractor must seal the entire length of the leaking joint using High Weight Methyl Methacrylate at no extra cost to the State. The Contractor may elect to seal the joint using High Weight Methyl Methacrylate instead of performing the watertight integrity test.

If a rain event occurs that meets the requirements of §567-3.01.H, the Contractor may elect to perform the watertight integrity test using the rain as the water supply.

Repair
Abrasive blast clean the area to be treated, removing all contaminants from the surface. Clean adjacent surfaces of the leaking joints using compressed air which is free of oil and moisture.

Do not apply sealers if rain is expected within 12 hours of completion. Apply sealers to clean, dry surfaces when the surface temperature is at least 50° F, and if near 50° F, rising. The sealer shall be mixed and applied according to the manufacturer’s instructions and no more than 5 gallons at a time. Pour the sealer over the joints.
ITEM 557.21030016 - FIELD CAST UHPC JOINTS BETWEEN PRECAST CONCRETE UNITS (LENGTH)
ITEM 557.21040016 - FIELD CAST UHPC JOINTS BETWEEN PRECAST CONCRETE UNITS (VOLUME)

When the methacrylate surface will be used as a driving surface, sand must be applied to provide friction. After the resin has been applied, at least 20 minutes shall elapse before applying the sand. The sand shall be broadcast at a rate of approximately two pounds per square yard, completely covering the sealer.

The sealer must be tack-free before construction traffic is permitted to resume.

MEASUREMENT FOR PAYMENT
Length: Measurement will be by length of UHPC joints placed in feet. The volume of in-place UHPC shall be calculated to the nearest foot.

Volume: Measurement will be by volume of UHPC joints placed in cubic feet. The volume of in-place UHPC shall be calculated to the nearest cubic foot.

BASIS OF PAYMENT
Payment at the contract price for the above item shall be full compensation for all labor, equipment, and material to do the work.
ITEM 557.60010004 – FULL DIAMOND GRINDING OF STRUCTURAL SLAB AND STRUCTURAL APPROACH SLAB WITH SLURRY REMOVAL

DESCRIPTION
This work shall consist of diamond grinding and texture the Portland cement concrete (PCC) structural slab and approach slab surface.

MATERIALS AND EQUIPMENT
No materials specified

Use equipment having gang-mounted diamond saw blades on a multiblade arbor specifically designed for PCC pavement or superstructure production grinding. Use equipment capable of producing a 3 ft wide (minimum) grinding pass that is equipped with a vacuum system capable of removing slurry from the bridge deck surface. Smaller diamond grinding equipment shall be used as necessary to complete grinding adjacent to curbs or barriers. The Contractor shall submit requests to use other equipment at least 7 days prior to the start of grinding operations.

CONSTRUCTION DETAILS
The depth of grind shall be approximately 3/16 inch to obtain a smooth texture. Begin and end diamond grinding lines normal to the bridge deck centerline. Grind the bridge deck longitudinally such that at least 95% of the bridge deck surface is ground and the bridge deck is in the same plane across a joint or crack when measured with a 3 ft (minimum) straightedge. Provide surface drainage by maintaining the proper cross-slope on the finished surface and by blending adjacent passes. Regrind the bridge deck if an acceptable surface is not being obtained.

If the existing bridge joint system will remain, feathering will be required to match the existing joint elevation. The feathering operation at the joints shall achieve a uniform cut that will be flush to the existing joints.

Continuously remove slurry from the bridge deck using the vacuum system on the grinding equipment. If required, provide equipment capable of transporting the slurry from the job site to an acceptable waste area or facility, without spilling. Traffic may be allowed on ground areas after slurry removal is complete or on decks where only partial diamond grinding is complete.

In any case, do not allow slurry discharge into:
1. Occupied travel lanes.
2. Drainage structures, scuppers, or bridge downspout systems
3. Wetlands, streams, or sensitive environmental resources identified in the contract documents.
4. Areas where it will become a public nuisance.

Dispose of slurry in conformance with all Federal, State, and Local regulations.
ITEM 557.60010004 – FULL DIAMOND GRINDING OF STRUCTURAL SLAB AND STRUCTURAL APPROACH SLAB WITH SLURRY REMOVAL

After diamond grinding is complete, concrete shall be saw cut grooved according to contract documents and specifications for saw cut grooving, followed by penetrating sealer application placed in accordance with contract documents and specifications for penetrating sealers. The saw cut grooving and penetrating sealing will be paid for under their appropriate items.

METHOD OF MEASUREMENT
The work will be measured for payment as the number of square yards of structural slab and approach slab satisfactorily diamond ground, measured to the nearest square yard. No deductions will be made for isolated areas, providing that a minimum of 95% of the surface is diamond ground.

BASIS OF PAYMENT
The unit bid per square yards of Full Diamond Grinding of PCC Structural Slab and Structural Approach Slab shall include the cost of all labor, materials, and equipment necessary to satisfactorily complete the work, including slurry removal.
ITEM 557.66010101 PRECAST BRIDGE SYSTEM WITH EMBEDDED STRUCTURAL STEEL
ITEM 557.66020101 PRECAST CONCRETE APPROACH SLABS
ITEM 557.16020101 INTEGRAL PRECAST BARRIER

DESCRIPTION: This specification covers the material and fabrication and installation requirements for precast bridge system with embedded structural steel, approach slabs, and integral precast barrier. “Panels” refers to both the precast bridge system and to the approach slab.

The design and detail shown in the contract documents is only applicable when the panel layout as shown is used. If the Contractor proposes a different layout, all necessary revisions and supporting calculations, stamped by a Professional Engineer, shall be submitted to the DCES.

MATERIAL REQUIREMENTS:

Concrete PCCM
Concrete Reinforcing §709
Concrete Repair Material §701-04, §701-06, §701-08, or §701-09.
Paint as specified by the contract documents.
Structural Steel §715-01
Stud Shear §709-05
Fasteners ASTM A325M, Type 3.
Nuts, bolts and washers §715-14, and the SCM, part 1001.1.

CONSTRUCTION DETAILS

STEEL:
FABRICATION REQUIREMENTS: All structural steel fabrication and shear connector installation work shall be done in accordance with the requirements of the New York State Steel Construction Manual (SCM). If the steel is to be painted, it shall be painted prior to shipping from the fabrication shop.

CONCRETE
The requirements of the New York State Prestressed Concrete Construction Manual (PCCM) shall apply, including Section 2.3, Installation Drawings, with the following modifications:

Section 5.5.1 - The following shall also apply: All structural steel to be embedded in concrete shall exhibit a cleanliness grade as defined by SSPC-Vis 1, cleanliness grades BSt3, or CSt3, as applicable.

Section 5.8, Second sentence - Change to: If no strength is indicated, the required minimum strength shall be 3000 psi at lifting, and 5000 psi at 28 days.

Section 5.9.1, add the following: In addition, all steel stringers shall be cast such that the webs will be truly vertical upon installation at their permanent locations.

If the structural steel portions of the unit have been painted prior to concrete casting, all material which might act as a bond breaker between the concrete and steel shall be removed. In addition, all paint shall be protected from the effects of the curing procedure by a method(s) acceptable to the Inspector. All paint damage shall be repaired in a manner approved by the DCES at no additional cost.
ITEM 557.66010101 PRECAST BRIDGE SYSTEM WITH EMBEDDED STRUCTURAL STEEL
ITEM 557.66020101 PRECAST CONCRETE APPROACH SLABS
ITEM 557.16020101 INTEGRAL PRECAST BARRIER

Section 5.10.2 - Delete this subsection, replace with: The tops of all units shall be finished in an identical manner. The finished surface shall be that approved on the Shop Drawings.

Section 6 - Add a new subsection: Lifting of Units. Units shall be lifted as soon as the final curing phase is completed, and the minimum lifting strength is reached. Lifting shall be done in the manner approved on the Shop Drawings.

Section 6.4.2 Add the following: Honeycombing of concrete to such an extent that chipping away the honeycombed concrete exposes:
   a. Any reinforcement comprising the top reinforcing mat.
   b. Reinforcement comprising the bottom reinforcing mat which is 24 diameters or longer, or two or more reinforcing bars regardless of length.
   c. Any unit exhibiting a crack in any part of the concrete that is greater than ½ inch in depth and 0.002 inches in width.

Section 7 The following shall apply:

Precasting - In accordance with the concrete placement requirements of Section 550, all forms, bar reinforcement, unit camber, and other relevant factors shall be inspected for compliance with the applicable tolerances listed below:

<table>
<thead>
<tr>
<th>Specification</th>
<th>Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Width</td>
<td>¼ inch</td>
</tr>
<tr>
<td>Overall Depth of Structural Slab</td>
<td>+3/8 inch, -1/8 inch</td>
</tr>
<tr>
<td>Slope (Top of Unit)</td>
<td>+½%, -0%</td>
</tr>
<tr>
<td>Reinforcing Cover - Both Mats</td>
<td>±1/4 inch</td>
</tr>
<tr>
<td>Reinforcing Placement - Horizontal</td>
<td>±2 inches</td>
</tr>
<tr>
<td>Inserts</td>
<td>±3/8 inch</td>
</tr>
<tr>
<td>Deviation from square, or designated skew</td>
<td>±1/4 inch (vertical)</td>
</tr>
<tr>
<td>Deviation from theoretical diagonal length</td>
<td>±3/4 inch</td>
</tr>
</tbody>
</table>

Any movement of the forms during casting beyond the tolerances listed above is cause for rejection of the unit. The Inspector will document all form movements to the D.C.E.S. A determination will be made by the D.C.E.S. regarding the unit’s acceptability.

Post Lifting - All units shall be inspected for compliance with the tolerances listed below within 24 hours after lifting. All units failing to meet any one tolerance limit will be rejected with the concurrence of the D.C.E.S.:

<table>
<thead>
<tr>
<th>Specification</th>
<th>Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horizontal Alignment</td>
<td>3/8 inch</td>
</tr>
<tr>
<td>(Deviation from straight line parallel to centerline of unit):</td>
<td></td>
</tr>
<tr>
<td>Deviation between adjacent steel</td>
<td>±1/4 inch (within units)</td>
</tr>
<tr>
<td>stringer flanges</td>
<td></td>
</tr>
<tr>
<td>Camber deviation from design camber</td>
<td>±1/4 inch</td>
</tr>
<tr>
<td>(upright position):</td>
<td></td>
</tr>
<tr>
<td>Overall length of Unit:</td>
<td>±3/4 inch</td>
</tr>
<tr>
<td>±3/4 inch, Adjacent units shall not</td>
<td></td>
</tr>
<tr>
<td>vary by more than 3/4 inch.</td>
<td></td>
</tr>
</tbody>
</table>

INSTALLATION
Installation shall be in accordance with the approved Installation Drawings.
ITEM 557.66010101 PRECAST BRIDGE SYSTEM WITH EMBEDDED STRUCTURAL STEEL
ITEM 557.66020101 PRECAST CONCRETE APPROACH SLABS
ITEM 557.16020101 INTEGRAL PRECAST BARRIER

METHOD OF MEASUREMENT
Precast Bridge System With Embedded Structural Steel shall be measured by the plan area actually installed as shown on the contract documents.

BASIS OF PAYMENT
DESCRIPTION

This work shall consist of furnishing and installing Northeast Extreme Tee - NEXT Beam in accordance with the contract documents and as directed by the Engineer.

MATERIALS

All materials shall conform to Section 563-2 of the Standard Specifications, and the following:

CONSTRUCTION DETAILS

The requirements of the PCCM shall apply.

METHOD OF MEASUREMENT

This work will be measured as the number of square of Northeast Extreme Tee - NEXT D Beam unit satisfactorily furnished and installed.

BASIS OF PAYMENT

The unit price bid shall include the cost of furnishing all labor, materials, diaphragms, and equipment necessary to satisfactorily complete the work, except that bearings shall be paid for under their respective item. This work does not include field placement of reinforcement or casting of longitudinal closure pours.

Damaged units which cannot be satisfactorily repaired or which do not meet dimensional and camber tolerances shall be replaced by the Contractor at no additional cost to the State.

Payment will be made under:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>563.XXXXNN02</td>
<td>Prestressed NEXT D Beam, Type 1</td>
<td>Foot</td>
</tr>
<tr>
<td>563. XXXXNN02</td>
<td>Prestressed NEXT D Beam, Type 2</td>
<td>Foot</td>
</tr>
</tbody>
</table>

\[NN = Type\ Designation\ (1\ or\ 2,\ as\ shown\ on\ the\ plans)\]
DESCRIPTION
This work shall consist of furnishing and installing Prestressed Concrete Deck Bulb Tees in accordance with the contract documents and as directed by the Engineer. The Contractor will notify the Engineer of the source of the prestressed units, for approval, within (7) days after the award of the contract.

MATERIALS
The concrete shall meet the requirements of §718-06, High Performance Concrete for Precast and Prestressed Bridge Beams. All other materials shall meet the requirements of Section 4 of the PCCM.

CONSTRUCTION DETAILS
The requirements of the PCCM shall apply.

METHOD OF MEASUREMENT
This work will be measured as the number of feet of Prestressed Concrete Deck Bulb Tees satisfactorily furnished and installed.

BASIS OF PAYMENT
The unit price bid shall include the cost of furnishing all labor, materials, and equipment necessary to satisfactorily complete the work, except that bearings will be paid for under their respective items.

Damaged units which cannot be satisfactorily repaired or which do not meet dimensional and camber tolerances shall be replaced by the Contractor at no cost to the State.

Progress payments will be made when each unit is furnished and placed in accordance with the plans and specifications exclusive of preparing and filling joints. Payment will be made at the unit price bid for 90% of the quantity properly placed. The balance of the quantity will be paid for upon completion of the work. The completion of work will include the correct preparation and filling of the joints.
ITEM 607.96000008 - REMOVE AND DISPOSE OF EXISTING FENCE

DESCRIPTION:

The contractor shall remove existing fence in accordance with the plans, specifications and directions of the Engineer. All references to "fencing" shall include existing gates, if any to be removed.

MATERIALS:

Materials needed for modifying end sections shall conform to the requirements of Section 710 of the Standard Specifications or shall conform to the material requirements of the existing fence, as directed by the Engineer.

Concrete for footings shall conform to Section 607-2.01 of the Standard Specifications.

CONSTRUCTION DETAILS:

The contractor shall remove and dispose of the existing fence to a point shown on the plans or where directed by the Engineer. If a portion of the existing fence is to remain, the remaining end section shall be modified to adequately secure the fencing. This modified section shall include all hardware necessary to secure the fencing in a manner similar to the existing end section or as directed by the Engineer. Parts salvaged from the removed portion, acceptable to the Engineer, may be reused in the end section.

All work shall be done in a workmanlike manner with care taken not to disturb the surrounding area or existing fence to remain. Any damage to the area or existing fence to remain caused by the contractor's operations shall be repaired to the original condition at no expense to the state. Any concrete post footings shall be either broken up and removed or removed in one piece as determined by the contractor and approved by the Engineer. All post holes shall be filled to meet existing grade. All excavation and backfill shall conform to Section 203 "Excavation and Embankment".

METHOD OF MEASUREMENT:

This work will be measured as the number of feet of fence removed in accordance with the plans or as directed by the Engineer. An additional 10 foot allowance will be paid for each end section modified to secure the remaining fence.

BASIS OF PAYMENT:

The unit price bid shall include the cost of all labor, equipment and materials necessary to complete the work, including the cost of any fill required to fill the post holes.
ITEM 608.01020005 – COLORED AND IMPRINTED PORTLAND CEMENT CONCRETE SIDEWALK

ITEM 608.01030005 – COLORED PORTLAND CEMENT CONCRETE SIDEWALK

ITEM 608.01040005 – IMPRINTED PORTLAND CEMENT CONCRETE SIDEWALK

DESCRIPTION

Construct Portland cement concrete sidewalks as shown on the contract documents according to §608 of the Standard Specifications, using colored and/or imprinted concrete, including color matching joint material, when specified.

MATERIALS

Apply §608-2.01 with the following modifications:

Colored Concrete

All coloring agents shall produce a color conforming to the Federal Standard 595. The color shall be as indicated on plans.

Color admixtures for integrally colored concrete will be certified by the manufacturer as meeting the requirements of ASTM C979 Standard Specifications for Pigments for Integrally Colored Concrete and be packaged such that one dose is the proper dosage for one cubic yard of concrete.

Imprinted Concrete

Use imprinting tools capable of imprinting the surface of the concrete with a uniform and aligned pattern and/or texture. Use a clear release agent as specified by the imprinting tool manufacturer. These materials shall be approved by the Engineer prior to their use.

Color Matching Joint Material

When specified for any location, use a color matched caulking compound designed for joint sealing.

CONSTRUCTION DETAILS

Apply §608-3.01 with the following modifications:

Test Panels

Prior to the start of work, the Contractor shall show evidence of successful completion of similar installations. The Contractor shall construct a job site test panel for each individual color and pattern or combination of color and pattern specified in the contract documents. The test panel(s) shall be 5 feet x 5 feet, minimum, and constructed at a location selected by the Engineer. As many test panels will be constructed as are necessary to produce sample panels that meet the approval of the Engineer. The permanent work shall be consistent with the appearance of the approved test panel(s) as determined by the Engineer. The test panel(s) shall not be incorporated into the work and will be removed when ordered by the Engineer.
Colored Concrete

Apply color admixtures and dry shake additives at the manufacturers recommended dosage rate. This rate is to remain constant for all batches of concrete produced. Prior to placing concrete, protect adjacent surfaces and structures from spatters. Once a portion of the batch has been placed, no additional water shall be added to the remaining batch.

To integrally color the concrete, introduce the color additive into the mixer drum in a manner recommended by the manufacturer. The quantity of concrete being delivered shall be no less than one-third the capacity of the mixer drum. Batch the concrete in full cubic yard increments.

After the concrete is placed, apply a color matching hardener evenly to the plastic surface by the “dry shake” method as recommended by the manufacturer.

Imprinted Concrete

Screed concrete to the finished grade and apply release agent. Using methods as recommended by the manufacturer, apply pre-approved imprinting tools to the surface while the concrete is still plastic. The requirement for a lightly broomed surface is waived.

Unless otherwise specified, score or saw cut the surface to a minimum depth of ¼ the thickness of the slab at intervals of 5 feet. Tool the edges, joints and scored areas in a manner consistent with the imprinting pattern. If the saw cut option is used, the Contractor shall be responsible for performing the saw cut operation at such time as to minimize the possibility of spalling and/or cracking.

Within 24 hours, remove release agent with pressure wash and apply a pre-approved sealer, recommended by the coloring manufacturer, at a rate consistent with manufacturer’s specifications.

Color Matching Joint Material

Install pre-molded resilient joint filler (§705-07) where the sidewalk line intersects a building, walk, permanent structure or other location designated by the Engineer, to within 1-inch of the top of the slab. Caulk the top 1-inch of the joint with color matching caulking compound.

METHOD OF MEASUREMENT

Apply §608-4.01
ITEM 608.01020005 – COLORED AND IMPRINTED PORTLAND CEMENT CONCRETE SIDEWALK

ITEM 608.01030005 – COLORED PORTLAND CEMENT CONCRETE SIDEWALK

ITEM 608.01040005 – IMPRINTED PORTLAND CEMENT CONCRETE SIDEWALK

BASIS OF PAYMENT

Apply §608-5.01

The cost of construction and removal of the test panel(s) is to be included in the price bid for the specified item(s).

Payment will be made under:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>608.01020005</td>
<td>Colored and Imprinted Portland Cement</td>
<td>Cubic Yard</td>
</tr>
<tr>
<td></td>
<td>Concrete Sidewalk</td>
<td></td>
</tr>
<tr>
<td>608.01030005</td>
<td>Colored Portland Cement Concrete Sidewalk</td>
<td>Cubic Yard</td>
</tr>
<tr>
<td>608.01040005</td>
<td>Imprinted Portland Cement Concrete Sidewalk</td>
<td>Cubic Yard</td>
</tr>
</tbody>
</table>
**ITEM 610.14000011 – STRUCTURAL SOIL MIX**

**DESCRIPTION**
Under this item the Contractor shall furnish and place Structural Soil Mix in accordance with the contract documents and as directed by the Engineer.

**MATERIALS**
Structural Soil Mix shall be a mixture of crushed stone, clay loam, hydrogel and amendments meeting the requirements of “CU Structural Soil®” patented by Cornell University (Patent #5,849,069) also known as “CU Soil™”. The material shall be obtained from a Producer sub-licensed by Amereq, the exclusive Licensee of Cornell University for CU-Structural Soil®. Proof of such sub-licensing shall be submitted to the Engineer along with a sample of the finished mix, prior to delivery to the site. A list of sub-licensed Producers can be obtained from:

Amereq Inc.
“CU Soil™” Division
19 Squadron Blvd. New City, New York 10956,
phone: (800) 832-8788 ext. 11
contact: bkalter@amereq.com

**Water:** Shall comply with Standard Specifications Section 712-01.

**CONSTRUCTION DETAILS**

**Mixing and Quality Control Testing:** All Structural Soil components, including any organic material, water, or other amendments necessary to meet the requirements of CU-Structural Soil® shall be mixed by a licensed Producer at that Producer’s yard prior to delivery. No mixing shall be done at the project site. Sufficient time must be allowed prior to delivery for the Producer’s internal quality control, independent laboratory testing, analysis and (if necessary) amendment of the mix.

**Delivery, Storage and Handling:** The Contractor shall arrange for delivery of the Structural Soil Mix to the site, either by the Producer, or the Contractor’s own forces. The Contractor shall ensure that the delivered Mix is received from the Producer at or near optimum compaction moisture content as determined by AASHTO T-99 (ASTM D698) and shall protect the Mix from drying out or from excess moisture until placed. The Mix shall also be protected from contamination by toxic materials, trash, debris, water containing cement, clay, silt or materials that will alter the particle size distribution.

Structural Soil Mix shall not be transported when rain is expected. If not placed the day of delivery, it shall be stored and protected from excess water absorption and/or potential erosion.

The Engineer shall obtain and furnish to the EIC, a ticket ensuring that the delivered Structural Soil Mix was obtained from and mixed by a licensed Producer. The delivered Structural Soil Mix should also be compared to the original sample to ensure consistency.
ITEM 610.14000011 – STRUCTURAL SOIL MIX

Placement: The Contractor shall notify the Engineer of any subsurface conditions which may affect the Contractor’s ability to install the Structural Soil Mix. If subsurface drain lines are included, they shall be installed prior to placement of the mix.

The Mix shall not be worked when frozen, excessively wet, or under otherwise unsatisfactory conditions nor shall it be placed on frozen, wet or muddy sites. The Mix must not be excessively or incorrectly handled to the point of separation of the clay loam soil from the crushed stones.

Structural Soil Mix shall be placed in 6 inch lifts, each compacted to at least 95% Proctor Density. If compaction moisture content exceeds the optimum per AASHTO T 99 (ASTM D 698), delay compaction and protect Mix until sufficiently dry to compact.

METHOD OF MEASUREMENT
The quantity to be measured for payment will be in cubic yards to the nearest cubic yard of Structural Soil Mix installed.

BASIS OF PAYMENT
The unit bid price shall include the cost of all labor, materials and equipment necessary to complete the work satisfactorily.

Payment will be made under:

<table>
<thead>
<tr>
<th>ITEM NO.</th>
<th>ITEM</th>
<th>PAY UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>610.14000011</td>
<td>Structural Soil Mix</td>
<td>Cubic Yard</td>
</tr>
</tbody>
</table>
ITEM 610.16XXNN24 - TURF ESTABLISHMENT – SEED MIX AS SPECIFIED

DESCRIPTION
This work shall consist of furnishing, placing and establishing a turf seed mix at the locations shown in and in accordance with the contract documents as directed by the Engineer.

All information indicated in this specification as being “…as specified in the contract documents” will be contained in a special note titled, “Turf Establishment – Seed Mix As Specified” in the contract documents.

MATERIALS
The following sections of the standard specifications shall apply:

Turf Establishment 610-2.03

with the following exceptions:

• the seed mix shall be as specified in the contract documents.

CONSTRUCTION DETAILS
The following sections of the standard specifications shall apply:

Turf Establishment 610-3.03

with the following qualifications:

• The application rate of the seed mix shall be as specified in the contract documents.
• Initial watering shall be a minimum 1” depth of water applied over all seeded areas.
• The acceptance criteria shall be indicated in the contract documents as one of the following:
  o §610-3.03 A. Turf Establishment – Roadside, or
  o §610-3.03 B. Turf Establishment – Lawns, or
  o Turf Establishment – Mowing not Included. Areas will be accepted when:
    • free from thin or bare ground greater than one foot in diameter,
    • ground surface is covered with established specified permanent turf species at a uniform density of at least eighty percent (80%),
    • turf growth height of at least eight inches (8”), and
    • turf exhibits healthy green color.
  o Turf Establishment – Permit Requirements. Areas will be accepted when:
    • free from thin or bare ground greater than one foot in diameter or compliant with permit requirements,
    • the ground surface is covered with established specified permanent vegetative species at a uniform density of at least eight percent (80%), or compliant with permit requirements,
    • compliant with permit conditions not listed here, and
    • determined healthy (visual inspection) as indicated by color and vigorous growth.

Page 1 of 2
July, 2015
ITEM 610.16XXNN24 - TURF ESTABLISHMENT – SEED MIX AS SPECIFIED

METHOD OF MEASUREMENT
The work will be measured as the number of square yards on slope to the nearest whole square yard on slope of turf seed mix furnished, placed and established.

BASIS OF PAYMENT
The unit price bid for turf establishment – seed mix as specified shall include the cost of all labor, materials and equipment including initial water, mulch and mulch anchorage as necessary to satisfactorily complete the work.

Where:
XX indicates the region using the specification (e.g. 05 for Region 5; 10 for Region 10), and
NN is a serialization for each unique turf seed mix established using this specification.
ITEM 611.19010024  - POST-PLANTING CARE WITH REPLACEMENT - MAJOR DECIDUOUS TREES
ITEM 611.19020024  - POST-PLANTING CARE WITH REPLACEMENT - MINOR DECIDUOUS TREES
ITEM 611.19030024  - POST-PLANTING CARE WITH REPLACEMENT - CONIFEROUS TREES
ITEM 611.19040024  - POST-PLANTING CARE WITH REPLACEMENT - DECIDUOUS SHRUBS
ITEM 611.19050024  - POST-PLANTING CARE WITH REPLACEMENT - EVERGREEN SHRUBS
ITEM 611.19060024  - POST-PLANTING CARE WITH REPLACEMENT - VINES, GROUNDCOVERS
ITEM 611.19070024  - POST-PLANTING CARE WITH REPLACEMENT - HERBACEOUS PLANTS

DESCRIPTION

This work consists of the care of newly planted and transplanted trees, shrubs, vines, groundcovers and other plants and replacement of plants in kind and as necessary, in accordance with the contract documents and as directed by the Engineer.

MATERIALS

Materials shall meet the requirements of the following subsections of Section 700 Materials and Manufacturing.

- Water 712-01
- Topsoil 713-01
- Mulch for Landscape Bedding 713-05
- Trees, Shrubs and Vines 713-06
- Materials for the Protection of Plants 713-08
- Pesticides 713-13

CONSTRUCTION

Post-Planting Care. The Contractor shall perform all work as specified under Standard Specification section 611-3.05 Post-Planting Care.

Replacement Planting. Plants that die, become diseased or badly impaired during Post-Planting Care shall be removed and replaced in kind once with new, healthy plant material, in the same location as the initial planting. Replacement planting shall occur within the planting seasons shown in Standard Specification Table 611-1. For any plants replaced during the Post-Planting Care period, Post-Planting Care shall continue to the end of the period.

Replacement plants shall be planted, maintained and accepted per Standard Specification Section 611-3.01. Planting soil used in the initial planting shall be reused for replacement plants and shall be supplemented with topsoil at no additional cost if additional material is needed to meet grade and surface finish. Watering shall accompany backfilling, at no additional cost. No replacement tree shall be staked, guyed or anchored.
ITEM 611.19010024 - POST-PLANTING CARE WITH REPLACEMENT - MAJOR DECIDUOUS TREES
ITEM 611.19020024 - POST-PLANTING CARE WITH REPLACEMENT - MINOR DECIDUOUS TREES
ITEM 611.19030024 - POST-PLANTING CARE WITH REPLACEMENT - CONIFEROUS TREES
ITEM 611.19040024 - POST-PLANTING CARE WITH REPLACEMENT - DECIDUOUS SHRUBS
ITEM 611.19050024 - POST-PLANTING CARE WITH REPLACEMENT - EVERGREEN SHRUBS
ITEM 611.19060024 - POST-PLANTING CARE WITH REPLACEMENT - VINES, GROUNDCOVERS
ITEM 611.19070024 - POST-PLANTING CARE WITH REPLACEMENT - HERBACEOUS PLANTS

METHOD OF MEASUREMENT.

The quantity to be measured for payment will be the number of plants of each type cared for and, if necessary, replaced in kind.

BASIS OF PAYMENT.

The unit price bid shall include the cost of all labor, materials, and equipment necessary to satisfactorily complete the work.

Payment will be made under:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>611.19010024</td>
<td>Post Planting Care with Replacement - Major Deciduous Trees</td>
<td>Each</td>
</tr>
<tr>
<td>611.19020024</td>
<td>Post Planting Care with Replacement - Minor Deciduous Trees</td>
<td>Each</td>
</tr>
<tr>
<td>611.19030024</td>
<td>Post Planting Care with Replacement - Coniferous Trees</td>
<td>Each</td>
</tr>
<tr>
<td>611.19040024</td>
<td>Post Planting Care with Replacement - Deciduous Shrubs</td>
<td>Each</td>
</tr>
<tr>
<td>611.19050024</td>
<td>Post Planting Care with Replacement - Evergreen Shrubs</td>
<td>Each</td>
</tr>
<tr>
<td>611.19060024</td>
<td>Post Planting Care with Replacement - Vines, Groundcovers</td>
<td>Each</td>
</tr>
<tr>
<td>611.19070024</td>
<td>Post Planting Care with Replacement - Herbaceous Plants</td>
<td>Each</td>
</tr>
</tbody>
</table>
ITEM 619.24000004 – NIGHTTIME OPERATIONS (WITH BALLOON LIGHTING REQUIREMENTS FOR MOVING OPERATIONS)

DESCRIPTION
Under this work the Contractor shall develop a Nighttime Operations and Lighting Plan; furnish, install, operate, maintain, move and remove lighting equipment for construction operations; construct devices and adapt equipment to be compatible with lighting equipment; and furnish nighttime safety apparel and devices as shown in the contract documents and as directed by the Engineer.

MATERIALS
None Specified.

CONSTRUCTION DETAILS

Nighttime Operations. Work occurring after sunset and before sunrise will be considered nighttime operations. A nighttime operations meeting shall be held prior to the start of any nighttime operations.

For moving operations, the Contractor shall implement a lighting plan and provide illumination to illuminate nighttime moving operations, including milling, paving, mechanical sweeping, applying tack, asphalt rolling, crack sealing, and crack and seat, by mounting balloon lights to the equipment as the primary source of illumination. The Contractor should maintain traffic in a single lane during nighttime moving operations on freeways. For static operations, the Contractor shall implement a lighting plan and provide illumination through the work areas.

All workers involved in nighttime operations shall wear hard hats and nighttime apparel in accordance with §107-05A. High Visibility Apparel at all times. In addition, where the Contractor implements a mobile lighting plan, the Contractor shall equip workers on foot with a personal active safety system which enhances the visibility of the worker from all directions, such as a powered hardhat light ring or a powered safety vest lighting system, and ANSI Class E gaiters or pants. The Contractor shall provide the Department with the same personal active safety systems and Class E garments for 20 Department individuals. When workers on foot are passing between illuminated work areas, the Contractor shall provide personal headlamps or flashlights producing a minimum of 5 foot candles at the ground to navigate their path.

Vehicles operating on the pavement of a closed roadway or travel lane shall display four-way flashers or rotating amber beacons at all times. Vehicles using headlights, except for rollers and vehicles retrieving channelizing devices, shall travel facing in the same direction as adjacent traffic to avoid glare and confusion to drivers.

A. Nighttime Operations and Lighting Plan. Thirty days prior to the start of nighttime operations, the Contractor shall submit a written Nighttime Operations and Lighting Plan to the Engineer for approval. The plan shall detail all aspects of the traffic control setup, the functions, responsibilities and identities of the nighttime traffic control competent person and other details as necessary. The Contractor shall maintain a supply of emergency flares for use in the event of unanticipated situations such as traffic accidents, equipment breakdowns, failure of lighting equipment, etc. The plan shall include a contingency plan identifying foreseeable problems and emergencies that may arise, and the approach that will be used to address them. This plan shall be revised and updated by the Contractor as necessary during the progress of the work to accommodate conditions on the contract.
The Nighttime Operations and Lighting Plan shall be submitted to the Engineer at a scale and printed size similar to the contract plans, and appropriate to adequately describe the work, including the following:

- The general layout of equipment involved in the moving operation, including typical or variable spacing.
- Schematic of the equipment-mounted balloon lights and supplemental lights.
- Listing of the anticipated workforce to be located within the work zone.
- Internal traffic control plan to coordinate the flow of deliveries, moving equipment, workers, and vehicles at the worksite to minimize or eliminate vehicles and employees from crossing paths, and how to communicate this plan to all individuals involved.
- Specific illuminated areas for cleanout, specific areas for trucks entering and exiting the work area, and how to communicate this plan to the workers and truck drivers prior to arrival on site.
- Means to illuminate areas to perform tasks not in the immediate vicinity of the major work.
- Means to ensure visibility of personnel and equipment involved with the set-up and removal of work zone traffic control devices.
- Description and specific technical details on all lighting equipment, including brand names, model numbers, power rating and photometric data.
- Details of any hoods, louvers, shields or other means to be used to control glare.
- Attachment and mounting details for lights to be attached to equipment.
- Layout showing the location of stationary light towers, including typical spacing, lateral placement and mounting height.

B. Lighting for Nighttime Operations. Prior to the first night of nighttime operations, the Contractor shall set up and operate the lighting equipment at night as a trial run to demonstrate its ability to establish a safe, properly illuminated, nighttime operation. The Contractor shall furnish the Engineer with a photometer, capable of measuring the level of illumination, for use as necessary to check the adequacy of illumination throughout nighttime operations. The Contractor should have backup lighting equipment available onsite. In the event that any required lighting equipment is no longer operational or available to perform the work, the Contractor shall remove the work zone associated with the operation until the lighting equipment is restored.

1. Equipment. The Contractor shall supply all lighting equipment required to provide a work zone safe for the workers and traffic. Material and/or equipment shall be in good operating condition and in compliance with applicable safety and design codes.

   a. Balloon Lights. Balloon lights shall be defined as a commercially available light source inside a translucent material that produces a low-glare, diffuse light. The Contractor shall equip the following equipment in conjunction with nighttime moving operations with balloon lights to sufficiently illuminate the work area and to safely and accurately carryout the work: all rollers, pavers, mechanical sweepers, milling machines, tack trucks, material transfer devices, crack and seat equipment, and other miscellaneous equipment utilized for the moving operation. There shall be a minimum of one balloon light mounted to each piece of equipment. Pavers and large milling machines shall be equipped with a minimum of two balloon lights. Additional balloon lights shall be required, where obstructions exist, to safely and adequately perform the work. Balloon lighting equipment shall be sufficiently ballasted.
and durable to withstand the anticipated weather conditions and vibrations from the host equipment. Mountings shall be designed so that light fixtures can be aimed and positioned as necessary to reduce glare and to provide the required illumination. Mounting brackets and fixtures shall not interfere with the equipment operator or any overhead structures or utilities, and shall provide for secure connection of the fixtures with minimal vibration.

b. Light Towers. Light towers shall be provided as a primary means of illumination for stationary operations, and shall provide Level I illumination throughout the work area. Light towers shall be sturdy and free-standing without the aid of guy wires or bracing, and shall be capable of being moved as necessary to keep pace with construction operations. Light towers shall be positioned to minimize the risk of being impacted by traffic on the roadway or by construction traffic or equipment.

c. Construction Equipment Lights. All construction equipment, including rollers, backhoes, loaders, and other equipment operating in areas not illuminated to a minimum of Level I Illumination, shall be equipped with a minimum of two 500 watt flood lights facing in each direction to provide a minimum of 1 foot-candle of horizontal illumination measured 60 feet in front of and behind the equipment. In areas illuminated to a minimum of Level I, construction equipment may move unescorted. In non-illuminated areas, construction equipment shall be equipped with conventional vehicle headlights, shall be illuminated with flood lights on the vehicle, or shall be escorted to permit safe movement. Headlights shall not be permitted as the sole means of illumination while working.

d. Equipment Mounting. The Contractor shall provide suitable brackets and hardware to mount lighting fixtures and generators on machines and equipment. Mountings shall be designed so that light fixtures can be aimed and positioned as necessary to reduce glare and to provide the required illumination. Mounting brackets and fixtures shall not interfere with the equipment operator or any overhead structures, and shall provide for secure connection of the fixtures with minimum vibration.

e. Portable Generators. The Contractor shall provide portable generators to furnish adequate power to operate all required lighting equipment. Fuel tank capacity and availability of fuel on site shall be sufficient to permit uninterrupted operation throughout the planned shift. Adequate switches shall be provided to control the various lights. All wiring shall be weatherproof and installed in accordance with 29 CFR 1926 Subpart K. All power sources shall be equipped with a Ground-Fault Circuit Interrupter.

2. Illumination Requirements. Balloon lights and tower-mounted luminaires, whether fixed, portable, trailer-mounted, or equipment-mounted, shall be of sufficient wattage and/or quantity to provide the required level of illumination and uniformity over the work area while minimizing glare. The uniformity of illumination, defined as the ratio of the average illumination to the minimum illumination over an area requiring an indicated illumination level, shall not exceed 5:1. Illumination levels on approach roadways should be increased sequentially to prevent motorists from becoming disoriented by rapid changes from full dark to very bright conditions. Existing street and highway lighting shall not eliminate the need for the Contractor to provide lighting. Consideration will be given to the amount of illumination
provided by existing lights in determining the wattage and/or quantity of lights to be provided. Such consideration shall be presented in the Contractor’s lighting plan. In the event of any failure of the lighting system, nighttime operation(s) shall be discontinued until the required level of illumination is restored.

a. **Illumination for moving operations.** Equipment-mounted balloon lights shall provide illumination to a minimum of 5 foot-candles measured at the work surface for 20 feet from the equipment on sides where workers generally work. Balloon lights shall be located to optimally illuminate the work area, mounted at a minimum height of 10 feet above the ground, and temporarily relocated as necessary to not interfere with overhead obstructions. Other types of equipment-mounted light sources shall be used as supplemental illumination around the equipment, where necessary, to safely and adequately carry out the work. The hopper, auger, and screed areas of pavers shall be uniformly illuminated. The operator’s controls on all machines shall be illuminated. Tack shall be illuminated as it is applied.

The Contractor shall provide illumination to a minimum of 5 foot candles at locations where miscellaneous or incidental tasks, such as sawcutting, are performed. The illumination shall be accomplished via flood lights or balloon lights mounted to a truck, cart, or terrain vehicle, tow behind trailer lights, lights on light stands, or other suitable means. No tasks shall be performed without adequate illumination.

The Contractor shall furnish adequate illumination for Department construction inspection and quality assurance. The illumination shall be accomplished via flood lights or balloon lights mounted to a truck, cart, or terrain vehicle, tow behind trailer lights, lights on light stands, or other suitable means. The Contractor shall furnish and maintain illumination equipment. The Contractor shall provide a minimum of 10 foot candles in locations where the Department’s representatives will perform tasks such as core drilling, density testing, and concrete testing.

b. **Level I (5 foot-candles) for static operations.** Level I illumination shall be provided for work areas of general construction operations to include all work operations by Contractors personnel, including work zone traffic control set-up and operations, staging, excavation, pavement marking, spoil disposal, landscaping, planting and seeding, layout and measurements ahead of the actual work, borrow areas, spoil areas, and truck cleanout areas. Level I illumination shall be provided near the beginning of lane closure tapers, exit ramps, and at road closures for nighttime work zones, including the setup and removal of the closure tapers. Level I illumination shall be provided continuously through area of concrete placement.

c. **Level II (10 foot-candles) for static operations.** Level II illumination shall be provided for flagging stations and concrete placement and removal operations, including bridge decks. Illumination shall set-up to avoid adverse backlighting, a condition which presents the object indented to be illuminated as a shadow due to a bright light from behind.

d. **Level III (20 foot-candles) for static operations.** Level III illumination shall be provided for pavement or structural crack filling, joint repair, pavement patching and repairs,
installation of signal equipment or other electrical/mechanical equipment, and other tasks involving fine details or intricate parts and equipment.

3. Glare Control. All lighting shall be designed, installed, and operated to avoid glare that affects traffic on the roadway or that causes annoyance or discomfort for residences adjoining the roadway. The Contractor shall locate and aim lighting fixtures to provide the required level of illumination and uniformity in the work zone without the creation of objectionable glare to workers or motorists.

The Engineer will determine when glare exceeds acceptable levels, either for traffic or for adjoining residences. The Contractor shall provide shields, visors or louvers on luminaires as necessary to reduce objectionable levels of glare. As a minimum, the following requirements shall be met to avoid objectionable glare on roadways open to traffic in either direction:

- Tower-mounted luminaires shall be aimed either generally parallel or perpendicular to the roadway.
- Luminaires shall be aimed such that the angle between the center of the beam axis and the vertical mounting pole is no greater than 45°.
- No luminaires shall be permitted that provide a luminous intensity greater than 20,000 candelas at an angle of 72° above the vertical.
- Except where prevented by overhead utilities or structures, towers shall be extended to their full working height when in use to reduce glare and provide uniform illumination.
- Balloon lights shall be mounted at a minimum height of 10 feet.

**METHOD OF MEASUREMENT**

The work under nighttime operations (with balloon lighting requirements during moving operations) will be measured for payment on a lump sum basis.

**BASIS OF PAYMENT**

The provisions of §619-5.01 *General* shall apply, including the provisions for Non-Payment, Liquidated Damages, and Major Non-Conformance.

The lump sum price bid for nighttime operations shall include all labor, materials and equipment necessary to satisfactorily complete the work, including the cost to adapt equipment and provide power to light sources. Progress payments will be made based on the lump sum price bid as follows: 20 percent when the Nighttime Operations and Lighting Plan has been accepted and satisfactory lighting of nighttime operations has begun; the remaining 80 percent will be paid in progress payments per week of nighttime operations completed. The amount of such weekly payment will be determined by dividing 80 percent of the lump sum amount bid by the number of weeks of nighttime operations in the approved Nighttime Operations and Lighting Plan.
ITEM 634.99010017 – BUILDING CONDITION SURVEY
ITEM 634.99020017 – VIBRATION MONITORING (NONBLASTING)

DESCRIPTION

A. Building Condition Survey. This work shall consist of performing a building condition survey(s) and preparing permanent records as indicated in the contract documents prior to the commencement of work, after completion of work, and at locations and times during construction as directed by the Engineer.

B. Vibration Monitoring (Nonblasting). This work shall consist of performing vibration monitoring of background and construction activities and preparing daily and summary report(s) of vibration readings.

MATERIALS

A. Building Condition Survey. Provide general photography and video equipment, analog or digital, capable of superimposing the date and time on all images.

B. Vibration Monitoring (Nonblasting). Provide a 3-component seismograph, capable of measuring particle velocity data in three mutually perpendicular directions. Annual factory calibration is required throughout the duration of the work.

CONSTRUCTION DETAILS

A. General. The Contractor shall engage the services of a firm capable of furnishing a New York State licensed Professional Engineer to conduct a condition survey of the existing building(s) indicated in the contract documents in the Special Note entitled Vibration Criteria and an experienced vibration monitoring Consultant to measure peak particle velocities prior to, and during, construction operations. Submit as proof to the Deputy Chief Engineer Technical Services (DCETS) the experience and qualifications of the firm’s personnel conducting the work.

B. Building Condition Survey. Provide, as a minimum, the following information:

1. Photographic and videotape documentation of the interior and exterior condition of the building(s).

2. Extent and location of existing signs of building distress such as cracks, spalling, signs of settlement, flooding, leaking, etc.

The Engineer may accompany the Contractor on each building condition survey for verification of the data recorded. Provide two copies of all documentation of each building condition survey to the Engineer.

C. Vibration Monitoring (Nonblasting). The DCETS may waive the requirements of vibration monitoring based on the results of the building condition survey.

Perform continuous vibration monitoring during construction operations when adjacent construction activities make monitoring prudent. The Contractor shall perform contract work in
a manner that will limit construction vibration at the specified locations to within the limits set within the contract documents.

1. **Submittal of Written Vibration Monitoring Plan.** Prior to performing work adjacent to specified locations, a written Vibration Monitoring Plan prepared by the Contractor shall be submitted to the Engineer a minimum of 10 work days in advance for approval. The Engineer will send a copy of the Vibration Monitoring Plan to the Geotechnical Engineering Bureau, Engineering Geology Section, for review and written comment. The vibration monitoring plan may be returned to the Contractor for revision or clarification.

The vibration monitoring plan shall include the necessary information to outline the recording collection. The vibration monitoring plan shall include, but not be limited to, the following items:

**a. Contract Designations**
- The name of vibration monitoring specialist(s).
- The scheduled start date and length of construction operations which require vibration monitoring.
- The limits of vibration monitoring work, including sites on or off State-owned right-of-way.
- The location of all structures to be monitored in proximity to the construction operation.
- The location of any underground utilities in proximity to the construction operation.

**b. Experience and Equipment**
- Submit proof and details, as references, of two projects in the past five years where the vibration monitoring consultant performing the work has satisfactorily monitored construction operations by recording maximum peak particle velocities (PPVs). Include contact information for each reference.
- Submit information on the required 3-component seismograph, capable of measuring particle velocity data in three mutually perpendicular directions, including: the manufacturer’s name, model number, and documentation of factory calibration performed within the last 12 months.

**c. Methods and Procedures**
- The location of adjacent structures to be monitored and maximum allowable PPVs as indicated in the contract documents. If not otherwise specified, a maximum allowable PPV in accordance with the United States Bureau of Mines (USBM) Vibration Criteria (Figure 1) shall be observed at all structures.
- The location of seismograph(s) placements, as directed by the Contractor’s Professional Engineer. Recording seismographs may be installed on selected structures.
- Appropriate details for anchoring the geophone(s).
The procedure for tracking PPV throughout construction operations (e.g., Pile Driving Operations: pile tip vs. vibrations may be correlated through time of day. A record of the time of day at each depth interval, included on the pile driving records, would be required to correlate to a time-based readout of PPV).

Figure 1—Safe Vibration Limit Recommendations for Residential Structures

Figure 1 – USBM Vibration Criteria (after Siskind et al, 1980)
The figure provides a “threshold damage” limit, defined as cosmetic damage (e.g., cracking) within the structure, categorized by both frequency ranges and particle velocity.
2. Measuring Vibrations. The Contractor shall inform the Engineer immediately each time measured particle velocities exceed 85% of the allowable peak particle velocity. The Contractor shall make equipment or procedural modifications as required to avoid exceeding the allowable vibration intensity.

If the measured velocities exceed the maximum allowable PPVs, the Contractor shall stop operations immediately and revise equipment and procedures to reduce vibrations to allowable levels.

The Contractor shall be in communication with his monitoring firm’s personnel during vibration monitoring at all locations to verify the data recorded.

The Contractor shall provide the Engineer with the results of daily vibration monitoring, one work day after the readings are taken. Upon completion of the construction operations for those locations requiring vibration monitoring, the daily submittals shall be synthesized into a final report.

If the seismographs show any indication of damage or vandalism, the seismographs shall be immediately recalibrated or replaced.

METHOD OF MEASUREMENT

A. Building Condition Survey. This work will be measured on a lump sum basis.

B. Vibration Monitoring (Nonblasting). This work will be measured on a lump sum basis.

BASIS OF PAYMENT
The unit price bid for building condition survey(s) and vibration monitoring shall include the cost of furnishing all labor, materials, and equipment necessary to satisfactorily complete the work.

Vibration Monitoring (Nonblasting). Progress payments will be made for this item paid proportionally in accordance with the amount of work completed, measured on a workday basis.

Payment will be made under:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
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<tbody>
<tr>
<td>634.99010017</td>
<td>Building Condition Survey</td>
<td>Lump Sum</td>
</tr>
<tr>
<td>634.99020017</td>
<td>Vibration Monitoring (Nonblasting)</td>
<td>Lump Sum</td>
</tr>
</tbody>
</table>
ITEM 643.99010004 - PRECAST CONCRETE NOISE BARRIER SYSTEM

DESCRIPTION
This work shall consist of furnishing and erecting a precast concrete noise barrier wall at the locations and to the elevations shown in the contract documents and as directed by the Engineer.

MATERIALS
The following sections of the standard specifications shall apply:

- Portland Cement Concrete – General
- Structural Concrete
- Reinforcing Steel for Concrete Structures
- Precast Concrete – General
- Caulking Compound for Structures
- Preformed, Closed-Cell Foam Material
- Structural Steel
- Galvanized Coatings and Repair Methods
- Anchor Bolts
- Rubber Impregnated Woven Cotton-Polyester Fabric
- Rubber Impregnated Random Fiber Pad

and the following ASTM reference shall apply:

- Standard Specification for Carbon and Alloy Steel Nuts and Bolts for High Pressure or High Temperature Service or Both
- Standard Specifications for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
- Standard Specification for Carbon and Alloy Steel Nuts
- Standard Specification for Concrete Aggregates
- Standard Specification for Backer Material for Use with Cold- and Hot-Applied Joint Sealants in Portland Cement Concrete and Asphalt Joints
- Standard Practice for Determination of the Effectiveness of Anti-Graffiti Coating for Use on Concrete, Masonry and Natural Stone Surfaces by Pressure Washing
- Standard Specification for Hardened Steel Washers

and the following standards shall apply:

- NYSDOT LRFD Bridge Design Specification

with the following modifications and additions:

**A. Precast Concrete:** The concrete for precast panels, posts and caps shall have a minimum compressive strength of 5000 psi at 28 days.
ITEM 643.99010004 - PRECAST CONCRETE NOISE BARRIER SYSTEM

B. Cast In Place Concrete:  The concrete for cast in place piers and footings shall be Class A meeting the requirements of §501 Portland Cement Concrete - General.

C. Reinforcing Steel:  Reinforcing steel used in precast concrete panels, caps and posts shall be epoxy coated.

D. Coarse Aggregate:  The coarse aggregate, used in precast components with an exposed aggregate finish, shall be screened gravel with a No. 1 size designation.  A coarse aggregate gradation meeting the requirements of ASTM C 33, size No. 67 may be used as an alternate to size No. 1.  The screened gravel shall be the color indicated in the contract documents.  Samples, (1-gallon each) shall be submitted for approval prior to the start of production.

E. Misc. Materials:  

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<table>
<thead>
<tr>
<th>Material</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post base plate</td>
<td>§715-01</td>
</tr>
<tr>
<td>Caulking compound</td>
<td>§705-06</td>
</tr>
<tr>
<td>Backer rod</td>
<td>polyethylene conforming to ASTM D5249 Type I</td>
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<td>Neoprene pads</td>
<td>§728-01 or §728-02</td>
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<td>Anchor bolts</td>
<td>§723-60; galvanization §719-01, Type II</td>
</tr>
<tr>
<td>Bolts</td>
<td>ASTM A325, Type1; galvanization §719-01, Type II</td>
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<tr>
<td>Nuts</td>
<td>ASTM A563, Grade DH or ASTM A194, Grade 2H and be galvanized in accordance with §719-01, Type II</td>
</tr>
<tr>
<td>Washers</td>
<td>ASTM F436 and be galvanization §719-01, Type II</td>
</tr>
<tr>
<td>Miscellaneous steel connection hardware</td>
<td>galvanization §719-01, Type II</td>
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<tr>
<td>Closed cell foam gasket</td>
<td>§705-08</td>
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F. Anti- Graffiti Coating:  Exposed concrete surfaces shall receive an anti-graffiti coating.  The anti-graffiti coating shall be

\begin{itemize}
  \item one component,
  \item clear-drying,
  \item non-sacrificial (permanent),
  \item tested according to ASTM D7089 and capable of achieving a rating of “Cleanability Level 1” after cleaning,
  \item applied at the precast manufacturer, no anti-graffiti coating shall be field applied, and
  \item applied according to manufacturer’s instructions.
\end{itemize}
ITEM 643.99010004 - PRECAST CONCRETE NOISE BARRIER SYSTEM

SI-Coat 531 as manufactured by CSL Silicones Inc
144 Woodlawn Road West Guelph, ON N1H 1B5 Canada
1.800.265.2753 www.csilsilicones.com

Blok-Guard & Graffiti Control II as manufactured by PROSOCO
3741 Greenway Circle Lawrence, KS 66046
1.800.255.4255 1.800.255.4255 www.prosoco.com

Permashield Non-Sacrificial #5300/5400 as manufactured by Monopole, Inc
4661 Alger Street Los Angeles, CA 90039
1.818.500.8585 www.monopoleinc.com

Or equal as approved by the Engineer.

Refer to the contract documents for foundation diameter and depth for each post for the noise barrier system.

FABRICATION:
The fabrication, curing, and repair requirements for precast components shall meet the requirements of §704-03. Precast Concrete - General, with the following modifications and additions:

A. **Fabrication:** Panels shall be full height with no horizontal joints.

   The concrete posts and caps shall have a smooth finish, unless specified otherwise in the contract documents. Panel finish shall be as shown in the contract documents. If an exposed aggregate finish is specified, the panels shall have completely covered, uniform surface of exposed aggregate. The depth of exposure shall be 30% of the primary size dimension of the coarse aggregate exposed.

   If a form liner finish is specified, the form liner style shall be as shown in the contract documents. The number of uses per form liner shall not exceed the manufacturer’s recommendations. Architectural treatments shall meet the requirements of §704-03.

B. **Repair:** The procedure for repairing damaged areas in the precast concrete, including exposed aggregate or form liner finish shall follow the requirements listed in §704-03 Repair.
ITEM 643.99010004 - PRECAST CONCRETE NOISE BARRIER SYSTEM

CONSTRUCTION DETAILS
The following sections of the standard specifications shall apply:

- Trench, Culvert and Structure Excavation 206-3
- Structural Concrete 555-3
- Cement Mortar Pads 568-3.02

DESIGN AND SHOP DRAWINGS:
The Contractor shall design the precast concrete noise barrier system and components in accordance with these specifications, the contract documents and in conformance with the NYSDOT LRFD Bridge Design Specification, latest edition. The design shall be submitted as shop drawings to the Materials Bureau in accordance with the requirements for Drawing in §704-03 – Precast Concrete - General.

Shop drawings shall be submitted for review and approval before beginning any work related to the precast concrete noise barrier system. No components of the precast concrete noise barrier system shall be fabricated until design calculations and shop drawings have been approved.

The shop drawings shall include:
- noise barrier system design
- design calculations,
- all relevant aspects of the precast concrete installation,
- connections including the posts to the footing and the panels to the posts. The panel to post connection shall be designed to be as inconspicuous as possible.
- sizes of all bolts, nuts, washers, plates, and shapes to be used along with the applicable material specifications.

The shop drawings and design calculations shall be stamped by a professional engineer who is licensed and registered in the State of New York.

INSTALLATION
Holes for post shafts shall be pre-bored, true and plumb, to the depth and diameter shown in the contract documents. Precautions shall be taken to protect the holes from collapse. Holes shall contain no free water at the time of concrete placement. Holes shall then be filled with Class A concrete in direct contact with soil, properly consolidated to the point shown on the Plans as top of shaft elevation.

The Contractor shall lift, place, and secure precast concrete wall units in accordance with manufacturer’s instructions and approved shop drawings. Follow erection procedures and sequences of erection as recommended by precast concrete wall manufacturer. When overhead utilities are present above the proposed noise barrier, placement methods must be approved by the Engineer. Consideration shall be given to a method different than placement from above.

After the posts are set in their final, truly vertical position, the space between the base plate and top of foundation shall be filled with grout meeting the requirements of §701-05. The requirements of §568-3.02 shall apply.
ITEM 643.99010004 - PRECAST CONCRETE NOISE BARRIER SYSTEM

Posts shall be true and plumb within ½” of the total height. Top of posts and panel shall be within ½” of the elevations noted in the contract documents. The Contractor shall perform any required grading between the posts to provide a continuous and smooth ground line which will meet the tolerances shown on the drawings for the distance between the bottom of the panel and the ground surface.

BASIS OF ACCEPTANCE:
The sampling and testing, marking, final product inspection, shipping and basis of acceptance requirements for precast components shall meet the requirements of §704-03 Precast Concrete - General.

METHOD OF MEASUREMENT
The work will be measured as the number of square feet of precast concrete noise barrier system furnished and erected.

The Noise Barrier System will be measured as the total number of square feet of the noise barrier measured from the top of noise barrier to the bottom of the wall panels and from center to center of posts as shown on the plans.

Only one side of the proposed wall will be measured for payment. No additional payment will be made for the canted panels or for the portion of post caps (all types) that extend above the top of the wall elevation.

BASIS OF PAYMENT
The unit bid price per square foot of precast concrete noise barrier system furnished and erected shall include the cost of furnishing all labor, materials, and equipment necessary to satisfactorily perform the work. Work includes, excavation, concrete foundation, reinforcement, backfill, hardware (anchor bolts, nuts, washers, etc.), formliner treatment, final grading along the noise wall, anti-graffiti coating, and design.
ITEM 662.60010004 – FURNISHING ELECTRICAL SERVICE

DESCRIPTION
Under this item, the Contractor shall have the Utility Company provide electric service to a single or multiple work site(s) to power equipment being installed at the contract site.

The Contractor shall pay the Utility for the work completed as invoiced by the individual Utility, the amount shown on the invoice in payment for work performed and material installed by the Utility, as specified in the Contract Documents or as ordered by the Engineer to provide electrical service at the location indicated in the Contract documents.

MATERIALS
All materials will be furnished by the Utility.

CONSTRUCTION DETAILS
The Contractor shall notify the Utility when the contract site is ready for the Utility work, shall ensure that the site is readily and safely accessible to the Utility’s workers and equipment, and shall conduct his operations in such a manner as to allow the Utility’s forces to perform their work efficiently. All labor and equipment necessary to accomplish the work shall be furnished, installed and supervised by the Utility except that if there is a survey and stakeout item in the Contract, the Contractor shall perform any stakeout of the location to which electrical service is to be supplied before the Utility starts work.

METHOD OF MEASUREMENT
The pay item will be measured on a fixed price Dollar Cents pay unit basis.

BASIS OF PAYMENT
The pay item is a 'draw down' item. As payments are made to the Utility, the Contractor shall submit receipts for the payments to the Engineer.

The actual payment for the item will be based upon the billing invoice submitted by the Utility for the work performed. Such billing will be subject to approval of the Engineer and he will direct the Contractor to pay the Utility for any invoice reviewed and approved for the amount shown. The Contractor shall provide the Engineer with proof of payment for any approved invoice and the Contractor thereafter shall be entitled to the amount paid on the invoice plus 5% (rounded up to the nearest dollar) for the Contractor's preparatory and processing costs associated with this item.

The total cost shown in the itemized proposal for this pay item will be considered the price bid even though payment will be made only for actual invoices paid plus 5%. The unit price amount is not to be altered in any manner by the bidder. Should the bidder alter the amount shown, the altered figure will be disregarded, and the original price will be used to determine the total amount bid for the contract.
ITEM 663.01NN - DRY STANDPIPE SYSTEM

DESCRIPTION

The work shall also include testing and certification of the installed dry standpipe system in accordance with this specification, the requirements of the NFPA 14, NFPA 24, and the local Fire Marshall or Authority Having Jurisdiction. The Contractor shall furnish five copies of the referenced NFPA Standards prior to installation, for use by the Engineer.

MATERIALS
Materials shall conform to the requirements of the following Subsections:

- Excavation and Embankment: 203
- Trench, Culvert, and Structure Excavation: 206
- Subbase Course: 304
- Miscellaneous Structural Reconstruction: 586
- Sidewalks, Driveways, Bicycle Paths, and Vegetation Control Strips: 608
- Signs: 645
- Concrete Grouting and Anchoring Material: 701-05
- Anchoring Materials – Chemically Curing: 701-07
- Wrought Aluminum: 715-04
- Galvanized Coatings and Repair Methods: 719-01

The Contractor shall be responsible for all material furnished under this item and shall replace, at his expense, all material found defective in manufacture or damaged in handling. Material shall be as specified in the Contract Documents and as follows:

Pipe and Fittings

All pipe, fittings, valves, and devices shall be UL 6 Fire Protection Directory (UL) listed or Factory Mutual Underwriters FM P7825 (FM) approved for fire protection service when supplied at a minimum of 20.7 bar (300 PSI) rated pressure and 13.8 bar (200 PSI) working pressure unless otherwise indicated.

Pipe shall be ductile iron factory formed rolled grooved end or machined grooved in accordance with AWWA/ANSI C606, centrifugally cast conforming to AWWA/ANSI C151/A21.51, and cement lined conforming to AWWA/ANSI C104/A21.4. Flanged ductile iron pipe shall be in accordance with AWWA C115, Class 150. All pipe shall be Class 53 with
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rigid grooved ends.

Fittings, full flow, shall be ductile iron or malleable-iron factory formed, cast, or fabricated with rolled grooved end or machined grooved in accordance with AWWA/ANSI C606 and conform to AWWA C153, AWWA/ANSI C110/A21.10, and ANSI B16.3. Fitting interiors shall be cement lined conforming to AWWA/ANSI C104/A21.4. Couplings shall be of a rigid style, meeting ASTM A536, Grade 65-45-15. Gaskets for grooved end pipe and fitting couplings shall be type and material as recommended and furnished by the fitting manufacturer for the service of the pipe system. Gaskets shall be molded of synthetic EPDM rubber especially compounded to conform to ductile pipe surfaces in a central cavity, pressure-responsive configuration, conforming to the pipe outside diameter and coupling housing, of elastomers having properties as designated in ASTM D2000. Reference shall be made to the latest published selection guide of the coupling manufacturer’s gaskets for proper gasket selection for the intended service. Bolts shall meet ASTM A193, Type 316 stainless steel oval neck track head bolt grade B8M and ASTM A194, Type 316 heavy hex head nuts grade B8M, Class 2.

Transitions between grooved and either bolted flange or threaded connections shall be full flow and as approved by the Engineer. All couplings, fittings, and gaskets suitable for use in the mechanical grooved piping system shall be by the same manufacturers.

Provide technical data meeting system design based on maintaining minimum flow of 1893 Liter per minute (500 gallon per minute) at 13.8 bar (200 PSI) working pressure with 6.9 bar (100 PSI) surge loads. Working pressure limitations and pipe wall thickness shall be established by the coupling manufacturer based on listed tested assemblies.

Appurtenances

Fire Department Connections shall be constructed of components, and arranged and sized as indicated on the drawings. Single inlet Fire Department Connection fittings are large diameter, quick connection hard coated cast aluminum coupling with Storz inlet and female NPT outlet supplied with internal debris screen and aluminum cap with attachment chain. Free Standing Fire Department Connections shall have a large diameter, quick connection hard coated cast aluminum, 90 degree Storz inlet and female NPT outlet with bright aluminum finish. Inlet shall be supplied with an internal debris screen and aluminum cap and attachment chain. Escutcheon identification plate shall be lettered with “DRY STANDPIPE”.

Check valve shall be high pressure, single disk spring assisted internal clapper valve, with grooved ends to match adjacent pipe. Valve body shall be ASTM A536, grade 65-45-12 ductile iron with EPDM rubber coated ASTM 240, Type 304 stainless steel clapper; ASTM A582, Type 303 stainless steel shaft; and ASTM A313, Type 302 stainless steel spring. Valve shall be equipped with sillcock hose bib end and automatic ball check valve from threaded openings. Flow indicators shall be cast integral to the valve body on both sides.

Hose valve at each drain connections shall be 63.5 mm (2 ½”) OS&Y globe valve for wet and
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dry systems, rough brass body with a bonnet and spindle of polished brass and cast brass spoked wheel handle provided with female NPT inlet x male hose thread outlet. Provide valves with thread pattern to match local Fire Department equipment and supply each with cap and chains.

Flexible expansion joint shall accommodate movement in pipe lines and designed to compensate for expansion, contraction, rotation, bending, and settlement of the pipe line, allowing for 100mm (4 inches) of movement. Joint casing shall be ductile iron, meeting or exceeding ASTM A536, grade 65-45-12, with flanged ends, Class 150 AWWA C115. Internal parts shall be constructed of ASTM A582, Series 400 stainless steel. Gaskets shall be made with EPDM rubber. Interior shall be coated in accordance with AWWA C213 Fusion-Bonded Epoxy Coating.

Coatings

All pipe, fittings, couplings, and appurtenances shall be exterior coated with an epoxy coating system, specified for ductile iron. All products that make up the completed system shall be compatible and the same products shall be used throughout the project. Coating shall meet the requirements of AWWA/ANSI C116/A21.16 Protective Fusion-Bonded Epoxy Coatings and as approved by the Engineer. The thickness of the lining / coating shall not be less than 10 mils. Fittings and coupling may be finish painted with the specified standpipe color and painting system using a manufacturer and Engineer approved field applied equal. Final color of the coating system for pipe shall match Federal Standard #26521 (Tan) or as approved by the Engineer.

For field painting of ductile iron surfaces, the Contractor shall utilize the following two-coat system:

   Primer: High-Build Surface Tolerant Epoxy, 5 mils thickness
   Finish: High-Build Aliphatic Acrylic Polyurethane, 5 mils thickness

For painting galvanized surfaces, the Contractor shall utilize the following two-coat system:

   Primer: High-Build Epoxy, 4 mils thickness
   Finish: Aliphatic Polyester Polyurethane, 4 mils thickness

Paint in storage shall be protected from damage and maintained in accordance with manufacturer's recommendations. Paint will be considered in storage if it is onsite for more than 8 hours prior to application.

Paint arriving at the work site in new, unopened containers and labeled with the manufacturer's name, product name, component part, batch number, color, and shelf life date shall be used. Paint in containers having expired shelf life dates shall not be used. They
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shall be immediately removed from the work site

Mounting Brackets & Hardware

Pipe hangers and supports shall be as shown on the drawings designed for dynamic thrust, static seismic, wind support, and to provide allowance for thermal and bridge expansion criteria. Pipe bracket and supports shall be fabricated from Type 316 stainless steel bar stock. All wall (shear) anchors for threaded rods or bolts shall installed in accordance with Specification Section 586, Miscellaneous Structural Reconstruction, and Specification Section 701-07, Anchoring Materials – Chemical Curing. Fully threaded rods, nuts, washers, and lock washers for anchors and wall supports shall be ASTM Type 316 stainless steel.

Any hardware that is non-stainless steel shall meet the requirements of ASTM A575, Grade 1015 or 1020, and shall be galvanized in accordance with Specification Section 719-01.

CONSTRUCTION DETAILS
Construct dry standpipe system at locations shown in the drawings and as shown in the details, and according to the following:

Fabrication

A. Shop Drawings - Shop drawings and manufacturer’s submittal data for the pipe, fittings, appurtenances, etc., will be required. Connections or attachments for the standpipe system that affect structural work, such as hangers and railing attachments, shall be shown in the appropriate shop drawings for the respective structural support elements.

B. Welding - Welding, if necessary, shall conform to the provisions of the NYSDOT Steel Construction Manual (SCM). Weld inspection shall be done in accordance with the requirements of the SCM.

C. Galvanizing

1. Supports

   All non-stainless steel pipe support elements shall be galvanized Type 1 and shall conform to the requirements of §719-01, Galvanized Coatings and Repair methods, unless otherwise noted. All holes and cutting of steel pipe support elements and bolting hardware is to be done prior to galvanizing. Pipe hangers shall be ordered plain steel to be galvanized as per §719-01, unless otherwise noted.

2. Bolts, Washers and Nuts

   All non-stainless steel bolts, washers and nuts shall be galvanized Type 2 and shall conform to the requirements of §719-01, Galvanized Coatings and Repair methods. All
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bolts shall have a standard oversize tap to allow for the galvanizing on the bolts, washers and nuts.

D. **Coatings** - The Contractor shall follow the manufacturer’s recommended paint application and application conditions for applying the coating to the dry standpipe system, including all structural steel supports, hangers and connection hardware. All ductile iron surfaces shall be shop cleaned and coated with the system as per this Specification. All galvanized surfaces shall be shop cleaned and coated with a two-coat paint system as noted in this Specification. Coating shall be applied to galvanized surfaces within 30 days after galvanizing.

The Contractor shall comply with the requirements of all applicable Federal, State, and Local laws, codes, and regulations, including but not limited to the regulations of the United States Environmental Protection Agency (USEPA), Occupational Safety and Health Administration (OSHA), New York State Department of Environmental Conservation (NYSDEC), New York State Department of Health (NYSDOH), and the New York State Department of Labor (NYSDOL).

Paint coating work of the Standpipe System elements shall be performed prior to their installation on the structure, in an enclosed paint cleaning and coating facility which complies with all applicable Federal, State, and Local Government regulations, as well as USEPA, OSHA, NYSDEC, NYSDOH, and NYSDOL regulations and any warnings and recommendations of the Paint coating manufacturer. Once installed, the entire Standpipe System will be carefully inspected for any areas that were damaged by handling or erection of the elements necessary to complete the installation of the Standpipe system, or by any other construction activity that caused damage to the applied paint coat. These areas shall be repaired to the satisfaction of the engineer and in accordance with the requirements of Section 708-06 of the Standard Specifications.

The Contractor will prepare and submit for approval a written plan that describes the method of environmental protection for this work that involves the surface cleaning of ductile iron piping and fittings and cleaning of galvanized steel supports, hangers and hardware, as well as for applying the paint coating, any coating overspray and dripping, and any VOC emissions and conditions that call for monitoring and/or health and safety related actions to be employed by the contractor. The Contractor will submit this written plan 30 days ahead of the start of work, to the engineer for his review. The Contractor will also submit with the written plan, the paint cleaning, paint coating and any other chemicals or abrasives manufacturer Material Data Spec sheets, Material Health Data Sheets, and any other health, safety, and hazardous/ warning information that the manufacturer has for these cleaning and coating materials to be used by the contractor for this work. The Contractor shall identify methods and/or procedures that will be used to clean up any paints, solvents, materials of construction, fuel, debris or other contaminants from the surrounding ground (soil), equipment, structures, water, sediment and other surfaces.
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The Contractor shall coordinate all painting activities to ensure that the products of only one paint manufacturer are utilized on the entire standpipe, unless approved by the Engineer in writing.

The Contractor shall identify the name and chemical composition of detergents or solutions that will be used for cleaning the surface of galvanized elements and for the removal of mildew. The Contractor shall only use biodegradable detergents which are environmentally safe and which will have no adverse effect on aquatic life, flora, fauna, workers, and the public, subject to the discretion of the Engineer.

The Contractor shall prepare and submit for approval a plan and/or procedure for the repair of damaged galvanizing, treatment of galvanized surfaces (if needed) and repair of coatings. Identify the cold galvanizing compound or other materials to be applied to repair damaged galvanizing and the material to be used to treat all galvanized surfaces (if required by the coating manufacturer). Include the manufacturer’s name, product names, product numbers and product data sheets for each material.

The Contractor shall submit samples of each coat, in the selected color, to the Engineer prior to use. The samples are to be “stepped down,” so that each coat of a multi-coat system is visible on the coupon. Prepare the samples using the same methods of application that will be utilized for the work in order to demonstrate the texture and appearance of the product. Do not use any of the materials until the samples have been reviewed and approved by the Engineer in writing.

Surface Cleaning/Preparation Requirements for Ductile Iron Surfaces

The Contractor shall prepare any ductile iron product arriving in the field without the specified manufacturers shop coat or finish system following the procedures for cleaning to base metal. Prior to painting, the Contractor shall thoroughly blast clean all ductile iron surfaces. Comply with the requirements of SSPC SP-6 to remove all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except for staining.

The Contractor shall allow staining to remain on no more than 33 percent of each 80 mm x 80 mm increment of surface area. Acceptable staining is limited to light shadows, slight streaks, or minor discoloration caused by stains of rust, stains of mill scale, or stains of previously applied paint. Slight residues of rust and paint are permitted in the bottom of pits if the original surface is pitted.

Note that a SP-6 cleanliness requires the removal of all mill scale. If the surface being prepared contains intact mill scale, the appearance after cleaning may approach SP-10, Near White, or SP-5 White Metal. The Department shall make no additional payments to the Contractor for the Near White or White Metal appearance that may result when removing the mill scale.
The Contractor shall accomplish the SP-6 degree of cleaning using dry blast cleaning with recyclable abrasives, wet abrasive blast cleaning, water jetting with abrasive injection, or vacuum blast cleaning. The Contractor shall not use expendable abrasives. When using wet methods of preparation, incorporate an inhibitor of type and concentration as approved by the Engineer in writing and coating manufacturer into the cleaning process to prevent flash rusting of the steel. Excess water with inhibitor shall be washed or blown from horizontal surfaces before it dries. Allow the surface to thoroughly dry prior to painting, and apply the primer before any visible rusting occurs, but no longer than 24 hours after cleaning. If more than 24 hours have elapsed since cleaning, the surface must be cleaned again prior to application of the primer coat.

**Painting Ductile Iron Surfaces**

Apply coatings by brush, roller, spray, or other means in accord with the manufacturer’s recommendations. The minimum number of coats and dry film thickness required is the same regardless of the application method used. Do not apply later coats until the previous coat has dried or cured. Do not exceed manufacturer’s recommended maximum recoat time. Dry film thicknesses shall be taken in accordance with SSPC-PA2 Paint Application Specification No. 2, Measurement of Dry Paint Thicknesses with Magnetic Gages. Stripping of all edges, corners, crevices, bolts and welds with primer shall be performed in accordance with SSPC-PA1 Paint Application Specification No. 1.

Apply each coating material not thinner than the manufacturer’s recommended spreading rate. Provide minimum dry film thickness for coatings within each coating system as specified herein. Do not exceed dry film thicknesses by more than the maximum amount recommended by the manufacturer.

Before applying finish coat, apply prime coat as recommended by coating manufacturer. All coats shall be as scheduled herein. Recoat areas where there is evidence of blisters, delamination, suction spots, or unsealed areas in the undercoats to assure a finish coat with no burn-through or other problems due to insufficient or defective undercoats.

Where acceptable or required to be brush applied, brush-out and work brush coats into surfaces in an even film. Eliminate cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness and other surface imperfections. Use mechanical methods for application when permitted by the manufacturer’s recommendations and by regulations of governing authorities.

Match accepted samples for color, texture, and coverage. Remove, refinish, or recoat work not in compliance with specified requirements.

**Surface Cleaning/Preparation Requirements for Galvanized Surfaces**

The Contractor shall clean all galvanized surfaces in accordance with Section 740-03 of the
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Standard Specifications unless otherwise noted in this Specification. Supplement the cleaning by hand or power tool cleaning over the entire area in accordance with SSPC-SP 2 (Hand Tool Cleaning) and SSPC-SP 3 (Power Tool Cleaning), when ordered by the Engineer. The supplemental cleaning shall be performed in such a manner that removes contaminants such as zinc and iron corrosion products while minimizing damage or removal of the zinc metal. Galvanized surfaces shall be painted or treated the same shift or day that they are cleaned.

Galvanized surfaces shall be repaired and treated in accordance with coatings manufacturer’s requirements and as approved by the Engineer. Information from the manufacturer shall include:

a. Galvanized Repair material
b. Galvanized Repair application requirements and methods
c. Drying time/recoat interval for the repair material
d. Surface treatment material for the galvanized surface and application
e. requirements (if required)
f. Drying time/recoat interval for the repair material, before applying the next coat

Painting Galvanized Surfaces

The Contractor shall paint all galvanized surfaces in accordance with Section 708-06 of the Standard Specifications unless otherwise noted.

Erection of Dry Standpipe System

A. Excavation – Excavation shall conform to the requirements of Section 206, Trench, Culvert and Structure Excavation, or Section 203, Excavation and Embankment, except as modified herein and the limit as shown in the Contract Documents and Standard Sheets.

B. Backfilling – Backfilling shall conform to the requirements of Section 203, Excavation and Embankment, Section 206, Trench, Culvert and Structure Excavation, or Section 304, Subbase Course. No trench, pit, or other excavation shall be backfilled until the pipe or appurtenances contained herein have been completely installed, inspected, and approved by the Engineer and applicable municipality, as appropriate.

C. Sheeting – Sheeting shall conform to the requirements of Section 552, Support and Protection Systems.

D. Concrete Pad – Concrete shall be placed in conformance with Section 608, Sidewalks, Driveways, Bicycle Paths, and Vegetation Control Strips, except as modified herein and the limit as shown in the Contract Documents.

E. Dry Standpipe System
ITEM 663.01NN_09 - DRY STANDPIPE SYSTEM

1. Erection Plan

Prior to installation, the contractor shall submit his erection method for the installation of the dry standpipe system to the Engineer for his review. If the contractor intends to hoist piping from existing / proposed structures, he shall supply the loads for his arrangement of erection hoisting use, and any other hoisting details that would be imposed on the segments by that work. If the contractor proposes to suspend anything other than the pipe and hangers themselves to existing / proposed structures, such as temporary construction platforms or walkways, all details will be provided of the temporary attachment and support for it to the structure, the loads (total dead weight of the platforms/walkways, equipment loads, wind loads, and worker live loads) to be imposed on the structure by it, and the description of worker access along with procedures and equipment that will be used to provide fall protection. Details on how the platforms and suspended walkways are assembled, disassembled, and moved to a new location on or suspended under the structure will be included with plan drawings and notes, as part of the Contractor’s submitted written plan for the engineers review. All calculations of loads, as well as the design and details of any temporary construction platforms or walkways that are imposed on the structure, attached or suspended from it, will be performed and stamped with Seal by a current New York State Licensed Professional Engineer.

2. Inspection

Immediately prior to installation, the Engineer shall inspect Dry Standpipe System components for damage that is attributable to improper storage of delivered components or shipping.

3. Noise Barrier Penetration

Contractor shall submit a procedure for coring holes in the existing / proposed noise barrier for approval by the Engineer. Any damage to the noise barrier panel during the installation process shall be repaired to the satisfaction of the Engineer.

Holes in the noise barrier shall be filled as shown in the Contract Documents with a material meeting the requirements of Specification Section 701-05, as approved by the Engineer. This shall only occur after the pipe has been firmly secured in place and deemed acceptable to the Engineer.

4. Pipe Installation

The pipe shall be installed sloped uniformly (minimum of 1:50) to the low points and adjusted to eliminate potential undrained segments, and vertical segments shall be run plumb as shown in the Contract Documents or as directed by the Engineer. Pipe expansion joints shall be installed with the allowable movement adjusted for the actual
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temperature range and shall be set at mid-point at the time of installation. The Contractor is directed to follow the installation requirements outlined in NFPA 14 and the expanded descriptions in the associated NFPA 13, whichever is more stringent.

5. Fire Department Connections

Fire Department Connections shall be installed as shown in the Contract Documents and as approved by the Engineer and local Fire Marshall. Free Standing Fire Department Connections shall be installed plumb and true to grade, with the connection facing the adjacent road.

6. Pipe Support

Install hangers and fittings complete with necessary bolts, rods, nuts, anchors, and other accessories as specified in the Contract Documents. All hangers and supports shall be spaced in accordance with the manufacturer’s recommendation and shall meet NFPA 13 requirements. In any case, spacing shall not exceed 3.9 meters unless shown otherwise in the Contract Documents. Supports for vertical piping shall be spaced at 1.8 meters maximum unless shown otherwise in the Contract Documents.

7. Pipe Joints

All joints in pipe shall be made with groove type couplings. Before couplings are assembled, pipe ends and outside of gaskets shall be lightly coated with lubricant approved by the coupling manufacturer to facilitate installation.

8. Flushing

Before acceptance for operation all portions of the dry standpipe system shall be flushed as specified or prescribed by NFPA 14 and 24 to remove all contaminants and debris. Minimum flushing velocity is 3 meter per second (10 feet per second). The Contractor shall obtain prior approval of acceptable means of disposal of any contaminated water.

9. Field testing

Prior to the acceptance of work, the completed system shall be tested in the presence of the Engineer. Testing includes verifying the operation of all check valves, valves, drains, connections, hose threads, etc. The dry standpipe system shall be tested by Hydrostatic Test Method, Valve-Operating Tests, and Drainage Tests for dry standpipe systems. Certificates of testing shall be provided to the Engineer. Follow test procedures as outlined in ANSI/AWWA C600, Section 5, and NFPA 14 and 24. Dry standpipe system shall be tested hydrostatically for no less than 2 hours, at either 13.8 bar (200 PSI) or 3.5 bar (50 PSI) in excess of the maximum working pressure, whichever is greater. Test pressure shall be measured at the low elevation point of the system being tested. Dry
ITEM 663.01NN 09 - DRY STANDPIPE SYSTEM

standpipe system shall maintain the test pressure, plus or minus 0.35 bar (5 PSI), for 2 hours. Dry standpipe shall show no leakage other than that permitted by NFPA 24.

F. **Signs** – Sign construction and installation shall conform to the requirements of Section 645, Signs, Standard Sheets Section 645, and as shown in the Contract Documents.

G. **Surface Restoration** – Surface restoration shall be in accordance with the Contract Documents and as directed by the Engineer.

**METHOD OF MEASUREMENT**

This work will be measured on an each location basis for satisfactorily completed work as indicated in the Contract Documents.

**BASIS OF PAYMENT**

The unit price bid for dry standpipe system per location shall include the cost of furnishing all labor, materials, equipment, permits, approvals, and fees necessary to complete the work, including excavation, sheeting, backfill, pipe, valves, appurtenances, surface restoration, mounting hardware, and signs per complete installation, to the satisfaction of the Engineer. A location is as defined in the contract documents.

**Progress Payments**

A. **Installation of Dry Standpipe System**

   Progress payments up to 80% of the unit price bid for each location will be paid based on the percentage of completed work to install the Dry Standpipe System.

B. **Field Testing**

   The remaining 20% of the unit price bid for each location will be paid upon satisfactory completion of the field testing and acceptance of the system.

   NN = Serialized by location
ITEM 663.95000004 – FIRE ACCESS PIPE AND LOCATION SIGN

DESCRIPTION

MATERIALS
Materials shall conform to the requirements of the following Subsections:

- Miscellaneous Structural Reconstruction
- Signs
- Concrete Grouting and Anchoring Material
- Anchoring Materials – Chemically Curing
- Galvanized Coatings and Repair Methods

The Contractor shall be responsible for all material furnished under this item and shall replace, at his expense, all material found defective in manufacture or damaged in handling. Material shall be as specified in the Contract Documents and as follows:

Pipe and Fittings

All pipe, fittings, valves, and devices shall be UL 6 Fire Protection Directory (UL) listed or Factory Mutual Underwriters FM P7825 (FM) approved for fire protection service when supplied at a minimum of 300 PSI rated pressure and 200 PSI working pressure unless otherwise indicated.

Pipe shall be steel pipe, meeting the requirements of ASTM A53, Schedule 40, Grade A, Type F.

Fittings shall be as approved by the Engineer. All pipe threads shall conform to ANSI B1.20.1.

Provide technical data meeting system design based on maintaining minimum flow of 500 gallon per minute at 200 PSI working pressure with an additional 100 PSI surge loads. Working pressure limitations and pipe wall thickness shall be established by the coupling manufacturer based on listed tested assemblies.

Appurtenances

Fire Department Connections shall be constructed of components, and arranged and sized as
ITEM 663.95000004 – FIRE ACCESS PIPE AND LOCATION SIGN

indicated on the drawings. Single inlet Fire Department Connection fittings are large diameter, quick connection powder coated cast aluminum coupling with Storz inlet and female NPT outlet supplied with internal debris screen and aluminum cap with attachment chain.

Coatings

All pipe, fittings, and couplings, including their interior shall be galvanized in accordance with Specification Section 719-01.

Mounting Brackets & Hardware

Pipe hangers and supports shall be as shown on the drawings designed for dynamic thrust, static seismic, and wind support. All wall (shear) anchors for threaded rods or bolts shall installed in accordance with Specification Section 586, Miscellaneous Structural Reconstruction, and Specification Section 701-07, Anchoring Materials – Chemical Curing. Fully threaded rods, nuts, washers, and lock washers for anchors and wall supports shall be ASTM Type 316 stainless steel.

Any mounting brackets / hardware that is non-stainless steel shall meet the requirements of ASTM A36 grade structural steel or ASTM A575, Grade 1015 or 1020, and shall be galvanized in accordance with Specification Section 719-01.

CONSTRUCTION DETAILS

Construct fire access pipe at locations shown in the drawings and as shown in the details, and according to the following:

Fabrication

A. Shop Drawings - Shop drawings and manufacturer’s submittal data for the pipe, fittings, appurtenances, etc., will be required. Connections or attachments for the fire access pipe shall be shown in the appropriate shop drawings for the respective structural support elements.

B. Welding - Welding, if necessary, shall conform to the provisions of the NYSDOT Steel Construction Manual (SCM). Weld inspection shall be done in accordance with the requirements of the SCM.

C. Galvanizing

1. Pipe and Supports

All non-stainless steel pipe and support elements shall be galvanized Type 1 and shall conform to the requirements of §719-01, Galvanized Coatings and Repair methods, unless otherwise noted. All holes and cutting of steel pipe support elements
ITEM 663.95000004 – FIRE ACCESS PIPE AND LOCATION SIGN

and bolting hardware is to be done prior to galvanizing. Pipe hangers shall be ordered plain steel to be galvanized as per §719-01, unless otherwise noted.

2. Bolts, Washers and Nuts

All non-stainless steel bolts, washers and nuts shall be galvanized Type 2 and shall conform to the requirements of §719-01, Galvanized Coatings and Repair methods. All bolts shall have a standard oversize tap to allow for the galvanizing on the bolts, washers and nuts.

D. Coatings - The Contractor shall prepare and submit for approval a plan and/or procedure for the repair of damaged galvanizing, treatment of galvanized surfaces (if needed) and repair of coatings. Identify the cold galvanizing compound or other materials to be applied to repair damaged galvanizing and the material to be used to treat all galvanized surfaces (if required by the coating manufacturer). Include the manufacturer’s name, product names, product numbers and product data sheets for each material.

Installation of Fire Access Pipe

A. Fire Access Pipe

1. Installation

Prior to installation, the contractor shall submit his erection method for the installation of the fire access pipe to the Engineer for his review.

2. Inspection

Immediately prior to installation, the Engineer shall inspect Fire Access Pipe components for damage that is attributable to improper storage of delivered components or shipping.

3. Noise Barrier Penetration

Contractor shall submit a procedure for coring holes in the existing / proposed noise barrier for approval by the Engineer. Any damage to the noise barrier panel during the installation process shall be repaired to the satisfaction of the Engineer.

Holes in the noise barrier shall be filled as shown in the Contract Documents with a material meeting the requirements of Specification Section 701-05, as approved by the Engineer. This shall only occur after the pipe has been firmly secured in place and deemed acceptable to the Engineer.
ITEM 663.95000004 – FIRE ACCESS PIPE AND LOCATION SIGN

4. Pipe Installation

The pipe shall be installed sloped uniformly (minimum of 1:50) to the low points and adjusted to eliminate potential undrained segments, and vertical segments shall be run plumb as shown in the Contract Documents or as directed by the Engineer. The Contractor is directed to follow the installation requirements outlined in NFPA 14 and the expanded descriptions in the associated NFPA 13, whichever is more stringent.

5. Fire Department Connections

Fire Department Connections shall be installed as shown in the Contract Documents and as approved by the Engineer and local Fire Marshall.

6. Mounting Brackets

Install mounting brackets with necessary bolts, rods, nuts, anchors, and other accessories as specified in the Contract Documents.

B. Signs – Sign construction and installation shall conform to the requirements of Section 645, Signs, Standard Sheets Section 645, and as shown in the Contract Documents.

METHOD OF MEASUREMENT

This work will be measured on an each basis for satisfactorily completed work as indicated in the Contract Documents.

BASIS OF PAYMENT

The unit price bid for fire access pipe per each shall include the cost of furnishing all labor, materials, equipment, permits, approvals, and fees necessary to complete the work, including pipe, appurtenances, modifications to the noise barrier panel, mounting hardware, and signs per complete installation, to the satisfaction of the Engineer.
ITEM 680.51100010 - CLEAN EXISTING PULLBOX

DESCRIPTION:
The Contractor shall clean existing pullboxes as indicated on the plans or as directed by the Engineer.

MATERIALS:
Not applicable.

CONSTRUCTION DETAILS:
Existing pullboxes shall be cleaned to the base of its walls in a workmanlike manner and maintained clean as determined by the Engineer for the duration of the contract.

Existing pullboxes shall be dried by pumping, bailing, hauling or by any other method approved by the Engineer. Drying operations shall not cause soil erosion and shall be performed so as to avoid contamination of other new or existing facilities.

Material removed from the pullboxes shall be disposed of in accordance with provisions of Subsection 203-3.08, Disposal of Surplus Excavated Materials.

The Contractor shall execute care and protect all facilities within the pullboxes and the area adjacent to the work.

The Contractor shall replace in kind, any pullboxes or other facilities damaged by his operations at his own expense.

METHOD OF MEASUREMENT:
Cleaning existing pullboxes will be measured by the number of pullboxes actually cleaned and maintained in accordance with the Contract Documents and as directed by the Engineer.

BASIS OF PAYMENT:
The unit price bid to clean each existing pullbox shall include the cost of furnishing all labor, materials, and equipment necessary to satisfactorily complete the work. Payment will be made for only those existing pullboxes designated by the Engineer to be cleaned. Only one payment for each existing pullbox will be made regardless of the number of times it is cleaned. No payments will be made for pullboxes which are installed by the Contractor under this contract. No separate payments will be made for pullboxes damaged by the Contractor’s operations.
ITEM 680.53010010 - CLEAN EXISTING CONDUIT

DESCRIPTION –
The Contractor shall clean existing conduit at the locations indicated on the plans or as directed by the Engineer to make certain that the conduit is clear and satisfactory for the installation of cable. The work does not include cleaning of a conduit following repair in place or replacement of a defective conduit.

MATERIALS –
Not applicable.

CONSTRUCTION DETAILS –
All existing cable shall be removed and a steel mandrel with wire brush cleaner no less than 2 inches long and having a diameter no less than 70 percent of the inside diameter of the conduit shall be passed through the entire run of conduit from one end to the other between pullboxes and/or poles without binding. Conduits which will not allow the mandrel with brush to be pulled through will be repaired under other contract pay items. After the conduit has been cleaned, the Contractor shall furnish and install a No. 10 AWG galvanized steel drag wire or nylon or polypropylene rope with a tensile strength of at least 495 lbf in the conduit from one end to the other, leaving no less than 3 ft of slack at each end in each pullbox or base of pole. The galvanized wire shall be grounded to a suitable grounding device at each end of the conduit in accordance with Section 680-3.12.

METHOD OF MEASUREMENT –
This work will be measured for payment as the number of feet of existing conduit actually cleaned in accordance with the Contract Documents and as directed by the Engineer.

BASIS OF PAYMENT –
The unit price bid shall include the cost of furnishing all labor, materials and equipment required to satisfactorily complete the work.
DESCRIPTION:

Under these items the contractor shall furnish and install a wireless, battery-powered magnetometer vehicle detection system as shown in the contract documents or where directed by the Engineer.

The wireless, battery-powered magnetometer vehicle detection system shall consist of the following equipment:

- Battery-powered sensors installed in-pavement in each traffic lane as indicated in the Contract Documents
- System radios (including repeaters, if required) that communicate wirelessly with the sensors and provide detection information to the processing unit.
- A base station unit capable of interpreting the information provided by the sensors. Software to control and configure the detectors, base station units and access points.
- A SDLC interface to provide a communication interface between a base station unit and a standard 2070 controller.

Communications between the detectors and the access point shall be via radio. When only one access point is used, it shall be hard-wired to the base station. When two access points are used in one site, the access point with the weakest signal shall be hard-wired to the base station, except when the cable routing distance is greater than 950 ft. For traffic signal applications, detection data shall be relayed from each sensor to a local 2070 controller for real-time vehicle presence detection using SDLC interfaces. If a network interfaced base station unit is specified in the contract documents, data shall be broadcast from each base station unit to a central software system or central server over standard TCP/IP (Internet Protocol) networks. NYSDOT shall provide the contractor with network configuration information necessary for the configuration of each networked base station unit.

MATERIALS:

PAVEMENT SENSOR

- All detector components shall be contained within a single housing. The sensor housing shall conform to NEMA Type 6P and IEC IP68 standards.
- Detectors should communicate at an Ultra High Frequency, increasing the range and battery life of the sensor device.
- The detector housing shall be capable of being installed in a 4.5” diameter hole.
- The detector components shall be fully encapsulated within clamshell housing to prevent moisture from degrading the components.
- The detector shall operate at temperatures from -35° F to +176° F.
ITEM 680.58801108 - WIRELESS VEHICLE DETECTION SYSTEM PAVEMENT SENSOR

ITEM 680.58801208 - WIRELESS VEHICLE DETECTION BASE STATION

ITEM 680.58801308 - WIRELESS VEHICLE DETECTION ACCESS POINT

ITEM 680.58801408 - WIRELESS VEHICLE DETECTION SYSTEM CONTACT CLOSURE CARD

- A detector shall be battery-powered with a minimum lifetime of eight (8) years when the detector is configured for, and operating under normal traffic conditions.
- Each detector shall detect a vehicle by magnetometer detection by measuring changes in the earth’s magnetic field near the sensor as caused by a stopped or passing vehicle. The sensor shall have a three (3) axis magnetometer with dual sensors in the Z-axis to improve capture accuracy.
- The detector shall be capable of operating in three (3) detection modes: count, presence and speed.
- The detector shall be capable of wirelessly accepting software and firmware upgrades.
- In the event of a detector lock, “memory on”, each detector shall automatically recalibrate.
- Each detector shall transmit its detection data within 150ms of a detected event.
- Each detector shall automatically re-transmit a detected event if no acknowledgement is received from the base station unit. Each detector may stop retransmission after 8 attempts.
- After losing radio contact because of stopped vehicles over or near the detector, each detector shall be capable of re-establishing the radio link with its supporting access point or receiver in less than 2 seconds.
- Each detector shall transmit a unique identifying code and shall respond within 100 seconds when the base station unit is powered on.
- When no base station unit is present or powered on, the detector shall not be required to detect vehicles.
- Each detector in an installation shall be capable of being individually configured with its own sensitivity level. A single detector shall be capable of being configured with a sensitivity level that approximates the detection zone of a standard 6’ x 6’ inductive loop.
  - Each detector shall be capable of being configured with relatively higher or lower sensitivity levels as may be required to detect bicycles or motorcycles.
  - Each pavement sensor is only required to be capable of reporting vehicle presence.
  - Up to two detectors properly configured shall be capable of detecting motorcycles in a standard traffic lane and bicycles in a designated bicycle lane.
- The detector shall be supplied with sufficient two part epoxy resin to secure and cover the sensor inside the cored hole in the pavement where it will be installed.

BASE STATION UNITS

- The base station shall be capable of being installed in shelf mount within the cabinet.
- The base station shall be capable of being installed in card mount within the cabinet.
- Each base station unit shall be capable of operation at temperatures from -35° F to +176°F.
ITEM 680.58801108 - WIRELESS VEHICLE DETECTION SYSTEM PAVEMENT SENSOR

ITEM 680.58801208 - WIRELESS VEHICLE DETECTION BASE STATION

ITEM 680.58801308 - WIRELESS VEHICLE DETECTION ACCESS POINT

ITEM 680.58801408 - WIRELESS VEHICLE DETECTION SYSTEM CONTACT CLOSURE CARD

- The base station unit shall include, or make available via the Internet at no extra charge, an interface specification or application programming interface that will allow for retrieval of traffic data from the base station unit over a TCP/IP Ethernet connection.
- The base station unit shall consist of, at a minimum, the base station, SDLC interface, software, and all ancillary equipment needed for a complete installation.

ACCESS POINTS

- The access points shall operate at temperatures from -35°F to +176°F.
- The access points shall be FCC Part 15 compliant and shall not interfere with public safety radio bands or other radio services.
- A detection access point shall be no larger than 8” H x 8” W x 8”D. The access point shall not weigh more than 4 pounds (1.8 kg)
- All access point components shall be contained within a single housing. The access point housing shall conform to NEMA Type 4X and IEC IP67 standards
- The access point shall support communications with at least 48 sensors.
- The access point shall reliably communicate with all in-pavement detectors within 500 feet, without the use of repeaters.
- Additional range may be provided through the use of repeaters. If repeaters are required, all repeater components shall be included in this item, including poles, foundations, mounting hardware, and any other items required for a complete installation. There is no separate payment for repeater equipment.
- The access point shall be able to support up to three (3) radios directly connected to it.
- The access point shall be able to communicate with the base station with a fixed cable, a wireless connection or both simultaneously.
- The access point shall also be able to accept RF splitters being used on up to two (2) of the connected radios to allow for up to five (5) radios per access point.
- Each access point shall include all antennas, mounting devices, cabling, surge protection and RF splitters, needed to a complete installation. There is no separate payment for this equipment.
- Each access point must be supplied with any electrical isolation equipment necessary for protection from electrical surges in the power supply. There is no separate payment for this equipment.
- Each access point must be supplied with any cabling necessary for its operation. There is no separate payment for this equipment.
- The access point shall be capable of accepting firmware upgrades.
- The radio links between each sensor and each access point shall conform to the following requirements:
  - The physical layer of the radio links between each sensor and access point shall conform to published standards.
ITEM 680.58801108 - WIRELESS VEHICLE DETECTION SYSTEM PAVEMENT SENSOR
ITEM 680.58801208 - WIRELESS VEHICLE DETECTION BASE STATION
ITEM 680.58801308 - WIRELESS VEHICLE DETECTION ACCESS POINT
ITEM 680.58801408 - WIRELESS VEHICLE DETECTION SYSTEM CONTACT CLOSURE CARD

- The center frequencies, bandwidths, and transmit power levels of the radio links shall allow operation in an unlicensed frequency band for Detector Wireless links.
- Frequency channels shall be employed by the sensors and system radio to avoid interference with other devices operating in the unlicensed band. The frequency channels shall be user-configurable and at least 16 frequency channels shall be supported.

VEHICLE DETECTION APPLICATIONS

This application uses the wireless magnetometer system as vehicle detection for signalized intersection control, as well as other applications where the wireless magnetometer system data is being subsequently processed or communicated by a 2070 controller. These applications require the card mount form factor.

- Detection data shall be communicated to a standard roadside 2070 controller via a base station unit expansion card capable of being installed in standard 33X input file assemblies, with a SDLC cable.
- If expansion cards are to be installed within the detector input rack of the cabinet. The cards shall have a minimum of four (4) optically isolated outputs per card.
- Rack mount processing units shall include an Ethernet interface for communicating directly via a wired TCP/IP network. This shall include a minimum 3 foot (1 meter) long EIA/TIA 568B RJ45 terminated category 6 network cable.
- The base station unit shall be capable of simultaneously communicating detection data via the contact closure interface and Ethernet interface.
- Contact closure card shall operate at Temperatures from -35 F to +176 F.
- Each installed contact closure card shall provide an additional minimum of 4 channels of detection data to the input file and 2070 controller.
- Each contact closure card shall be configurable to provide contact closure signals in either presence or pulse mode.
- The contact closure card front panel shall provide status LEDs to monitor detection channel status, line quality and fault monitor.
- The contact closure card front panel shall provide means to select and configure presence or pulse mode, delay timing and extension timing.
- Contact closure cards shall be powered from input file assembly rack or detector rack, not from controller back panel.
- Contact closure cards shall be surge protected to GR-1089 standards.
- Contact closure cards shall operate in humidity up to 95% (non-condensing).
CONSTRUCTION DETAILS:

- All construction shall conform to Section 680-3.01 of the Standard Specifications.
- The contractor shall not damage the components of the wireless vehicle detection system during construction.
- The contractor shall ensure that the wireless vehicle detection system operates according to manufacturer specification during all phases and sub-phases of construction.
- All equipment shall become the property of NYSDOT upon project completion.

PAVEMENT SENSORS

- The roadway shall be core drilled to provide a 4.5” diameter hole at the location and to the depth indicated in the contract plans or as directed by the Engineer. All debris from the drilling process shall be removed cored hole to provide a clean surface to mount the sensor.
- A layer of two part epoxy shall be applied to cover the bottom of the hole. The detector, within a protective shell (if offered by the manufacture), shall then be placed on top of this layer in the correct orientation as marked on the detector. The upper edge of the sensor should be a minimum distance of 3/8” from the road surface. The detector shall then be fully encapsulated with the two part epoxy to the lip of the cored hole. The depth of detector placement and distance to the access point shall not exceed the link tolerances specified by the manufacturer for consistent, accurate reception of detector data at the base station unit.
- All detector protection, such as clamshell covers and two part epoxy resin necessary for operation of the access points shall be included in the item for the access point. There is no separate payment for this equipment.

BASE STATION UNITS

- Rack mounted base station units, and if required by the contract documents, additional Contact Closure cards, shall be inserted into the input file assembly for the site. Specific ordering of cards and associated detection contact closures may be stipulated in the contract documents or as directed by the engineer.
- Shelf mounted base station units shall be placed on an equipment shelf provided within the cabinet at the site.
- Shelf mounted units in cabinets provided with standard 120V 60Hz line electricity shall be connected to power using a standard power receptacle provided within the cabinet unless otherwise directed by the contract documents or the engineer.
- Shelf mounted units in cabinets provided with 12VDC electricity shall be connected to power according to manufacturer instructions, unless otherwise directed by the contract documents or the engineer.
ITEM 680.58801108 - WIRELESS VEHICLE DETECTION SYSTEM PAVEMENT SENSOR
ITEM 680.58801208 - WIRELESS VEHICLE DETECTION BASE STATION
ITEM 680.58801308 - WIRELESS VEHICLE DETECTION ACCESS POINT
ITEM 680.58801408 - WIRELESS VEHICLE DETECTION SYSTEM CONTACT CLOSURE CARD

- Ethernet communications cables shall be connected to network interfaces as shown in the contract documents or as directed by the engineer.
- All cabling and electrical isolation necessary for operation of the base station unit shall be included in the item for the base station unit. There is no separate payment for this equipment.

ACCESS POINTS (RADIOS)

- System access points are to be installed according to the contract documents and subject to the following stipulations;
  o Access points shall be placed within a clear line-of-sight to the detectors, the unit in question is intended to receive traffic data from.
  o The height of placement of access points and distance to the detectors shall not exceed the link tolerances specified by the manufacturer for consistent, accurate reception of detector data at the base station unit.
- All cabling and electrical isolation (such as surge protection for the Ethernet cable) necessary for operation of the access points shall be included in the item for the access point. There is no separate payment for this equipment.
- If repeaters or additional equipment are required to provide constant communications with detectors, they shall be included within these items with no separate payment required. Any additional equipment shall be installed as shown on Contract Documents or as ordered by the Engineer.

METHOD OF MEASUREMENT:

This work will be measured by the number of successfully installed radios, detectors, processing units, or contact closure cards installed as part of the wireless, battery-powered magnetometer vehicle detection system, per site, as defined by the contract documents and the Engineer.

BASIS OF PAYMENT:

The unit price bid for furnishing and installing each item shall include the cost of furnishing all labor, materials, equipment, tools and all necessary tests to satisfactorily complete the work in accordance with the contract documents.
**ITEM 680.62XXYY10 - MAST ARM TRAFFIC SIGNAL POLE - MAST ARM**
**LENGTH 51 ft. TO 75 ft. (FATIGUE DESIGN)**

**ITEM 680.63XXYY10 – DUAL MAST ARM TRAFFIC SIGNAL POLE - LONG ARM**
**LENGTH 51 ft. TO 75 ft. (FATIGUE DESIGN)**

**DESCRIPTION:**
This work shall consist of furnishing and installing Mast Arm Traffic Signal Pole or Dual Mast Arm Traffic Signal Pole in accordance with the Contract Documents or as directed by the Engineer.

**MATERIALS:**
The pole(s) shall meet the requirements of 724-03 *Traffic Signal Poles* except as modified below:

The anchor bolts shall be ASTM F1554 grade 36 or 55 with a minimum diameter of 1.5 inches.

**DESIGN CRITERIA:**
The pole(s) shall be designed in accordance with the 2009 AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals and all interims. In addition to the conventional group load combinations, the cantilevered support structure shall be designed for fatigue in accordance with Section 11 of the 2009 AASHTO specifications. For Natural Wind Gusts, a fatigue importance factor, $I_f = 0.80$, shall be used. Cyclic loads induced by Galloping and Vortex Shedding need not be considered.

**Wind Loads:**
Poles and attachments there to covered by this specification shall be designed for the following wind speeds in accordance with the AASHTO Appendix C: Alternate Method for Wind Pressures.

- 70 mph - All other counties.

**FABRICATION**
**Physical and Mechanical Properties.** Mast arms and shafts shall conform to the following requirements:

- Minimum Wall Thickness – 1/8 inch
- Maximum Deflection at Design Load.
  - Shaft – 1/2 inch per foot of length.
  - Arm - 1/2 inch per foot of length.
- Maximum Diameter at base of shaft or arm.
  - Shaft – 1 inch per foot of length.
ITEM 680.62XXYY10 - MAST ARM TRAFFIC SIGNAL POLE - MAST ARM
LENGTH 51 ft. TO 75 ft. (FATIGUE DESIGN)
ITEM 680.63XXYY10 – DUAL MAST ARM TRAFFIC SIGNAL POLE - LONG ARM
LENGTH 51 ft. TO 75 ft. (FATIGUE DESIGN)

Arm – 3/4 inch per foot of length.
  • Maximum tip diameter of Arm
    Mast arm length 51 ft. to 65 ft. – 10 inches
    Mast arm length 66 ft. to 75 ft. – 12 inches

CONSTRUCTION DETAILS:
All the requirements of 680-3 shall apply.

METHOD OF MEASUREMENT:
All the requirements of 680-4 shall apply.

BASIS OF PAYMENT:
All the requirements of 680-5 shall apply.

Payment will be made under:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
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<tbody>
<tr>
<td>680.62XXYY10</td>
<td>Mast Arm Traffic Signal Pole</td>
<td>Each</td>
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<tr>
<td>XX = Mast Arm mounting height in feet.</td>
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<td>YY = Mast Arm length in whole feet.</td>
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<tr>
<td>680.63XXYY10</td>
<td>Dual Mast Arm Traffic Signal Pole</td>
<td>Each</td>
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<td>XX = Mast Arm mounting height in feet.</td>
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<td>YY = Mast Arm length of longer arm in whole feet.</td>
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<td>(Length of the shorter arm shall be as noted in the Contract Documents.)</td>
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ITEM 680.78010005 - Alter Pullbox for Conduit(s)

DESCRIPTION
The work shall consist of providing openings in an existing pullbox to facilitate the installation of new conduit(s).

MATERIALS
None

CONSTRUCTION DETAILS
The Contractor shall create the opening using industry accepted standards. The area around the conduit shall be sealed as shown on the standard sheets. The Contractor will be required to replace or repair, to the satisfaction of the Engineer, any equipment damaged or destroyed by the Contractor's operations or negligence as determined by the Engineer.

METHOD OF MEASUREMENT
The work shall be measured as the number of pullboxes altered.

BASIS OF PAYMENT
The unit price bid for each altered pullbox shall include the cost of all equipment, labor and materials, to satisfactorily complete the work.

Conduit(s) will be paid for under its respective item.
DESCRIPTION:

Under this item the contractor shall install Microcomputer Cabinets, which are supplied by the State, at locations shown on the plans or where directed by the Engineer. The State will supply and install the microprocessor, peripheral equipment and software.

MATERIALS:

The State will supply the Microcomputer Cabinets to the Contractor to install. The Contractor shall provide conduit nipples, grounding bushing, L. B. fitting and mounting hub for wiring entrance interface panel between the steel pole and the aluminum cabinet base. The wiring entrance interface panel shall be of sufficient size to accommodate a minimum 4” conduit and may be larger if required to accommodate the traffic signal wiring. Cabinet features, dimensions and location of interface panel for field wiring are detailed in the NEW YORK STATE TRANSPORTATION MANAGEMENT EQUIPMENT SPECIFICATIONS.

CONSTRUCTION DETAILS:

The requirements of section 680-3 of the Standard Specification shall apply with the following additions:

1. The Contractor's request for delivery of the Microcomputer Cabinets supplied by the State shall be made, in writing, five weeks in advance, to the Engineer. The Microcomputer Cabinets will be delivered to the Contractor at the Regional Signal Shop. The Engineer will advise the Contractor of the location of the Regional Signal Shop. At least one week in advance of delivery, the Contractor shall make an appointment through the Engineer as to the time and date the Microcomputer Cabinets will be available to the contractor.

2. The Contractor shall mount the Microcomputer Cabinet to the steel signal pole as shown on the contract plans, Standard Sheets or as directed by the Engineer.

3. The Contractor shall enlarge the hole for conduit located in the bottom of the Microcomputer Cabinet, if necessary, to accommodate the traffic signal wiring.

4. In unpaved areas, the Contractor shall install a concrete work pad in front of the cabinet door as specified on the Standard Sheets or the plans. The work pad shall meet the requirements of section 608 of the Standard Specifications for concrete sidewalk, and include concrete, fill or excavation and all grading as necessary.

5. The Contractor shall establish ground as shown on the contract plan and further defined in the N.Y.S. Standard Specifications of Construction and Materials. The Contractor shall run number six copper stranded wire from the ground lug connection at the base of the pole to the EARTH ground bus within the Cabinet. The Contractor shall connect the power line common to the minus AC ground bus.

6. The Contractor shall arrange with the utility company and the Engineer to have the power hooked up to the Microcomputer Cabinet(s).

7. The Contractor shall perform all tests listed under Section 680-3.32, Tests, of the N.Y.S. Standard Specifications for Construction and Materials with the exception of the Functional Test, when all of his
ITEM 680.80324515 - INSTALL MICROCOMPUTER CABINET

Traffic signal installation work on the entire project, has been complete. The State may, at its option, have the Contractor perform the required testing at each individual signal installation location as soon as he completes his signal installation work at that location. The State will assume responsibility for the functional test.

8. Within 30 days of the Contractor successfully completing the required testing on his installation work, the State will install the microprocessor, peripheral equipment and software into the Microcomputer Cabinet. The State may, at its option, perform tests on the traffic signal equipment before installing the microprocessor, peripheral equipment and software.

9. Upon completion of the microcomputer installation, the Engineer may, at his option, conduct a functional test of the signal system for a period not to exceed 14 days. During this testing period, the existing signal system may be turned off or on as directed by the Engineer.

METHOD OF MEASUREMENT:

This work will be measured as the number of Microcomputer Cabinets installed in accordance with the plans, specifications and directions of the Engineer.

BASIS OF PAYMENT:

The unit price for each Microcomputer Cabinet installed shall include the cost of all labor, material, testing and equipment necessary to complete the work.

The concrete work pad, if required, and any necessary fill, excavation or grading, is to be paid for under this item.

Payment for connecting all input and output wiring to the interface panel of the Microprocessor Cabinet shall be included in the bid price for each specific cable item.
ITEM 680.81310109 - ACCESSIBLE PEDESTRIAN SIGNAL (APS) WITH POLE
ITEM 680.81310209 - ACCESSIBLE PEDESTRIAN SIGNAL (APS) WITHOUT POLE

DESCRIPTION
The APS shall consist of a Central Control Unit (CCU) and Accessible Pedestrian Push Button Stations (PBS). This work shall consist of furnishing and installing a APS in accordance with the Contract Documents or as directed by the Engineer. The System shall meet the functionality requirements of MUTCD 2009-4E.

MATERIALS
The Accessible Pedestrian Push Button Station shall be ADA compliant. It shall contain all electronic control equipment, mounting hardware, Audible-Tactile push button and 9 inch by 15 inch informational pedestrian sign mount with bracket assembly-sign face (MUTCD # R10-3E). The Audible-Tactile push button shall be designed to provide both a button with a raised directional vibrating tactile arrow on the button and a variety of audible sounds for different pedestrian signal functions. The unit shall have a weatherproof speaker, and the appropriate informational sign for each location.

The system shall consist of a Control Unit and the Accessible Pedestrian Push Button Station with Pole Mounting Assembly.

The Systems Specifications

- Pole Unit Speaker with, microphone shall be located in the PBS, non-visible, environmentally protected housing
- Pole Unit Temperature Range: -30°F to 165°F
- Pole Unit Push Button: ADA compliant with integrated sign bracket for the MUTCD # R10-3E sign
- Temperature and Humidity requirements- meet NEMA TS 2 Section 2.1
- Voltage Protection requirements - meet NEMA TS 2 Section 2.1
- Mechanical Shock and Vibration requirements - meet NEMA TS 2 Section 2.1
- Transient Suppression requirements – meet IEC 61000-4-4, ICC 61000-4-5
- Electronic Noise requirements – meet FCC Title 47, Part 15, Class A
- Electrical Reliability requirements- meet NEMA TS4 (Applicable Portions of Section 8)
- Enclosure requirements, (PBS) shall meet NEMA 250-Type 4X E, (CCU) shall meet NEMA 250-Type 1
Audio and System Specifications

- Volume Control Automatic Adjustment Range: 28dB Max
- Microphone for Ambient Noise:
  Approximate frequency range: 170 Hz to 2.3 kHz
- Button Tone: A brief “tick” confirms each button push
- Audible Locating Tone: 880Hz plus harmonic, 0.1 second duration, 1 second interval. Operates during pedestrian clearance and don’t walk interval.
- LED Operation: The LED lights when the button is pushed and remains lit until the next walk phase.
- LED Luminous Intensity:
  Greater than 1200 mcd, sunlight visible, ultra bright red, viewing angle 160°
- System shall provide the following audible features:
  o A locating tone
  o 5 walk sound choices
  o 3 pedestrian clearance sound choices
  o Direction of travel
  o User programmable informational message
  o Audible sound must emanate from push button
- System shall provide a “Wait” massage that plays once the button is activated.

CONSTRUCTION DETAILS
The Control Unit shall be mounted in the pedestrian head and powered from the pedestrian head lamp indications. The Pole Mounting Assembly shall be mounted on a pole near the start of the crosswalk. The Pedestrian push button shall be mounted between 3 ft. and 3 ft. 6 in. above an accessible surface and shall face an accessible approach (orientated parallel to the line of pedestrian travel) and within 10 in of adjacent accessible surface, as per Standard Sheets “Sidewalk Curb Ramp Details” and as per Standard Sheet “Pedestrian Signals and Flashing Beacon Installation Details”. All installations shall conform to manufacturers specifications and details required for a complete working Accessible Pedestrian Push Button. Street name shall be programmed, if there is an adjacent push button within 10 feet or as directed by the Engineer.

METHOD OF MEASUREMENT
This work will be measured by the number of stations satisfactorily furnished and installed.

BASIS OF PAYMENT
The unit price bid for each Accessible Pedestrian Push Button Station installed shall include the cost of all labor, materials, equipment, system programming and testing necessary to complete the work.
ITEM 680.81320009 – INFRARED PROGRAMMING DEVICE

DESCRIPTION
The contractor shall furnish a hand held remote Infrared Programming Device to be used for programming a Accessible Pedestrian Signal (APS) Push Button Station (PBS) in accordance with the contract documents and as directed by the Engineer.

MATERIALS
The Infrared Programming Device shall meet the following requirements:
- Use infrared technology with an LCD display to program the PBS’s as well as the Central Control unit (CCU)
- Be password protected
- Be capable of setting all volumes and features of the APS system specific to the PBS’s
- Be capable of setting/updating a single PBS or all PBS’s on the intersection for most functions from a single PBS (Global updating)

CONSTRUCTION DETAILS
Furnish Infrared Programming Device; program the Accessible Pedestrian signal system. Provide instruction manual on operation and storage of the unit.

METHOD OF MEASUREMENT
This work will be measured by the number of Infrared Programming Device satisfactorily furnished.

BASIS OF PAYMENT
The unit price bid shall include the cost of furnishing all materials and equipment necessary to satisfactorily complete the work.
ITEM 680.81500010 – PEDESTRIAN COUNT-DOWN TIMER MODULE

1.0 DESCRIPTION.
The purpose of this specification is to provide the minimum performance requirements for a Pedestrian LED Countdown Timer Module to be used in conjunction with Pedestrian Signal Indications. The unit will provide Pedestrians with numerical Pedestrian timing of the Pedestrian Clearance Interval. The unit will be connected in parallel with LED Pedestrian Signal Indications, Hand and Walking Person, and in series with the Model 200 switch packs controlling the LED Pedestrian Signal Indications.

This specification refers to definitions and practices described in “Vehicle Traffic Control Signal Heads” referred to in this document as “VTCSH,” and “Pedestrian Traffic Control Signal Indications”, referred to in this document as “PTCSI”, published in the Equipment and Materials Standards of the Institute of Transportation Engineers.

2.0 MATERIALS.
A. PHYSICAL AND MECHANICAL REQUIREMENTS
A.1 The countdown timer shall be designed to fit in the message bearing area of a 12 inch pedestrian traffic signal housing built to the PTCSI Standard.

The unit shall be a single, self-contained device, not requiring on-site assembly for installation into an existing traffic signal housing and not require special tools for installation. The timer module shall fit into Pedestrian Traffic Signal housings that are void of any incandescent lamp components - bulb sockets, gaskets, and reflector - and without the need to modify the housing. The module shall be sealed to provide a weather tight enclosure and an insulating covering for all electrical connections and electronic components. The unit shall fit securely in the housing and shall connect directly to existing electrical connections inside of the housing by means of push on type connectors.

A one piece “U” shaped cross section rubber gasket or other suitable means shall be provided with each module to insure a weather tight fit between the door of the signal housing and the module. The quality of gasketing supplied, and any method used to adhere the gasketing to the module if the gasketing is affixed to the module using adhesive, shall be such that the gasketing and adhesion technique shall not appreciably deteriorate over the life of the module when the module is used in its intended application.

The message bearing surface of the module shall be supplied with two numerical LED displays to display a count from “00” to “99”. These displays shall be a minimum 7 inches high and 3.75 inches wide. The display segments that comprise the numbers shall be approximately 0.5 inches wide and be formed by two or more rows of LED’s.

Materials used for the lens and signal module construction shall conform to ASTM specifications for those materials.

The lens of the LED countdown timer shall be polycarbonate UV stabilized and a minimum of 1/8” thick.

Each module shall be identified on the back side with the following:
ITEM 680.81500010 – PEDESTRIAN COUNT-DOWN TIMER MODULE

--- Manufacturer’s Trade Mark/Name
--- Part number as shown in the NYS DOT’s Transportation Management Equipment QPL
--- Serial number
--- Voltage rating
--- Power consumption (Watts and Volt-Ampere)
--- Each module shall have a sticker stating compliance to FCC Title 47 Subpart B, Section 15 regulations
--- An Indication to orient the user to the Top of the Unit (such as an Arrow symbol or the word top)

A.2 Barcoding. All Modules shall be barcoded using Barcode type 128. Barcodes shall be printed on a quality polyester white label (Black print only) where the print on the label and adhesion of the label to the surface shall be weather, UV and temperature resistant. Size of the label shall be 0.5 inch wide by 1.75 inch long. All barcodes shall be printed entirely on the label and be completely legible. Text of the Barcode Information shall also be legibly printed on the label.

Information on the Barcode shall be separated into the following four parts, but printed continuously on the label in the order shown:

--- Model Number - 2 Digits (Assigned Model Number for Pedestrian LED Countdown Timers is CT)
--- Manufacturer - 2 Digits. Digits assigned by NYSDOT upon Product Qualification
--- Date of Manufacture - 4 Digits. First two digits represents Month of Manufacture, Second two digits represent Year of Manufacture
--- Serial Number - minimum 6 digits assigned, maximum 10 digits assigned

An example of the information printed on the barcode for a Pedestrian LED Countdown Timer built to these specifications manufactured in June of 2008 with a serial number of 018356 by a company whose manufacturers’ code is XX would be CTXX0608018356.

Barcode labels, meeting the same requirements of the labels above, shall also be placed on the outside of all shipping boxes. Example: Should the shipping box contain six modules, individual barcode labels for all of the six modules inside the box shall be affixed to the outside of the box. The labels shall also be grouped together so that they can be easily and quickly scanned by a barcode reader.

A.3 The contractor shall provide the barcode ID numbers for all LED’s installed. This information shall be provided in the form of an electronic file (Excel Spreadsheet) and summarized by intersection. Barcode IDs will be collected by one of the following methods selected by NYSDOT:

1) Scanning the bar codes of each module with a bar code scanner provided by NYSDOT for use on this project only. The information will be downloaded to a spreadsheet.

2) Manually entering the bar code IDs of each module into an electronic spreadsheet.

This information shall be provided to the EIC on a weekly basis. The cost for this work shall be included
ITEM 680.81500010 – PEDESTRIAN COUNT-DOWN TIMER MODULE

in the bid price for various LED modules.

B. ENVIRONMENTAL REQUIREMENTS

B.1 The Countdown Timer signal module shall be rated for use in the ambient temperature range of -40 deg F to +165 deg F. The module shall be sealed to prevent dust and moisture intrusion and to protect all internal LED and electrical components. The module shall be capable of operating at rated voltage in an environment of +74 degrees Centigrade / 85% Relative Humidity for 1000 hours without the formation of internal condensing moisture.

C. OPTICAL REQUIREMENTS

C.1 The measured chromaticity coordinates of the individual led light sources used in the module shall conform to the chromaticity requirements of the Pedestrian “Hand” symbol of the PTCSI standard.

C.2 The module shall be designed so that when operated over the specified ambient temperature and voltage ranges during the warranty period of the unit, the numeric display shall attract the attention of, and be readable to, a viewer (both day and night) at all distances from 3 m to the full width of the area to be crossed.

C.3 To minimize luminous degradation over the life of the unit, the individual led light sources used in the unit shall be manufactured using AlInGaP technology or equal.

C.4 Variations in operating line voltage of between 80 and 135 volts rms shall have minimal effect, less than +/- 10 percent, on the luminous output of the module.

D. OPERATIONAL REQUIREMENTS

D.1 The module will be designed to countdown to zero only the “Clearance” time of the Pedestrian Interval. During the Steady Don’t Walk Indication the display will always be dark.

D.2 The module, when connected to the appropriate Pedestrian switch pack outputs, shall have an automatic learn mode in order to learn and store the Pedestrian clearance times in its memory and to self-adjust for subsequent changes in Pedestrian Clearance time.

D.2.1 Following power restoration to the unit after a power outage of greater than two seconds the unit will remain dark for one pedestrian cycle to learn, acquire the current pedestrian clearance timing, replace any values that were stored in memory prior to the power outage with the newly acquired values and display the newly acquired times on the next pedestrian cycle.

D.2.2 The unit shall detect changes in pedestrian clearance timing during normal operation and act upon them as described below:

D.2.2.1 The unit will automatically re-program itself should it detect any increase in Pedestrian clearance timing. The increased timing shall be displayed on the subsequent pedestrian cycle.
D.2.2.2 The unit will detect any reductions in pedestrian clearance timing (such as those occurring during a traffic Preemption cycle) and display on the subsequent pedestrian cycle the timing stored in its memory prior to the shortened pedestrian cycle.

D.2.2.3 The unit will re-program itself should it detect two consecutive identical shortened pedestrian clearance cycles and display this timing on the next pedestrian cycle.

D.3 The unit shall be designed to suspend any timing and go dark when, for any reason, the timing of the Ped Clear cycle is terminated before reaching the “zero” count and the clearance switchpack output reverts to a steady “On” condition.

D.4 The unit shall be capable of timing consecutive complete Pedestrian cycles outputed by the traffic control system.

D.5 The unit shall be designed to retain the Pedestrian timing stored in its memory for all power outages of less than one second and to continue timing of the Pedestrian timing if the traffic control system has resumed Pedestrian timing following this duration outage. For outages of between one and two seconds memory may or may not be retained. For all power outages greater than two seconds the unit will resume operation as described in Paragraph 4.2.

E. ELECTRICAL

E.1 All wiring shall meet the requirements of Section 13.02 Wiring of the VTCSH standard. Each wire shall be approximately 1 m long. All wiring shall be rated for use over the temperature range of -40 deg F to +165 deg F. Under normal handling of the module over the specified temperature range, the wiring insulation shall not crack or fray along its entire length. The wires of the module shall be terminated in insulated 0.250 inch female quick disconnect push on terminals.

Units shall be supplied with three colored coded wires as defined below:

Red (Connection to Pedestrian Hand Switch pack output), Brown (Connection to Pedestrian Man Switch pack output) & White (AC Neutral)

E.2 The module shall operate with 60 ± 3 Hz AC line voltage ranging from 80 volts to 135 volts rms. The circuitry shall prevent flicker over this voltage range. Rated voltage for all optical and power measurements shall be 120±3 volts rms.

E.3 The on-board circuitry of the module shall include voltage surge protection, to withstand high-repetition noise transients and low-repetition high-energy transients as stated in Section 2.1.8, NEMA Standard TS 2-2003.

E.4 Each module shall be designed so that the timer and displays do not function when connected to any voltage between 80 and 135 volts rms and in series with an impedance of 15 kohm (either resistive or capacitive) or greater.
ITEM 680.81500010 – PEDESTRIAN COUNT-DOWN TIMER MODULE

E.5 The individual LED light sources of the unit shall be wired so that a catastrophic failure of one LED light source will not result in the loss of illumination of more than one display segment.

E.6 All modules shall contain filtering dedicated to prevent inducing electronic noise into the AC power lines. In addition the module and associated on-board circuitry shall meet the requirements of the Federal Communication Commission (FCC) Title 47, Subpart B, Section 15 regulations concerning the emission of electronic noise by Class A digital devices.

E.7 All Modules shall be fused. The fuse shall be located before any electronic component used in the module and placed in series with the colored wire of the unit. Should fusing be external to the unit by placing inline fuse holders into the wiring of the unit, the fuse holder shall be installed so that it is between six to ten inches from the housing of the unit. Each individual circuit in the unit shall be fused separately. Fuse selection shall be such that it provides reliable operation for its intended operation.

E.8 All unit types shall be operationally compatible with the traffic signal equipment that each type is designed and intended to interface with. This equipment includes all controllers, conflict monitors, current monitors, switch packs and flashers and LED Signal Modules currently in use by the New York State Department of Transportation.

E.9 Power Requirements. The maximum power consumption of each circuit in the unit, when on, shall not exceed 10 Watts at rated voltage.

F. PERFORMANCE TESTS

F.1 Prior to shipment, each module shall be energized (burned-in), for a minimum of 24 hours, at rated voltage, and at a 100 percent on-time duty cycle. This test shall be conducted in an ambient temperature of 60 degrees Centigrade. Any failure of the module occurring during burn-in shall be cause for rejection.

F.2 Each timer module shall be visually inspected for any exterior physical damage or assembly anomalies. Careful attention shall be paid to the surface of the lens to ensure there are no scratches (abrasions), cracks, chips, discoloration, or other defects.

F.3 Each shipment from the manufacturer shall be furnished with a Certificate of Compliance. The certificate shall certify that the modules comply with the requirements of these specifications. The certificate shall include the signature of the person responsible for certifying the tests. In addition to the certificate, the modules shall be supplied with copies of all applicable test reports.

G. SAMPLE SUBMISSION

Low bidder(s) may be required to submit a sample unit. In the event that a sample is required, it shall be provided within ten (10) working days of receipt of the request. Each device submitted shall be accompanied by five copies of the complete circuit schematic for the unit, one standard catalog cut and one manufacturers specification sheet for the individual LED light sources used in the unit. Documentation shall also be provided describing the techniques used to ensure the units will satisfy the luminous intensity requirements over the life of the warranty. This documentation may include items such as the description of circuitry incorporated in the module needed to meet this requirement or literature from the LED manufacturer describing the expected degradation of luminous intensity of the individual LED.
ITEM 680.81500010 – PEDESTRIAN COUNT-DOWN TIMER MODULE

LED light sources used in the fabrication of the module over the life of the unit and operating temperature range.

3.0 CONSTRUCTION DETAILS

The contractor shall install the Pedestrian Count-Down Timer Module in new or existing traffic signal heads as shown on the plans or as ordered by the engineer. Unless otherwise waived, the Contractor shall submit to the Regional Director within 30 days following the award of contract, detailed specifications and catalog cuts of the equipment he proposes to install.

4.0 METHOD OF MEASUREMENT

This item will be measured for payment as the number of Pedestrian Count-Down Timer Modules furnished, installed in accordance with the contract documents or as ordered by the Engineer.

5.0 BASIS OF PAYMENT

The unit price bid shall include the cost of all labor, material, and equipment necessary to complete the work as shown on the plans, on the standard sheets, or as ordered by the Engineer. The cost of the pedestrian signal heads shall be paid for under their respective items.
ITEM 680.81990003 - TRAFFIC SIGNAL BACK PLATES WITH YELLOW REFLECTIVE TAPE

DESCRIPTION
This work shall consist of furnishing and installing TRAFFIC SIGNAL BACKPLATES WITH YELLOW REFLECTIVE TAPE in accordance with the contract documents and as directed by the Engineer.

MATERIALS
Back plates shall be constructed of a flat sheet of polycarbonate or ABS plastic, and shall have either a flat black finish or signal green finish. Reflective Tape shall meet the specifications for Section 730-05, Reflective Sheeting, ASTM Type I or Type III.

CONSTRUCTION DETAILS
Back plates shall be compatible with the signal heads to be installed, or with the existing heads to be retrofitted. The back plates shall have appropriate mounting brackets and when mounted shall not obstruct the signal head door openings. The back plates shall be a 5 or 8 inch border, as specified in the contract documents, around the entire signal head, and shall be either louvered or non-louvered, as specified in the contract documents. The yellow reflective tape shall border the back plate and have a minimum width of 1 inch and a maximum width of 3 inches, as specified in the contract documents.

METHOD OF MEASUREMENT
This work will be measured as the number of TRAFFIC SIGNAL BACKPLATES WITH YELLOW REFLECTIVE TAPE satisfactorily furnished and installed.

BASIS OF PAYMENT
The unit price bid shall include the cost of furnishing all labor, materials, and equipment necessary to satisfactorily complete the work.
ITEM 680.82250101 - REMOVE PEDESTRIAN PUSHBUTTON AND SIGN ASSEMBLY

DESCRIPTION:
Under this item, the Contractor shall remove pedestrian pushbutton and sign assemblies from existing traffic signal poles, pedestrian signal head poles, or pedestrian pushbutton and sign posts.

MATERIALS:
Not specified.

CONSTRUCTION DETAILS:
Under this item, the Contractor shall remove pedestrian pushbutton and sign assemblies from existing traffic signal poles, pedestrian signal head poles, or pedestrian pushbutton and sign posts at the locations indicated in the plans, or where ordered by the Engineer. Where the poles are to be reused, any holes caused by the removal shall be retapped when necessary and new screws and bolts shall be placed to fill the voids; larger holes shall either be tapped for insertion of threaded plugs or shall be welded shut and field galvanized as per Section 719-01, Galvanized Coatings and Repair Methods of the Standard Specifications. In locations where the assembly is located on a pedestrian pushbutton and sign post, the post shall be removed to below ground level and the surface shall be restored to match existing conditions. The material removed shall become the property of the Contractor and shall be removed from the site.

METHOD OF MEASUREMENT:
This work will be measured as the number of pedestrian pushbuttons and signs removed.

BASIS OF PAYMENT:
The unit price bid for each removal shall cover the cost of all labor, material, and equipment necessary to complete the work.
DESCRIPTION
Under these items, the Contractor shall furnish, install and test loose tube single mode fiber optic cables as shown in the plans and as directed by the Engineer.

All equipment required for installation and testing shall be provided by the Contractor. Fiber optic patch panels, splice closures, connectors, snowshoes and pull boxes shall be supplied under other contract items.

Any other ancillary components required to form a complete fiber optic cable plant, including but not limited to, moisture and water sealants, cable caps, fan-out kits, etc., shall be supplied under these items for fiber optic cable and will not be paid for separately.

MATERIALS
The single mode fiber optic cable shall incorporate a loose buffer tube cable design as specified herein. The fiber optic cable shall be suitable for conduit and aerial installation, supported by a messenger cable, in an outside cable plant environment and for indoor cabling environments when installed in accordance with the current NEC and local building code requirements.

A design using flooding compounds, water-swellable tape or yarn to prevent water penetration between the buffer tubes shall be provided.

The cable shall meet the requirements of REA 7 CFR1755.900 at a minimum, and shall be new, unused and of current design and manufacture.

The number of fibers in each cable shall be as specified on the plans.

Splicing Requirements
All optical fibers shall be spliced to provide continuous runs. Splices shall be made at locations shown on the plans. Any other splices in the trunk cables shall be permitted only with the approval of the Engineer.

All splices shall use the fusion technique. Fusion splicing equipment shall be provided by the Contractor and shall be cleaned, calibrated and specifically adjusted to the fiber and environmental conditions at the start of each shift. Tools and procedures shall be approved by the cable manufacturer as being compatible with the cable type being delivered.

Each spliced fiber shall be packaged in a protective sleeving or housing. Bare fibers shall be completely re-coated with a protective RTV, gel or similar substance, prior to application of the sleeve or housing, so as to protect the fiber from scoring, dirt or microbending.

Splice trays shall be used to hold the spliced fibers, with each fiber neatly secured to the tray.
Splice loss shall not exceed a mean of 0.03 dB. No splice losses above 0.06 dB shall be permitted. If a splice is measured to exceed 0.06 dB during the splicing process, it shall be remade until its loss falls below 0.06 dB. Each attempt shall be recorded for purposes of acceptance.

All splice losses shall be recorded in tabular form and submitted to the Engineer for approval. If an optical time domain reflectometer (OTDR) is used to record splice loss, chart recordings of the "signature" shall be submitted with the splice data with a record of all OTDR settings and the OTDR locations written on the trace.

Splices specifically required to connect drop cables or miscellaneous spur cables into the trunk/backbone cable system shall be supplied under another contract item. Splices of trunk/backbone cable segments directly to each other that are required due to reel length or other practical limitations shall be included under these items and shall not be paid for separately.

If splices to fiber optic “pigtailed” (short one-fiber cables with connectors attached at the factory) are used to provide the method of connectorizing the fibers at the field cabinets and other termination points, these splices will be paid for under the item for fiber optic connectorization and not under the item for splicing.

Slack Storage of Fiber Optic Cables

As part of these items, slack fiber shall be supplied as necessary for maintenance coils and to allow for splicing of the fiber optic cables in a controlled environment such as a splicing van or tent. The slack fiber shall then be stored underground in the fiber optic pull boxes.

Optical Requirements

Attenuation. The attenuation shall be less than 0.5 decibels/kilometer (dB/km) at a wavelength of 1310 nanometers (nm) and less than 0.4 dB/km at a wavelength of 1550 nm. Fiber attenuation shall be uniform with no discontinuities greater than 0.1 dB. The attenuation at 1383 ± 3 nm shall not exceed 2.1 dB/km. The attenuation measurements shall be in accordance with EIA/TIA Standards FOTP-20, 59, 61 and 78. The average change in attenuation at extreme operational temperatures (-40° F to +158° F) shall not exceed 0.05 dB/km at 1550 nm. The magnitude of the maximum attenuation change of each individual fiber shall not be greater than 0.15 dB/km at 1550 nm. The change in attenuation measurements shall be in accordance with EIA/TIA Standard FOTP-3.

Cutoff Wavelength. The fiber cutoff wavelength shall be less than or equal to 1260 nm.

Mode-Field Diameter. 9.20 ± 0.40 Fm at 1310 nm; 10.40 ± .8 Fm at 1550 nm
Zero Dispersion Wavelength. 1312 nm ± 10 nm

Zero Dispersion Slope. Shall be less than or equal to 0.092 ps/(nm².km)

Polarization Mode Dispersion. Shall be less than or equal to 0.5 ps/(km)²

Chromatic Dispersion. The chromatic dispersion shall be less than 3.3 ps/(nm.km) for 1285 nm through 1330 nm and less than 18 ps/(nm.km) at 1550 nm as measured in accordance with EIA/TIA Standard FOTP-169.

Mechanical Requirements

Fibers. All optical fibers shall be Corning, Spectrum or Lucent single mode glass fibers or approved equivalent. All fibers within a given cable shall be from the same manufacturer, and shall contain no factory splices. Each fiber shall conform to the following minimum requirements:

Typical Core Diameter: 8.2 Fm
Cladding Diameter: 125.0 ± 1.0 Fm
Core-to-Cladding Offset: less than or equal to 0.8 Fm
Cladding Non-Circularity: less than or equal to 1.0%

Color Coating. Each fiber shall have a color coating applied to it by the manufacturer. The coating shall not affect the optical characteristics of the fiber. The basic color configuration shall be as follows, in accordance with EIA/TIA-598:

1. Blue
2. Orange
3. Green
4. Brown
5. Slate
6. White
7. Red
8. Black
9. Yellow
10. Violet
11. Rose
12. Aqua

The nominal colored fiber diameter shall be 250 Fm.

Primary Coating. Each fiber shall have a dual layered, UV acrylate coating applied to it by the manufacturer. The coating shall be mechanically strippable without damaging the fiber. The coating diameter shall be 245 ± 5 Fm.

The force required to mechanically remove at least 1.2 inches of unaged coating shall not exceed 2.25 pounds as measured in accordance with EIA/TIA Standard FOTP-178.
Central Strength Member. The anti-buckling central strength member shall consist of a Kevlar or epoxy-glass composite rod.

Buffering. All fibers shall be enclosed in non-conductive loose buffer tubes. Each buffer tube shall contain up to twelve fibers. The Contractor shall submit the fiber count per buffer tube and the buffer tube count configuration to the Engineer for approval. The fiber shall not adhere to the inside of the buffer tube. Each buffer tube containing fibers shall be color coded in a similar scheme as the fiber color. The basic color configuration shall be as follows, in accordance with EIA/TIA-598:

1. Blue     7. Red
2. Orange   8. Black
5. Slate    11. Rose

In buffer tubes containing multiple fibers, the colors shall be stable during temperature cycling and not be subject to fading or smearing onto each other or into the gel filling material. Colors shall not cause fibers to stick together. Buffer tubes shall be of dual layer construction.

The buffer tubes shall be filled with a hydrocarbon-based gel to prevent water and moisture penetration. The gel shall contain anti-oxidant additives, and the gel shall be readily removable with conventional solvents. The gel shall be non-toxic and dermatologically safe to exposed skin. It shall be chemically and mechanically compatible with all cable components, non-nutritive to fungus, non-hygroscopic and electrically non-conductive.

Filler Rods. Filler rods shall be used to fill all unused buffer tubes, or shall be used instead of unused buffer tubes. The filler rod shall be a solid polyethylene material and shall be natural in color. The filler rods shall maintain the concentricity of the cable cross section where required.

Stranding. The buffer tubes shall be stranded around the central strength member using an approved stranding process to form a tight cable core. Binders shall be applied with sufficient tension to secure the tubes to the central member without crushing the buffer tubes.

Core and Cable Flooding. To prevent water penetration outside of the buffer tubes, all cavities within the cable shall be filled with a flooding compound or water blocking tape shall be used. The flooding compounds shall not affect the optical characteristics of the cable. The flooding compound shall contain anti-oxidant additives, and shall be readily removable with conventional solvents. The flooding compound shall be non-toxic and dermatologically safe to exposed skin. It shall be chemically and mechanically compatible with all cable components, non-nutritive to fungus, non-hygroscopic and electrically non-conductive.
**Tensile Strength Provisions.** Aramid yarn shall be helically stranded evenly around the cable core to provide tensile strength. The yarn shall enable the cable to withstand a maximum pulling tension of 607 pounds during installation and 200 pounds long term installed without changing the characteristics of the optical fibers. Each length of cable shall have sufficient strength to be installed in continuous lengths as specified on the plans.

**Outer Jacket.** A medium density polyethylene (or approved equal) outer jacket shall be applied over the entire cable assembly. The outer jacket shall have a minimum nominal jacket thickness of 0.55 inches. The polyethylene shall contain carbon black and shall not promote the growth of fungus. The outer jacket shall contain no metallic elements and shall be of a consistent thickness.

The jacket shall be marked in contrasting color at 1-foot intervals with the following information:

“NYSDOT - XX – YYZZ”, where XX shall equal the number of optical fibers in the cable and YYZZ shall be the month and year that the cable was manufactured.

In addition, the outer jacket shall have sequential meter markings as approved by the Engineer. The actual length of the cable shall be within 1% of the length markings.

**Ripcord.** To facilitate cable preparation, the cable shall have an orange colored ripcord located under the outer jacket.

**Bend Radius.** The cable shall be capable of withstanding a minimum bending radius of 10 times its outer diameter during operation and 15 times its outer diameter during installation without changing the characteristics of the optical fibers.

**Other Requirements.**

**Manufacturer's Certification.** The following tests shall be performed and the results documented for a cable meeting the requirements herein. The cable manufacturer shall certify that each reel of cable furnished meets or exceeds the following specifications:

**Water Penetration.** When a one-meter static head of water or equivalent continuous pressure is applied at one end of a one-meter length of filled cable for 24 hours, no water shall leak through the open cable end. If the first sample fails, subsequent tests shall be done in accordance with either BELLCORE TR-TSY-000020 or REA PE-90. All water penetration testing shall be performed in accordance with EIA/TIA Standard FOTP-82.
Filling Compound Flow. When tested in accordance with EIA/TIA Standard FOTP-81, the cable shall exhibit no flow (drip or leak) of filling or flooding compound at 158 ± 3° F. If material flow is detected, the weight of any compound that drips from the sample shall be less than 0.05 grams.

Compressive Strength. The cable shall withstand a minimum compressive load of 220 N/cm applied uniformly over the length of the compression plate. The cable shall be tested in accordance with EIA/TIA Standard FOTP-41, except that the load shall be applied at the rate of 1 inch per minute and maintained for 1 minute. The magnitude of the attenuation change shall be within the repeatability measurement system for 90% of the test fibers. The remaining 10% of the fibers shall not experience an attenuation change greater than 0.1 dB at 1550 nm. The repeatability of the measurement system is typically ± 0.05 dB or less. No fibers shall exhibit a measurable change in attenuation after load removal.

Impact Resistance. When tested in accordance with EIA/TIA Standard FOTP-25, the cable shall withstand 20 impact cycles. The magnitude of the attenuation change shall be within the repeatability of the measurement system for 90% of the test fibers. The remaining 10% of the fibers shall not experience an attenuation change greater than 0.1 dB at 1550 nm. The repeatability of the measurement system shall be ± 0.05 dB or less. The cable jacket shall exhibit no cracking or splitting upon completion of the test.

Cable Flex. When tested in accordance with EIA/TIA Standard FOTP-104, the cable shall withstand 25 mechanical flexing cycles at a rate of 30 ± 1 cycles per minute with a sheath diameter not greater than 20 times the cable diameter. The magnitude of the attenuation change shall be within the repeatability of the measurement system for 90% of the test fibers. The remaining 10% of the fibers shall not experience an attenuation change greater than 0.1 dB at 1550 nm. The repeatability of the measurement system shall be ± 0.05 dB or less. The cable jacket shall exhibit no cracking or splitting when observed under five times magnification.

Cable Freezing. When tested in accordance with EIA/TIA Standard FOTP-98, the cable shall be immersed in water. Upon freezing, the magnitude of the attenuation change shall be within the repeatability of the measurement system for 90% of the test fibers. The remaining 10% of the fibers shall not experience an attenuation change greater than 0.1 dB at 1550 nm. The repeatability of the measurement system shall be ± 0.05 dB or less. The cable jacket shall exhibit no cracking.

Jacket Shrinkage. When tested in accordance with EIA/TIA Standard FOTP-86, the maximum outer cable jacket shrinkback shall be less than 5%.

Lightning Protection. When tested in accordance with the proposed EIA/TIA Standard FOTP-181, the cable shall withstand a simulated lightning strike with a peak value of the current pulse greater than or equal to 105 kA. The test current used shall be damped oscillatory with a
maximum time-to-peak value of 15 Fs (which corresponds to a minimum frequency of 16.7 kHz) and a maximum frequency of 30 kHz. The time to half-value of the waveform envelope shall be from 40-70 is.

Cable Twist. When tested in accordance with EIA/TIA Standard FOTP-85, a length of cable no longer than 6.5 feet shall withstand 10 cycles of mechanical twisting. The magnitude of the attenuation change shall be within the repeatability of the measurement system for 90% of the test fibers. The remaining 10% of the fibers shall not experience an attenuation change greater than 0.1 dB at 1550 nm. The repeatability of the measurement system shall be ± 0.05 dB or less. The cable jacket shall exhibit no cracking or splitting when observed under five times magnification.

Quality Assurance Provision. All optical fibers shall be proof tested by the fiber manufacturer at a minimum load of 685 MPa.

All optical fibers shall be attenuation tested. The attenuation of each fiber shall be provided with each reel of cable furnished.

Environmental Requirements. The cable shall meet all of its specified requirements during and after being subjected to any combination of the following requirements:

- Shipping/storage temperature: -58°F to +158°F
- Installation temperature: -22°F to +158°F
- Operating temperature: -40°F to +158°F
- Relative humidity from 0% to 95%, non-condensing

CONSTRUCTION DETAILS

Experience Requirements

Personnel involved in the installation, splicing and testing of the fiber optic cables shall meet the following requirements:

A minimum of three (3) years experience in the installation of fiber optic cables, including fusion splicing, terminating and testing single mode fibers.

Have installed two systems where fiber optic cables are outdoors aerially and in conduit and where the systems have been in continuous satisfactory operation for at least two years. The Contractor shall submit as proof, photographs or other supporting documents, and the names, addresses and telephone numbers of the operating personnel who can be contacted regarding the installed fiber optic systems.
One fiber optic cable system (which may be one of the two in the preceding paragraph) which the Contractor can arrange for demonstration to NYSDOT representatives and the Engineer.

Splicers shall have been trained and certified by the manufacturer of the fiber splice material to be used, in fiber optic splicing procedures. Proof of this training shall be submitted to the Engineer for approval.

Installers shall have been trained and certified by the manufacturer of the fiber optic cable to be used in fiber optic cable installation and handling procedures. Proof of this training shall be submitted to the Engineer for approval.

Personnel involved in testing shall have been trained and certified by the manufacturer of the fiber optic cable test equipment to be used, in fiber optic cable testing procedures. Proof of this training shall be submitted to the Engineer for approval.

Constructibility Review

The Contractor shall perform a careful and complete Constructibility Review of the proposed fiber optic system design. At least one month prior to beginning installation, the Contractor shall submit a report detailing the results of this review.

Installation in Conduit

The cable pulling operation shall be performed such that a minimum bending of the cable shall occur in the unreeling and pulling operations. Entry guide chutes shall be used to guide the cable into the pullbox conduit ports. Lubricating compound shall be used to minimize friction. Corner rollers (wheels), if used, shall not have radii less than the minimum installation bending radius of the cable. A series array of smaller wheels can be used for accomplishing the bend if the array is specifically approved by the cable manufacturers. The pulling tension shall be continuously measured and shall not be allowed to exceed the maximum tension specified by the manufacturer of the cable, or fuse links and breaks shall be used to ensure that the cable tensile strength is not exceeded. The pulling system shall have an audible alarm that shall sound whenever a preselected tension level is reached. Tension levels shall be recorded continuously and shall be given to the Engineer upon request.

The number of pullboxes and their locations shall be as shown on the plans. The Contractor may be required to install the cable one pullbox at a time. The direction of the cable pull shall be determined by the Contractor and shall require the approval of the Engineer.

The central strength member and aramid yarn shall be attached directly to the pulling eye during cable pulling. "Basket grip" or "Chinese finger" type attachments to the cable outer jacket shall
ITEM 680.92111208 - FIBER OPTIC CABLE – 12 FIBERS
ITEM 680.92112408 - FIBER OPTIC CABLE – 24 FIBERS
ITEM 680.92113608 - FIBER OPTIC CABLE – 36 FIBERS
ITEM 680.92114808 - FIBER OPTIC CABLE – 48 FIBERS
ITEM 680.92116008 - FIBER OPTIC CABLE – 60 FIBERS

not be permitted. A breakaway swivel with a cable manufacturer approved tensile rating shall be used on all pulls.

When simultaneously pulling fiber optic cable with other cables, separate grooved rollers shall be used for each cable.

No fiber optic cable shall be pulled through more than one 90 degree bend unless so indicated on the plans or specifically approved by the Engineer.

**Documentation Requirements**

**Installation Practices for Outdoor Fiber Optic Cable Systems Documentation**

At least one month prior to starting installation of the fiber optic cable plant, the Contractor shall submit to the Engineer for approval ten (10) copies of the Contractor’s “Installation Practices for Outdoor Fiber Optic Cable Systems” manual. This manual shall address the Contractor’s proposed practices covering all aspects of the fiber optic cable plant. This submittal shall include all proposed procedures, list of installation equipment, and splicing and test equipment. Test and quality control procedures shall be detailed as well as procedures for corrective action.

**Operation and Maintenance Documentation.** After the fiber optic cable plant has been installed, ten (10) complete sets of Operation and Maintenance Documentation shall be provided. The documentation shall, as a minimum, include the following:

- Complete and accurate as-built diagrams showing the entire fiber optic cable plant including locations of all splices.
- Final copies of all approved test procedures
- Complete performance data of the cable plant showing the losses at each splice location and each terminal connector.
- Complete parts list including names of vendors.
- Complete maintenance and trouble-shooting procedures.

**Testing Requirements**

All fibers shall be tested bi-directionally at both 1310 nm and 1550 nm. The Contractor shall submit detailed test procedures for approval by the Engineer.

The fiber optic cables shall be subjected to the levels of testing described in the General Provisions for ITS General Provisions for this project.

**METHOD OF MEASUREMENT**

The fiber optic cables will be measured for payment as the number of linear feet of cable, including lengths stored as splicing slack and maintenance coils, actually furnished and installed.
ITEM 680.92111208 - FIBER OPTIC CABLE – 12 FIBERS
ITEM 680.92112408 - FIBER OPTIC CABLE – 24 FIBERS
ITEM 680.92113608 - FIBER OPTIC CABLE – 36 FIBERS
ITEM 680.92114808 - FIBER OPTIC CABLE – 48 FIBERS
ITEM 680.92116008 - FIBER OPTIC CABLE – 60 FIBERS

BASIS OF PAYMENT
The unit price bid per linear foot for fiber optic cable shall include the cost of furnishing all labor, material, documentation, tools and equipment and testing of the fiber optic cable necessary to complete the work.

Progress payments will be made as described in the Measurement and Payment section in the ITS General Provisions for this Contract.
DESCRIPTION - Under this item, the Contractor shall install a State Supplied electrical disconnect / generator transfer switch as shown on the plans, or the standard sheets or as ordered by the Engineer.

MATERIALS - The electrical disconnect / generator transfer switch shall be State supplied.

CONSTRUCTION DETAILS - The electrical disconnect / generator transfer switch shall be attached to the pole or cabinet as shown on the plans or the standard sheet or as ordered by the Engineer, in accordance with the most current National Electrical Code.

METHOD OF MEASUREMENT - This item will be measured for payment as the number of electrical disconnect / generator transfer switch installed and accepted by the Engineer-in-Charge.

BASIS OF PAYMENT - The unit price bid shall include the cost of all labor and equipment necessary to complete the work as shown on the plans, on the standard sheets, or as ordered by the Engineer.
ITEM 680.95010415 - SERVICE CABLE 1 CONDUCTOR, NO. 04 AWG
ITEM 680.95010615 - SERVICE CABLE 1 CONDUCTOR, NO. 06 AWG
ITEM 680.95010815 - SERVICE CABLE 1 CONDUCTOR, NO. 08 AWG
ITEM 680.95011015 - SERVICE CABLE 1 CONDUCTOR, NO. 10 AWG
ITEM 680.95020415 - SERVICE CABLE 2 CONDUCTOR, NO. 04 AWG
ITEM 680.95020615 - SERVICE CABLE 2 CONDUCTOR, NO. 06 AWG
ITEM 680.95020815 - SERVICE CABLE 2 CONDUCTOR, NO. 08 AWG
ITEM 680.95021015 - SERVICE CABLE 2 CONDUCTOR, NO. 10 AWG

**Description.** Under this item the Contractor shall furnish and install in a raceway or conduit service entrance cable which is suitable for wet or dry locations at the location indicated on the plans and as directed by the Engineer. This cable will transmit current from the power source to the signal controller cabinet.

**Material.** The cable shall conform to the requirements for service entrance cable of the National Electrical Code and be Underwriters Laboratory approved. The cable shall be rated for 600 volt service and the conductors shall be stranded copper wire or as specified in the contract documents.

**Construction Details.** Service cable shall be installed in accordance with Details: the contract documents and as directed by the Engineer. A sufficient length of cable, not less than 24 inches, shall be left at the end of the run to allow for the tap to be made by the utility company at the power source entrance. The Contractor shall make all connections at the fused disconnect and the ground bar in the signal controller cabinet.

**Method of Measurement.** Service cable will be measured as the number of linear feet actually installed in accordance with the contract documents or as directed by the engineer.

**Basis Of Payment.** The unit price bid per linear foot shall include the cost of all materials, labor, connections, incidental fittings, equipment, tools, and all necessary tests to complete the installation.
ITEM 680.95600004 - ELECTRICAL METER PANE
ITEM 680.95610004 - POWER DISTRIBUTION PANEL

DESCRIPTION:

Under these items, the Contractor shall furnish and install meter pans and power distribution panels at locations as shown on the Plans or as directed by the Engineer. This equipment shall be used to meter and distribute electrical power to the various field devices.

MATERIAL:

All materials furnished, assembled, fabricated or installed shall be new, corrosion resistant and in strict accordance with the details as shown on the Plans and as specified in these Contract documents.

Electrical Meter Pan

The meter pan shall consist of the components and incidentals necessary as required by the utility to complete a totally operational assembly with all cabling and terminations matched to support the selected components.

The meter pan shall be U.L. listed, in accordance with the electrical utility standards and be self-contained, rated 120/240 volts single-phase, 150 amps or 200 amps as directed by the Utility, and rated NEMA 3R, rain tight, without by-pass facilities. The Contractor shall be responsible for furnishing and installing suitable support hardware, channels, struts, rods, nuts and bolts as required for cabinet or pole mounting. In applications where the meter pan is installed directly to a wood pole, the meter pan shall be installed within a hinged door NEMA type 3R rainproof enclosure, equipped with locking hasps and a glass polycarbonate window.

Power Distribution Panel

The Power Distribution Panel shall include a service rated distribution panel housed in a rainproof enclosure, a two pole plug in service rated main breaker, and single and double pole plug in circuit breakers, sized to suit the equipment on the branch circuits as shown on the plans.

The equipment furnished and installed shall be UL listed and shall conform to the following:

A NEMA type 3R rainproof enclosure, suitable for pole or cabinet mounting, shall be provided for each distribution panel. The enclosure supplied shall accommodate all entering conduit sizes, as shown on the plans, and shall have a means of being padlocked in the closed position.

The Power Distribution Panel shall have the capacity to house a minimum of fourteen single pole circuit breakers, and shall be able to accommodate all ground wires and neutrals required.

Plug in main breakers shall be double pole, rated at 240 volts, AC, and 100 amps per pole.

Plug in circuit breakers for branch circuits shall be single or double pole breakers sized to suit the equipment being serviced on each branch. (Circuit breaker size shall be submitted for approval.)
ITEM 680.95600004 - ELECTRICAL METER PAN
ITEM 680.95610004 - POWER DISTRIBUTION PANEL

Power cables required between the Power Distribution Panel and the connection to a utility company power feed shall be of the number of conductors and AWG # gauge shown on the plans, 600 volt, and shall conform to the following:

a. Cable shall bear Underwriters Laboratories label for type USE. It shall consist of copper conductor, and insulation constructed to conform to ICEA (Insulated Cable Engineers Association) Pub. No. S-66-524 and NEMA Pub. No. WC-7, "Thermoplastic - Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy."

b. Cable shall consist of 7 copper strands up to and including #2 AWG and shall be constructed of 19 copper strands in larger sizes.

c. Insulation shall be chemically cross linked (vulcanized) polyethylene insulating compound.

d. Cable shall be factory or shop twisted in a triplex configuration in accordance with the publications listed in (a) above and as indicated by the plans.

Circuit Breakers

Circuit breakers shall be rated for a system voltage of 120/240 VAC and of the ampere rating as required for the equipment being serviced.

Circuit breaker identification labels shall be engraved plastic laminate with the engraved legend in white alphanumeric characters on black face. The characters shall be a minimum of 6mm high. The label shall be a minimum of 645 mm² in size and mechanically attached.

Secondary Surge Arresters

Secondary surge arresters shall meet the requirements of NEC Article 280, UL Listed, ANSI/IEEE C62.11-1987. The arrester shall be rated for a discharge current of 10,000 Amperes and discharge voltage of 750V. The arrester shall be hardwired to the secondary and can be mounted externally or internally to the panel board or circuit breaker enclosure.

Ground Rods

Ground rods shall be as shown on the Plans and in accordance with Section 670-3.05 and 680-3.12 of the Standard Specifications.

CONSTRUCTION DETAILS:

All equipment shall be installed in accordance with manufacturer instructions, local utility
company practices and with these Contract documents. Connections of all cables between the line and load side of the meter socket, main circuit breaker and feeder circuit breakers shall be cut to proper length before terminating. No wire shall be doubled back to take up slack.

The legend for the circuit breaker identifiers shall be the equipment being fed by the circuit. All proposed engraving shall be submitted to the Engineer for approval.

**METHOD OF MEASUREMENT:**

The Metering Pan and the Power Distribution Panel will each be measured as the number of units furnished, installed and made operational in accordance with the Contract Documents or as directed by the Engineer.

**BASIS OF PAYMENT:**

The unit price bid for each unit shall include the cost of furnishing all labor, materials, equipment and incidentals as necessary to complete the work. This work shall include but not be limited to terminating service conductors, feeder conductors, conduits, testing and any special requirements of the local utility company.
ITEM 680.96030304 - FIBER OPTIC CABLE PATCH PANEL – RACK MOUNTED
ITEM 680.96030404 - FIBER OPTIC CABLE PATCH PANEL – FIELD EQUIPMENT

DESCRIPTION
Under this item of work the Contractor shall furnish and install fiber optic cable patch panels and terminate fiber optic cable installed under this Contract in these patch panels at the locations shown on the Plans and as directed by the Engineer.

MATERIALS
Each fiber optic patch panel shall be designed for the termination of 6, 96 and 144 single mode optical fibers with ST type connectors in field equipment cabinets or equipment enclosure racks located within buildings.

The construction and testing of the fiber optic patch panels shall comply with all applicable Electronic Industry Standards (EIA/TIA), International Telegraph and Telephone Consultative Committee (CCITT), ANSI, ASTM standards and FDDI specifications.

All fiber optic patch panels shall include the following accessories:

- Mounting bolts
- ST type receptacle, interconnect sleeve or bulkhead adapter
- Jumper cables
- Fiber drawers (96 fiber patch panel)
- Storage for fiber (6 fiber patch panel)
- Cable clamps with strain relief

Fiber optic cable patch panels that provide for the termination of 6 single mode optical fibers shall be installed in field equipment cabinets for VMS sites, CCTV sites, HAR sites and at workstation sites. The patch panel shall be wall mountable with a nominal size of 8 ½ inches high x 7 1/4 inches wide x 2 ½ inches deep. The storage compartment for excess fiber or pigtails shall be lockable. Fiber optic cable patch panels being installed at workstation shall have a protective cover installed over all the ST connectors.

Fiber optic cable patch panels terminating 96 optical fibers and 144 optical fibers shall be designed for installation in a standard EIA-483mm equipment rack.

The 96 fiber optic cable patch panels shall have a clear front cover that shall be easily removed or opened by use of a hinge and/or fastened with thumbscrews to provide easy access for cable installation. The bottom and/or back shall provide openings for cable entrance, and provide for strain relief at each entrance point. The patch panel shall provide drawers and other fixtures as required to maintain the cable fibers at or greater than the minimum bending radius without strain placed on the cable.
ST connectors shall be for single mode applications, pre-radiused, zirconia ceramic ferrule, metallic or composition body with strain relief boot. The ST connector shall meet the following specifications:

- Operating Temperature: -40º C to 50º C
- Insertion Loss: < 0.35 dB
- Reflectance: < – 40 dB
- Durability: < 0.3 dB change for > 200 matings

ST type receptacle, interconnect sleeve or bulkhead adapter shall have a zirconia sleeve.

Attenuators shall be for single mode operation and of the wavelength of the attached equipment. The attenuator shall be either a fixed or variable in-line type. The attenuator shall meet the following specifications:

- Operating Temperature: -40º C to 50º C
- Attenuation Accuracy: ± 1.5dB

Fiber optic patch cords shall be compatible with single mode optical fiber and provided with factory installed ST type single mode connectors, and shall be supplied with each patch panel. The patch cord shall have a maximum insertion loss of 0.3dB with a return loss of greater than 55dB. The following patch cords shall be included with each type of panel:

- Patch panels terminating 6 fibers shall include 6 patch cords, length - 3 feet for field equipment and 9 feet for workstations.
- Patch panels terminating 96 fibers shall include 100 patch cords, length - 9 feet

**CONSTRUCTION DETAILS**

The Contractor shall install fiber optic cable patch panels and terminate fiber optic cables at locations shown on the Plans.

Fiber optic patch panels and ST connectors shall be installed in accordance with manufacturer’s instructions.

ST connectors will be installed on all fibers, which terminate in patch panels. ST connectors with pigtails shall not be allowed for termination.

All required cross connecting and connections to equipment shall be in accordance with the Plans or as directed by the Engineer.
All ST receptacles on the patch panels and plug ends on patch cords shall be capped with an approved cap.

If attenuation is required for proper operation of the attached equipment the amount of required attenuation shall be noted on the patch panel and in the As-Built documentation.

Testing and documentation shall be as specified in these Contract documents.

**METHOD OF MEASUREMENT**
Fiber Optic Cable Patch Panel – Rack Mounted will be measured as the number of units furnished, installed and made fully operational.

Fiber Optic Cable Patch Panel – Field Equipment will be measured as the number of units furnished, installed and made fully operational.

**BASIS OF PAYMENT**
The unit price bid for each Fiber Optic Cable Patch Panel – Rack Mounted shall include all labor, materials, tools, equipment and incidentals as necessary to complete the work.

The unit price bid for each Fiber Optic Cable Patch Panel – Field Equipment shall include all labor, materials, tools, equipment and incidentals as necessary to complete the work.

Testing and documentation will be paid under a separate bid item.

*Progress payment will be made as follows:*

Fifty percent (50%) of the bid price for each item will be paid when the equipment is installed. Twenty percent (20%) of the bid price for each item shall be paid upon successful completion of Operational Tests. Twenty percent (20%) of the bid price for each item shall be paid upon successful completion of System Acceptance Tests. Ten percent (10%) of the bid price for each item shall be paid upon successful completion of the Final Acceptance Test.
ITEM 683.40020004 - WIRELESS ETHERNET TRANSCEIVER

DESCRIPTION
This work shall consist of furnishing and installing a Wireless Ethernet Transceiver in accordance with the contract documents and as directed by the Engineer.

The Wireless Ethernet Transceiver shall function as a wireless bridge for IP-based Ethernet connectivity. The Wireless Ethernet Transceiver shall utilize the unlicensed 900 MHz frequency and shall have the ability to avoid frequency interference by using a frequency hopping capability. The Wireless Ethernet Transceiver shall be manageable remotely utilizing a typical web-based user interface over an IP network. The communications shall be encrypted with a minimum of 128-bit WEP encryption.

MATERIALS

Functional Requirements
The Wireless Ethernet Transceiver shall function as a wireless bridge for IP-based Ethernet connectivity.
- Minimum link rate to support maximum serial data transmission rates
- 900Mhz unlicensed frequency usage with frequency hopping capabilities to minimize collision
- Secure communications with minimum 128-bit data WEP encryption
- Minimum of one (1) 10/100Base-TX, RJ-45 port for uplink/downlink
- Range: Minimum 46 mile Line Of Site

Environmental and Physical Conditions
The Wireless Ethernet Transceiver shall be environmentally field-hardened for rugged environments, and offer several mounting options.
- NEMA TS-1 and TS-2 Certified
- DIN Rail mountable
- -22°F to 158°F (Operating Temperature)
- Humidity: 10% to 90% Non-Condensing
- Meet FCC EMC compatibility

Standards and Protocol Compliance
The Wireless Ethernet Transceiver shall comply with the latest standards and protocols for a field deployable wireless Ethernet bridge.
- TCP, UDP, ICMP, DHCP, HTTP
- Compliance with IEEE 802.3 10Base-T and IEEE 802.3u 100Base-TX
- Management – SNMP, HTTP (web-based user interface), Serial Port Console (Local via serial RS-232 port, Remote via Telnet)
- Data Encryption: 128-bit WEP minimum

Radio Unit
- Operating Modes: Point-to-Point, Point-to-Multipoint, Store-and-Forward Repeater
- Link Rate: 1Mbps minimum constant
ITEM 683.40020004 - WIRELESS ETHERNET TRANSCEIVER

**Antenna**
The antenna shall be of a suitable design for mounting to the top of the equipment cabinet or as shown in the plans. The Contractor shall install the antenna and RF cable based on the manufacturer's recommendation or as directed by the Engineer. Surge protection including high frequency surge protection for the RF cable shall be provided by the Contractor.

**Power**
The Wireless Ethernet Transceiver shall utilize existing power available at installed location shown on the plans or as directed by the Engineer.
- The external AC Power supply and duplex receptacle plug shall be adequately secured in the cabinet, 12V Nominal
- Power consumption maximum 10W
- Meet FCC EMC requirements

**CONSTRUCTION DETAILS**
The Contractor shall prepare a shop drawing detailing the complete Wireless Ethernet Transceiver installation, including all components to be supplied, mounting details and interface cables.

The Contractor shall install the Wireless Ethernet Transceiver using a DIN Rail mount configuration. The Contractor shall follow the manufacturer’s installation instructions, and shall make all the appropriate connections necessary to satisfy the Engineer.

It is the Contractor’s responsibility to configure the device and test for full operation as intended herein and as directed by the Engineer.

**General**
The Contractor shall install the specified field equipment at locations shown on the plans and as directed by the Engineer. The equipment shall be installed on both existing poles and structures, new poles furnished under this contract and within equipment cabinets furnished and installed under other contract items.

All incidental parts which are necessary to complete the installation, but are not specified herein or on the plans, shall be provided as necessary to provide a complete and properly operating system.

Documentation, testing and training requirements as found applicable is specified within the Special Notes of the proposal.

**METHOD OF MEASUREMENT**
This work will be measured as the number of Wireless Ethernet Transceiver units satisfactorily furnished, installed, made fully operational and tested.
ITEM 683.40020004 - WIRELESS ETHERNET TRANSCEIVER

BASIS OF PAYMENT
The unit price bid shall include the cost of furnishing all labor, materials, equipment, incidentals, training, tools, documentation, and testing required to satisfactorily complete the work. All miscellaneous hardware required shall be included under this item.

Progress payments will be made as follows:

Fifty percent (50%) of the bid price of each item will be paid when it is installed.

Twenty percent (20%) of the bid price will be paid upon satisfactory completion of the On-Site Stand-Alone Test.

Twenty percent (20%) of the bid price will be paid upon satisfactory completion of the System Interface and Performance Tests.

Ten percent (10%) of the bid price will be paid upon satisfactory completion of the 90 Day Operational Test.
ITEM 683.84401004 – NETWORK SWITCH – FIELD EQUIPMENT, 8-PORT, SFP

DESCRIPTION
The Contractor shall furnish and install an Ethernet Switch of the type designated in the Contract Documents and as ordered by the Engineer. The Ethernet switch field equipment will be used in outside field cabinets and connect various IP and fiber optic field devices to the switch’s SFP and Ethernet ports. The field switch may also connect to other adjacent network switches, via SFP port, in each direction. The field switch shall be installed in the field cabinets or other locations as designated on the plans. The switch shall be field hardened to withstand varying environmental conditions such as temperature, humidity, and dust.

The switch shall be configured by the Contractor with basic network settings that will allow for Telnet connectivity from the local NYSDOT datacenter. The IP address and subnet information necessary for remote connectivity to each switch shall be provided by the local NYSDOT datacenter. Unless otherwise noted in the construction documents, all switch configurations shall be completed by NYSDOT.

MATERIALS
All material furnished, assembled, fabricated or installed shall be new, and in strict accordance with all the details shown in the Contract Documents and in these Special Specifications.

All equipment furnished under these items shall:
- Be from the same manufacturer
- Remain fully compatible with the existing datacenter Cisco switch stack running IP services. If an existing switch is not specified in the contract plans then the Contractor is responsible for contacting the local datacenter for information regarding their existing configuration.
- Supports compliance to NEMA TS-2, a variety of gigabit fiber uplinks, Cisco IOS Software to support critical ITS features, including virtual LAN (VLAN), QoS, Internet Group Management Protocol (IGMP) snooping, and security access control lists (ACLs).
- Support for SFP modules provides uplink connectivity supporting 100BASE-LX, 100BASE-FX, 1000BASE-SX, 1000BASE-LX, and 1000BASE-ZX options.
- Provide for easy switch replacement using removable memory, allowing the user to replace a switch without having to reconfigure.
- Provide support for Protocol-independent multicast (PIM) for IP multicast routing
- Include 1 year SMARTnet or similar support for maintenance and updates.
- Include a minimum of 2 SFP ports.

The Ethernet Switches shall meet the following requirements:
Operating System:
Compatibility with Cisco switches running IP Services (Universal K9 image) with routing capabilities HSRP, VRRP, EIGRP (stub).

- QoS Classification.
- Virtual LANs (VLANs) to allow for logical segmentation for a network for optimal use of bandwidth.
- Per-port broadcast, multicast, and unicast storm control prevents faulty end stations from degrading overall systems performance.
- IGMP filtering provides multicast authentication by filtering out no subscribers and limits the number of concurrent multicast streams available per port.
- Support Cisco Hot Standby Router Protocol (HSRP).
- EtherChannel LACP support for quick recovery and bandwidth utilization.
- 802.1q Trunking.
- Port Rate Limiting and Broadcast Storm Limiting
- Port Configuration, Status, Statistics, Mirroring and Security.
- Loss of Link Management on Fiber Ports.
- MAC address filtering to prevent the forwarding of any type of packet with a matching MAC address.

IEEE Compliance
- IEEE 802.1s
- IEEE 802.1w
- IEEE 802.11
- IEEE 802.1x
- IEEE 802.1x-Rev
- IEEE 802.3ad
- IEEE 802.3af
- IEEE 802.3at
- IEEE 802.3x full duplex on 10BASE-T, 100BASE-TX, and 1000BASE-T ports
- IEEE 802.1D Spanning Tree Protocol
- IEEE 802.1p CoS prioritization
- IEEE 802.1Q VLAN
- IEEE 802.3 10BASE-T specification
- IEEE 802.3u 100BASE-TX specification
- IEEE 802.3ab 1000BASE-T specification
- IEEE 802.3z 1000BASE-X specification
**ITEM 683.84401004 – NETWORK SWITCH – FIELD EQUIPMENT, 8-PORT, SFP**

**Ethernet Ports:**
- 1 Gigabit Capable SFP (2 min.)
- 10/100 or 10/100/1000 Capable Ethernet (6 min.)

**Switch Properties:**
- Forwarding rate based on 64-byte packets: 6.5 Mbps.
- 128 MB DRAM.
- Priority Queues.
- Configurable up to 8000 MAC addresses (Layer2).
- Configurable up to 2000 MAC addresses (Layer3).
- 64 MB Compact Flash memory.
- Configurable up to 256 IGMP multicast groups (Layer 2).
- Configurable up to 1000 IGMP groups and multicast routes (Layer 3).
- Configurable up to 3,000 unicast routes (Layer 3).
- Support jumbo frames up to 9018 bytes on GB uplink port and mini-jumbo frame (system MTU) up to 1998 bytes on both 10/100 and 10/100/1000 ports.
- Network Management: Cisco compatible command line RMON 1, RMON 2, SNMP v1, v2c, v3, Telnet.

**Indicators:**
Per Port:  Link, Activity, Duplex, Speed, Stack LEDS
Power: Power status indicator EMI Immunity and Environmental

**EMI Immunity:**
The switch shall be designed for Industrial Ethernet applications, including extended environmental, shock/vibration, and surge ratings and all applicable IEC and IEEE EMI immunity specifications.

**Environmental Requirements:**
Meet or exceeds the NEMA TS-2 Standard
Humidity: 10 to 95% non-condensing
Temperature: -40 to 167°F (-40 to 75°C)
-40 C to +70 C (vented enclosure operating)
-40 C to +60 C (sealed enclosure operating)
Operating Altitude: Up to 13,000 ft (3963m)

**Electrical Requirements:**
Voltage: 115 ± 20 VAC
Power Consumption: 20W max.
Circuit Protection: Resettable circuit breakers or fuses shall be provided to protect the equipment. The protection may be provided either as part of the cabinet wiring or on the equipment. All equipment shall be hot swappable.
ITEM 683.84401004 – NETWORK SWITCH – FIELD EQUIPMENT, 8-PORT, SFP

Mechanical
Mounting: Shall be suitable for rack mounting.

CONSTRUCTION DETAILS
The Contractor shall install the Ethernet switches in the equipment cabinets and locations as designated on the plans. The Ethernet switches shall be connected to other components as shown in the plans with all cables furnished as part of this item.

The included cables shall vary based on the proposed installation location as well as connected devices. They include both copper and fiber with the connector type and distance run as proposed in the contract documents.

All cables shall be neatly routed within the equipment cabinet and each cable shall have a unique identification at each connection point as designated on the plans.

Documentation Requirements:
TWO (2) advance copies of equipment manuals furnished by the manufacturer shall be submitted to the Engineer for review at least ten-days prior to the scheduled start of the first Operational Test. The Engineer will verify the manufacturer’s equipment manual as part of the test and integration process. The equipment manual incorporating the Engineer’s corrections and comments shall be integrated by the Contractor into the operations and maintenance manual as described in the General Requirements. The manuals shall, as a minimum, include the following:

a. Complete and accurate schematic diagrams.
b. Complete installation and operation procedures.
c. Complete performance specifications (functional, electrical, mechanical and environmental) of the unit.
d. Complete list of replaceable parts including names of vendors for parts not identified by universal part numbers such as JEDEC/ RETMA or EIA.
e. Complete maintenance and troubleshooting procedures.

Operational Testing Requirements:
After installation of the equipment in the field and prior to integration of the equipment into the system, the Contractor shall perform an Operational Test in the field for each Ethernet Switch installed. The test shall demonstrate as a minimum the ability of the switch to connect each field device to the existing or new Ethernet network equipment and transmit and receive Ethernet data between each of the field equipment and field hub or central as applicable.

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ITEM 683.84401004 – NETWORK SWITCH – FIELD EQUIPMENT, 8-PORT, SFP

The Contractor shall also have the E.I.C. contact the appropriate NYSDOT representative to remotely manage the switch to ensure the correct protocols and functionality of that switch is operational.

If the Operational Test fails, the equipment shall be repaired and the test shall be rerun for that site. If a component has been modified as a result of a failure, that component shall be replaced in all like units and the test shall be rerun for each unit.

METHOD OF MEASUREMENT
The Ethernet Switches will be measured for payment as the number of each specified in the Contract Documents satisfactorily installed.

BASIS OF PAYMENT
The unit price bid for each Ethernet Switch shall include the cost of furnishing all labor, materials and tools and equipment necessary to complete the work and to make the Ethernet Switch fully operational and tested.

Payment for all documentation, testing and test equipment shall be included under this item.
DESCRIPTION:
This work shall consist of the furnishing and installation of fiber optic cables, passive components and miscellaneous equipment required for a complete cable plant in accordance with the contract documents and as directed by the Engineer.

MATERIALS
Equipment to be installed as part of these bid items include the following:

1. Single Mode Fiber Optic Cable
2. Fiber Optic Cable Connectors and Splices
3. Fiber Optic Splice Trays
4. Fiber Optic Splice Cases
5. Fiber Optic Breakout Kits

Other passive components that are required to form a complete communication system include (1) terminators and (2) moisture and water sealants and cable caps for below grade applications. The components supplied shall be commercially available components whose specifications indicate state-of-the-art capability for the application.

1. Single-mode Fiber Optic Trunk Cable
The single-mode fiber optic cable shall incorporate a water swellable tape and be of a loose buffer tube cable design as specified herein. The fiber optic cable shall be all dielectric suitable for conduit and aerial installation in an outside cable plant environment and for indoor cabling environments when installed in accordance with the current NEC and local building code requirements. All cable shall consist of the number of fibers specified in the contract documents.

The cable shall meet the requirements of the United States Department of Agriculture Rural Utility Service (RUS) 7 CFR1755.900 and the requirements of ANSI/ICEA Standard for Fiber Optic Outside Plant Communications Cable, ANSI/ICEA S-87-640-1999 at a minimum, and shall be new, unused and of current design and manufacture. The cable manufacturer shall have a minimum of three years experience in manufacturing fiber optic cable of similar design.

Optical Requirements
The fiber shall meet the requirements of EIA/TIA-492CAAA “Detail Specification for Class Iva
ITEM 683.92100610 - SINGLE MODE FIBER OPTIC TRUNK CABLE, 6 FIBERS
ITEM 683.92101210 - SINGLE MODE FIBER OPTIC TRUNK CABLE, 12 FIBERS
ITEM 683.92102410 - SINGLE MODE FIBER OPTIC TRUNK CABLE, 24 FIBERS
ITEM 683.92103610 - SINGLE MODE FIBER OPTIC TRUNK CABLE, 36 FIBERS
ITEM 683.92104810 - SINGLE MODE FIBER OPTIC TRUNK CABLE, 48 FIBERS
ITEM 683.92106010 - SINGLE MODE FIBER OPTIC TRUNK CABLE, 60 FIBERS
ITEM 683.92107210 - SINGLE MODE FIBER OPTIC TRUNK CABLE, 72 FIBERS
ITEM 683.92150010 - FIBER OPTIC DROP CABLE

Dispersion-Unshifted Single-Mode Optical Fibers".

Attenuation: The nominal attenuation shall not exceed 0.4 dB/km at a wavelength of 1310 nm and and 0.3 dB/km at a wavelength of 1550 nm. Fiber attenuation shall be uniform with no discontinuities greater than 0.1 dB. The attenuation at 1383 ± 3 nm shall not exceed 2.1 dB/km. The attenuation measurements shall be in accordance with EIA/TIA Standards FOTP-20, 59, 61 and 78. The average change in attenuation at extreme operational temperatures (-40°F to 158°F) shall not exceed 0.05 dB/km at 1550 nm. The magnitude of the maximum attenuation change of each individual fiber shall not be greater than 0.15 dB/km at 1550 nm. The change in attenuation measurements shall in accordance with EIA/TIA Standard FOTP-3.

Cutoff Wavelength: Not to exceed 1250 nm.

Mode-Field Diameter:
9.30 ± 0.50 μm at 1310 nm.
10.50 ± 1.00 μm at 1550 nm.

Zero Dispersion Wavelength: 1312 nm ± 10 nm.

Zero Dispersion Slope: Not to exceed 0.092 ps/(nm²·km).

Polarization Mode Dispersion: Not to exceed 0.5 ps/(km)².

Dispersion: Less than 3.5 ps/(nm·km) for 1285 nm through 1330 nm and less than 18 ps/(nm·km) at 1550 nm as measured in accordance with EIA/TIA Standard FOTP-169.

Mechanical Requirements

Fibers

All optical fibers shall be Corning glass fibers or approved equivalent. All fibers within a given cable shall be from the same manufacturer, and shall contain no factory splices. Each fiber shall conform to the following minimum requirements:

- Typical Core Diameter: 8.3 μm (0.327mil)
- Cladding Diameter: 25.0±1.0 μm (1 mil to 0.04mil)
- Core-to-Cladding Offset: Not to exceed 0.5 μm (0.02 mil)
- Cladding Non-Circularity: Not to exceed 1.0 %

Color Coating

Each fiber shall have a color coating applied to it by the manufacturer. The coating shall not affect the optical
ITEM 683.92100610 - SINGLE MODE FIBER OPTIC TRUNK CABLE, 6 FIBERS  
ITEM 683.92101210 - SINGLE MODE FIBER OPTIC TRUNK CABLE, 12 FIBERS  
ITEM 683.92102410 - SINGLE MODE FIBER OPTIC TRUNK CABLE, 24 FIBERS  
ITEM 683.92103610 - SINGLE MODE FIBER OPTIC TRUNK CABLE, 36 FIBERS  
ITEM 683.92104810 - SINGLE MODE FIBER OPTIC TRUNK CABLE, 48 FIBERS  
ITEM 683.92106010 - SINGLE MODE FIBER OPTIC TRUNK CABLE, 60 FIBERS  
ITEM 683.92107210 - SINGLE MODE FIBER OPTIC TRUNK CABLE, 72 FIBERS  
ITEM 683.92150010 - FIBER OPTIC DROP CABLE

characteristics of the fiber. The basic color configuration shall be as follows, in accordance with EIA/TIA-598-A:

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The nominal colored fiber diameter shall be 250 μm (10 mil).

**Primary Coating**

Each fiber shall have a dual layered, UV acrylate coating applied to it by the manufacturer. The coating shall be mechanically strippable without damaging the fiber. The coating diameter shall be 245±10 μm (10 mil±0.4 mil).

**Central Strength Member**

The strength member shall consist of a dielectric, glass-reinforced plastic rod.

**Buffering**

All fibers shall be enclosed in non-conductive loose buffer tubes. Each buffer tube shall contain up to twelve (12) fibers. The Contractor shall submit the fiber count per buffer tube and the buffer tube count configuration to the Engineer for approval. The fiber shall not adhere to the inside of the buffer tube. Each buffer tube containing fibers shall be color coded in a similar scheme as the fiber color. The basic color configuration shall be as follows, in accordance with EIA/TIA-598-A:

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In buffer tubes containing multiple fibers, the colors shall be stable during temperature cycling and not subject to fading or smearing onto each other or into the gel filling material. Colors shall not cause fibers to stick together. Buffer tubes shall be of dual-layer construction.

The buffer tubes shall be filled with a non-hygroscopic gel to prevent water and moisture penetration. The gel shall contain anti-oxidant additives, and the gel shall be readily removable with conventional solvents. The gel shall be non-toxic and dermatologically safe to exposed skin. It shall be chemically and mechanically compatible with all cable components, non-nutritive to fungus, non-hygroscopic and electrically non-conductive.

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ITEM 683.92100610 - SINGLE MODE FIBER OPTIC TRUNK CABLE, 6 FIBERS
ITEM 683.92101210 - SINGLE MODE FIBER OPTIC TRUNK CABLE, 12 FIBERS
ITEM 683.92102410 - SINGLE MODE FIBER OPTIC TRUNK CABLE, 24 FIBERS
ITEM 683.92103610 - SINGLE MODE FIBER OPTIC TRUNK CABLE, 36 FIBERS
ITEM 683.92104810 - SINGLE MODE FIBER OPTIC TRUNK CABLE, 48 FIBERS
ITEM 683.92106010 - SINGLE MODE FIBER OPTIC TRUNK CABLE, 60 FIBERS
ITEM 683.92107210 - SINGLE MODE FIBER OPTIC TRUNK CABLE, 72 FIBERS
ITEM 683.92150010 - FIBER OPTIC DROP CABLE

Filler Rods: Filler rods shall be used to fill all unused buffer tubes, or shall be used instead of unused buffer tubes. The filler rod shall be a solid polyethylene material and shall be natural in color. The filler rods shall maintain the concentricity of the cable cross section where required.

Stranding: The buffer tubes shall be stranded around the central strength member using the reverse oscillation (S-Z) stranding process. Water swellable yarns shall be applied longitudinally along the central member during stranding.

Water Swellable Tape: A water swellable tape shall be applied longitudinally over the stranded tubes/fillers. The water swellable tape shall be non-nutritive to fungus, electrically non-conductive and homogenous. It shall also be free from dirt and foreign matter.

Tensile Strength Provisions: Aramid yarn shall be helically stranded evenly around the cable core to provide tensile strength. The yarn shall enable the cable to withstand a maximum pulling force of 607 lbs during installation and 200 lbs long term installed without changing the characteristics of the optical fibers. Each length of cable shall have sufficient strength to be installed in continuous lengths as specified on the plans.

Outer Jacket:

A medium density polyethylene (or approved equal) outer jacket shall be applied over the entire cable assembly. The outer jacket shall have a minimum nominal jacket thickness of 1/16 inch. The polyethylene shall contain carbon black and shall not promote the growth of fungus. Jacketing material shall be applied directly over the strength members and the water swellable tape. The outer jacket shall contain no metallic elements and shall be of a consistent thickness.

The MDPE jacketet material shall be as defined in ASTM D1248, Type II, Class C and Grades J4, E7 and E8. The jacket shall be marked in contrasting color at 2 feet intervals with the following information:

NYSDOT - INFORM FIBER OPTIC CABLE - XXX - YYZZ

where XXX shall equal the number of optical fibers in the cable and YYZZ shall be the month and year that the cable was manufactured. The height of the markings shall be approximately 3/32 inch.

In addition, the outer jacket shall have sequential meter markings as approved by the Engineer. The actual length of the cable shall be within -0% +1% of the length markings.

Ripcord: The cable shall contain a ripcord under the sheath to facilitate cable preparation.

Bend Radii: The cable shall be capable of withstanding a minimum bending radius of ten (10) times its outer diameter during operation and fifteen (15) times its outer diameter during installation without changing the characteristics of the optical fibers.
**Diameter:** The outer diameter of the cable shall be less than 19/32 inch.

**Other Requirements**

**Manufacturer’s Certification:** The cable manufacturer shall certify that each reel of cable furnished meets or exceeds the following specifications:

**Fluid Penetration:** When a one meter static head of water or equivalent continuous pressure is applied at one end of a one meter length of filled cable for one hour, no water shall leak through the open cable end. The water penetration testing shall be performed in accordance with EIA/TIA Standard FOTP-82.

**Filling Compound Flow:** When tested in accordance with EIA/TIA Standard FOTP-81, the cable shall exhibit no flow (drip or leak) of filling or flooding compound at 158°F.

**Compressive Strength:** When tested in accordance with EIA/TIA Standard FOTP-41, the cable shall withstand a minimum compressive load of 126 lb/inch applied uniformly over the length of the sample and applied at the rate of 0.1 inch per minute. The load shall be maintained for a period of 1 minute and then decreased to 63 lb/in. The 63lb/in load shall be maintained for a period of 10 minutes. Attenuation measurements shall be performed before release of the 63 lb/in load. The change in attenuation shall not exceed 0.15 dB at 885lb/in.

**Tensile Loading and Bending:** When tested in accordance with EIA/TIA Standard FOTP-33, using a maximum mandrel and sheave diameter of 22 inch, the cable shall withstand a rated tensile load of 600 lbs and a residual load of 30% of the rated installation load. The axial fiber strain shall be ≤ 20% of the fiber proof level after completion of 10 minutes of conditioning and while the cable is under the residual load. The change in attenuation at residual load and after load removal shall not exceed 0.15 dB at 1550 nm.

**Impact Resistance:** When tested in accordance with EIA/TIA Standard FOTP-25 except that the number of cycles shall be two at three locations along a one meter cable length and the impact energy shall be at least 3.24lbf ft (in accordance with ICEA S-87-640), the change in attenuation shall not exceed 0.15 dB at 1550 nm.

**Cable Flex:** When tested in accordance with EIA/TIA Standard FOTP-104, the cable shall withstand 25 mechanical flexing cycles around a sheave diameter not greater than 20 times the cable diameter. The fibers shall not experience an attenuation change greater than 0.15 dB at 1550 nm. The cable jacket shall exhibit no cracking or splitting when observed under 5X magnification.

**Temperature Cycling:** When tested in accordance with EIA/TIA Standard FOTP-3, the change in attenuation at extreme temperatures (-40°F to +158°F) shall not exceed 0.15 dB/km at 1550 nm.

**Low or High Temperature Bending:** When tested in accordance with EIA/TIA Standard FOTP-37, the cable...
shall withstand four full turns around a mandrel of \( \leq 20 \) times the cable diameter for four hours at test
temperatures of \(-22^\circ\text{F}\) and \(+140^\circ\text{F}\). Neither the inner our outer surfaces of the jacket shall exhibit visible cracks, splits, tears or other openings. The fibers shall not exhibit a change in attenuation greater than 0.30 dB/km at 1550 nm.

Cable Twist: When tested in accordance with EIA/TIA Standard FOTP-85, a length of cable no longer than 6 ½ ft shall withstand 10 cycles of mechanical twisting. The fibers shall not experience an attenuation change greater than 0.1 dB at 1550 nm. The cable jacket shall exhibit no cracking or splitting when observed under 5X magnification.

2. Fiber Optic Drop Cable

Fiber optic drop cables shall be installed in conduit, between the mainline fiber optic backbone cable and equipment cabinets patch panels as shown on the plans. They shall be spliced to the appropriate fiber within approved splice cases in pullboxes adjacent to equipment cabinets as specified.

**Optical Requirements:** The fiber optic drop cables shall have identical optical characteristics as the single-mode fiber optic trunk cable specified above.

**Material Requirements**

The drop cable shall have the identical physical configuration as the single-mode fiber optic trunk cable specified above. The fiber optic drop cable shall contain twelve (12) or more fibers. The number of fibers per drop cable shall be selected to allow for a minimum of 50% spare for the drop location.

The drop cable shall be able to withstand a minimum of 100 lbs of pulling force during installation.

The Contractor shall submit the drop cable buffer tube count configuration and fiber count per buffer tube to the engineer for approval.

The individual fibers in each drop cable shall be unterminated on one end and have a factory installed ST connector on the other end. The unterminated end shall be fusion spliced to the appropriate mainline fiber in a splice case and the terminated end shall interface with the cabinet distribution rack specified under a separate contract item. The manufacturer shall factory test the cable assembly with connectors and provide results to the Engineer for approval prior to field installation.

The drop cable shall be of sufficient length to be installed as shown on the plans, with a minimum of 10 ft of slack provided on either end.

The Contractor shall follow the drop cable manufacturer's recommendation in the installation of the drop cables, including the individual breakout fibers.
3. Fiber Optic Connectors:
Fiber optic connectors shall be factory installed. Field installation of connectors shall only be permitted with the express consent of the Engineer and will be considered on a case by case basis. The connectors shall meet the following requirements:

- Type ST twist lock (bayonet).
- Uses ceramic ferrules
- Fiber secured within the ferrule with epoxy, as specified by the connector or epoxy manufacturer.
- Operating temperature: -4°F to +158°F
- Insertion loss: 0.5 dB maximum
- Return loss: 55 dB minimum

4. Splice Cases
The Contractor shall furnish and install fiber optic splice cases in locations where splices require protection. The typical location where they will be required is in pullboxes where the fiber optic trunk cable will be spliced to fiber optic drop cables. The splice cases shall meet the following minimum requirements:

- The case shall be constructed of a rigid, high strength plastic material. The case shall be waterproof with the appropriate gaskets and protection to provide moisture integrity. When installed, the case shall be capable of withstanding severe conditions of moisture, vibration, impact, cable stress and temperature extremes.
- The case shall be capable of holding the type of splice trays specified herein, for fusion and ribbon splices. The case shall have the capability of holding trays from various manufacturers. The basic case shall have the capacity to hold three (3) splice trays with 24 splices per tray.
- The basic case shall have the input/output capacity for 6 cables.
- The case shall be re-enterable without disturbing the fibers or the fiber splices. No special tools shall be required for installation of maintenance of the case. All hardware and miscellaneous parts shall be standard industry equipment.
- The splice case shall be mountable to standard U-shaped sign channels using stainless steel hardware, or manufacturer approved hardware. Mounting shall be as shown on the details.
- Nominal dimensions of the basic case shall be 22 inch long by 9 inch wide by 9 inch high. The basic case shall weigh 20 lbs maximum.
- The splice case shall have a termination block to terminate the central strength members of the fiber optic cables.
5. Splice Trays
The Contractor shall furnish and install fiber optic splice trays to organize and store splices within splice cases. The trays shall be compatible with the fiber optic splices and splice cases specified herein and shall meet the following minimum requirements:

- The tray shall have the capacity for 24 splices. It shall be compatible with the fusion splices specified herein but shall also be adaptable to hold mechanical splices.
- The tray shall accommodate up to 8 loose tube buffers. No cable ties are to be used. The loose tube buffers shall be secured with a tube guide or channel snap.
- The tray shall accommodate both 250 micron and 900 micron fiber.
- Slack fiber within the tray shall be placed in an oval shape along an inside wall of the tray.
- The fiber optic splice trays shall be stackable within the splice case. Any tray within a stack shall be accessible without disassembly of any of the other trays.
- The nominal dimensions of the splice tray shall be 16 inch long by 4 ½ inch wide by ½ inch high.

6. Fiber Optic Breakout Kits
The fiber optic breakout kits contain all the tools and materials necessary to complete the installation of the fiber optic backbone and drop cables. It shall include, as a minimum, the following equipment:

- Pulling eyes with protective covering for the installation of preterminated fiber optic drop cable.
- Fiber optic installer test equipment, fusion splicers, test cables, connector adapters, inspection tools, attenuators, tracers, continuity checkers, consumables and all ancillary equipment.

Quality Assurance Provision
All optical fibers shall be proof tested by the fiber manufacturer at a minimum load of 100 ksi.
All optical fibers shall be attenuation tested. The attenuation of each fiber shall be provided to the Engineer with each reel of cable furnished.

The fiber optic cable shall conform to the following requirements:

Environmental Requirements
The cable shall function within specifications over the following temperature ranges:

- Shipping/Storage: -58°F to 158°F
- Installation: -22°F to 158°F
ITEM 683.92100610 - SINGLE MODE FIBER OPTIC TRUNK CABLE, 6 FIBERS
ITEM 683.92101210 - SINGLE MODE FIBER OPTIC TRUNK CABLE, 12 FIBERS
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ITEM 683.92106010 - SINGLE MODE FIBER OPTIC TRUNK CABLE, 60 FIBERS
ITEM 683.92107210 - SINGLE MODE FIBER OPTIC TRUNK CABLE, 72 FIBERS
ITEM 683.92150010 - FIBER OPTIC DROP CABLE

- Operation: -40°F to 158°F

CONSTRUCTION DETAILS:

All fiber optic cable will be installed in innerduct placed in steel conduit, steel conduit, lashed to or messenger cable, or overlashed to existing cables as indicated in these contract documents or otherwise directed by the Engineer. All fibers in the fiber optic cable shall be spliced and/or terminated in designated field cabinets or pullboxes only.

Prior to the installation of the fiber optic cable the Contractor shall submit his proposed cable plant design to the Engineer for approval. No cable shall be installed until the proposed cable plant design submission is approved by the Engineer. The cable plant design shall include the following:

- Catalog cuts and shop drawings for all cable, connectors, splice equipment, splice enclosures, splice trays and cable installation and test equipment.
- Preliminary locations of all proposed splices.
- Proposed pullbox locations where hand assists or intermediate assist winches will be required during installation.
- Proof of the experience requirements as defined in this special specification.
- Cable manufacturer's recommended cable installation techniques, both in conduit and overlashed to messenger or existing cable, such that the optical and mechanical properties of the cables are not degraded at the time of installation. The proposed recommendations shall include the following:
  - Cable manufacturer's approved pulling lubricant for use on the cable and method of application. No other lubricants will be permitted.
  - Installation set-up including size and types of rollers, feeder guides, tension gauge make and model number, attachment of pulling jig to jacket and direction of pull.
  - Method to overlash the cables to existing cables including spacing of drip loops, lashing material, slack cable storage.
  - Maximum pulling tensions, which shall specify both pulling from the cable's conductors and for pulling from the cable's outer jacket.
  - Minimum bend radii, which shall specify a radius both loaded and unloaded.
  - Method to install multiple cables.

The cable plant design shall be submitted at the Milestone specified in the Special Note of the Contract Documents.

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Experience Requirements
Personnel involved in the installation, splicing and testing of the fiber optic cable shall meet the following requirements:

- A minimum of seven (7) years experience in the installation of fiber optic cables, including fusion splicing, terminating and testing single mode fibers.

- Five (5) installed systems where fiber optic cables are installed in outdoor conduits and aerial plants and the systems are in continuous satisfactory operation for at least two (2) years. The Contractor shall submit as proof, photographs or other supporting documents, and the names, addresses and telephone numbers of the operating personnel who can be contacted regarding the fiber optic systems.

- One (1) fiber optic cable system (which may be one of the five in the preceding paragraph) which the Contractor can arrange for inspection and demonstration to INFORM representatives and the Engineer. Test records for the system including cable and splice loss shall be furnished for examination by the Engineer. A system splice enclosure and a patch panel selected at random by the Engineer shall be opened by the Contractor for inspection of workmanship. All inspection activities shall be approved in writing by the system owner prior to actual field inspection.

- Splicers shall have been trained and certified by the manufacturer of the fiber splice material to be used, in fiber optic splicing procedures. Proof of this training must be submitted to the Engineer for approval.

- Installers shall have been trained and certified by the manufacturer of the fiber optic cable to be used, in fiber optic cable installation and handling procedures. Proof of this training must be submitted to the Engineer for approval.

- Personnel involved in testing shall have been trained and certified by the manufacturer of the fiber optic cable test equipment to be used, in fiber optic cable testing procedures. Proof of this training must be submitted to the Engineer for approval.

Slack Cable Storage
Slack cable shall be stored underground on approved racks in fiber optic pullboxes, at grade in equipment cabinets, and overhead on pairs of approved cable snowshoes. Quantity of slack cable to be stored shall be as indicated in the contract documents and as approved by the Engineer.
Splicing Requirements
All optical fibers shall be spliced to provide continuous runs. Splices shall be allowed only at locations designated in the approved cable plant layout or as approved by the Engineer. All splices shall be performed in a controlled, clean environment such as a Contractor designated splicing truck/or van.

The splices shall meet the following requirements:

a. All splices shall use the fusion technique. Fusion splicing equipment shall be provided by the Contractor and shall be cleaned, calibrated and specifically adjusted to the fiber and environmental conditions at the start of each shift. Splice enclosures, tools and procedures, shall be approved by the cable manufacturer as being compatible with the cable type being delivered.
b. Only buffered tubes containing fibers to be spliced shall be opened. The other tubes shall be neatly looped and stored in the enclosure.
c. Each spliced fiber shall be packaged in a protective sleeving or housing. Bare fibers shall be completely re-coated with a protective RTV, gel or similar substance, prior to application of the sleeve or housing, so as to protect the fiber from scoring, dirt or microbending.
d. Rack mounted organizer trays shall be used to hold the spliced fibers, with each fiber neatly secured to the tray.
e. Splice loss shall not exceed a mean of 0.1 dB per link. A link is defined as the fiber optic path between two active components. No splice loss shall exceed 0.15 dB. If a splice is measured to exceed 0.15 dB during the splicing process, it shall be remade until its loss falls below 0.15 dB or the Engineer waives the 0.15 dB requirement. Each attempt shall be recorded for purposes of acceptance. If the mean exceeds 0.1 dB in any link, splices in the link shall be remade until the mean loss does not exceed 0.1 dB.
f. All splice losses shall be recorded in tabular form and submitted to the Engineer in paper and electronic formats for approval. If an optical time domain reflectometer (OTDR) is used to record splice loss, chart recordings of the "signature" shall be submitted with the splice data with a record of all OTDR settings and the OTDR locations written on the trace.

Installation
Fiber optic cable shall be installed in accordance with the approved manufacturer's recommendations. In addition the following requirements shall be met:

a. The number of pullboxes and their locations shall be as shown on the Contract Documents. The Contractor may be required to install the cable one pullbox at a time. The direction of the cable pull shall be determined by the Contractor and shall require the approval of the Engineer.
b. A minimum of 30 ft of cable slack, or as approved by the Engineer, shall be provided in pullboxes containing splices or otherwise designated on the Contract Documents or as directed by the Engineer. Additional slack, as indicated on the approved cable installation plan, may be provided for closure preparation and splicing.
c. No fiber optic cable shall be pulled through more than one 90 degree bend unless so indicated on the approved Contract Documents or specifically approved by the Engineer.
d. The cable shall not be pulled over edges or corners, over or around obstructions, or through unnecessary curves or bends.
e. The cable shall be looped in and out of cabinets and pull boxes to provide adequate slack and the least amount of stress on the fibers. The Contractor shall ensure that the cable is not damaged during storage or installation.

f. Fiber optic cable ends shall be kept sealed at all times during installation, using a method recommended by the cable manufacturer and approved by the Engineer. The cable end shall remain sealed until the Contractor terminates the fiber cables. Cables that are not immediately terminated shall have a minimum of 6 ½ ft of slack.

g. When using lubricants, the Contractor shall adhere to the cable manufacturer’s requirements for the proper amount, application tools and method, and removal of the lubricant from the exposed cable.

h. Optical fiber cable shall be installed in continuous lengths without intermediate splices throughout the project except where splices are indicated on the Contract Documents or approved by the Engineer. Splices shall only be in reenterable splice enclosures mounted in pullboxes, junction boxes and underground vaults.

i. The fiber optic drop cable shall be spliced to either the backbone or distribution cable at the locations indicated in the Contract Documents or as directed by the Engineer.

j. The maximum pulling tensions and minimum bending radii shall not be violated at any time during installation. The Contractor shall consult with the Engineer concerning existing conduit, pull boxes, and risers, which could force the violation of the minimum bending radius for the fiber optic cable. The Contractor shall obtain approval from the Engineer if modifications to these existing facilities are required. Violation of these parameters shall be cause for rejection of the installed cable.

k. Prior to any installation of cable, the Contractor shall clean existing conduit in accordance with the requirements of these special provisions.

l. Prior to overlashing cable, the Contractor shall inspect the existing aerial cable plant and report any deficiencies that may hinder the proper installation of the new cable to the Engineer who will determine, what, if any, action should be taken.

m. Slack cable and innerduct where pulled through a pullbox shall be racked to the pullbox wall.

Splicing Requirements

a. All optical fibers shall be spliced to provide continuous runs.

b. Prior to splicing, the Contractor shall test each fiber of the installed cable for continuity, anomalies (events above 0.3 dB) and attenuation using an Optical Time Domain Reflectometer (OTDR) at wavelengths of 1310 nm and 1550 nm.

c. Only the fibers designated for splicing shall be spliced. All other fibers shall be routed through the splice enclosure with at least 1 ft of slack left within the enclosure. Only buffer tubes containing fibers to be spliced shall be opened.

d. Splices shall be made only at locations designated in the approved cable plant layout or as approved by the Engineer.

e. Where two backbone cables are routed in the same duct bank, both cables shall not be spliced in the same pull box.
Termination Requirements
The connector loss for complete connection to the terminal equipment shall not exceed a mean of 0.5 dB. No connector losses above 1.0 dB shall be permitted.
Unused optical fibers shall be properly protected with sealed end caps.

Documentation Requirements
Ten (10) complete sets of operation and maintenance manuals shall be provided. The manuals shall, as a minimum, include the following:

- Complete and accurate as-built schematic diagrams showing the fiber optic cable plant and locations of all splices.
- Complete performance data of the cable plant showing the losses at each splice joint and each terminal connector.
- Installation, splicing, terminating and testing procedures.
- Complete parts list including names of vendors.
- Complete maintenance and trouble-shooting procedures.
- One (1) month prior to installation, ten (10) copies of the Contractors Installation Practices shall be submitted for approval. This shall include practices, list of installation equipment, and splicing and test equipment. Field quality control procedures shall be detailed as well as procedures for corrective action.

Testing Requirements
The following tests shall be conducted. All tests shall conducted in accordance with approved test procedures. The Contractor shall submit test procedures and forms in paper and electronic formats for approval to the Engineer.

Existing Fiber Cable Verification Test: Prior to splicing fibers installed under this contract to existing fibers (where designated in the plans), the Contractor shall verify the loss characteristics of the existing fiber. Any anomalies shall be reported to the Engineer.

Pre-Installation Tests
The fiber optic cable shall be inspected and tested at the site storage area prior to installation.

Proper fiber cladding and fiber tube colors shall be verified by visual inspection. Any difference discovered from approved fiber optic cable plant layout or approved catalogue cut sheets for the cable shall be grounds for rejection of the cable.

Each optical fiber in the cable shall be tested from one end with an OTDR compatible with wavelength and fiber type. Testing shall check for continuity, length, anomalies, and approximate attenuation at both 1310nm and 1550nm wavelengths. Each measurement shall be recorded with color, location and type of fiber measure. In the event that a meaningful measurement cannot be made from one end, it shall be performed from the opposite end of that fiber.
Post-Installation Tests

Pre-splice and Post-splice testing shall be performed as follows:

Pre-Splice Testing

After installation and prior to splicing or terminating each optical fiber in the cable shall be tested again for the loss characteristics at both 1310nm and 1550nm wavelengths. Both directions of operation of the fiber shall be tested.

Post-splice Testing

After each splice and connector installation, each optical fiber span including all black/spare fibers shall undergo the following tests after installation of all connectors and splices. A span is defined as a continuous length of fiber including all splices and connectors:

- Using an OTDR test each span at 1310 nm and 1550 for fiber attenuation, continuity, length, and anomalies. Each optical fiber shall meet the following acceptance criteria:
  - Attenuation: Not to exceed 0.4 dB/km + 0.1 dB/splice + 0.5 dB/connector. The number of splices and cable attenuation shall be based upon the approved cable plant layout.
  - Anomalies: No event shall exceed 0.3 dB. If any event is detected that value, the contractor shall repair or replace that section of cable.
- Using an optical source and a power meter measure the attenuation from both ends. The measured attenuation shall be meet the criteria defined for the attenuation using the OTDR.

All cable that fails to meet the aforementioned requirements shall be replaced.
The Contractor shall submit to the Engineer a tabulated list of fibers and the actual end-to-end measured values from the above tests and all traces and loss length printouts.

Each fiber shall be listed according to the color code and span. This test data shall be the basis of acceptance for the fiber.

For optical fibers spliced to existing fibers this test shall be repeated between the control center and the field termination after the new and existing fibers have been spliced together. If a fiber fails to meet the loss characteristics for the spliced section fiber, the Contractor shall determine whether the excessive loss is the result of an anomaly in the new section of fiber, splice or existing section of fiber. The Contractor will not be responsible for repairing the existing fiber. The Contractor shall, however, be responsible for the new section of fiber and the splice between the two sections.

METHOD OF MEASUREMENT:

The fiber optic cable will be measured for payment as the number of linear feet of each size actually furnished and installed in accordance with the contract documents.
BASIS OF PAYMENT:

The unit price bid per foot for Single Mode Fiber Optic Trunk Cable and Fiber Optic Drop Cable shall include the cost of furnishing all labor, material, tools and equipment and testing of the fiber optic cable to complete the work. The cost of furnishing and installing all passive components shall be incidental to and included in the pay item for fiber optic cable. All splicing, including set-up and individual terminations and connectors shall also be included in the pay item for fiber optic cable. All cable racks, snowshoes and other miscellaneous hardware necessary for slack cable storage shall also be included in the pay item for fiber optic cable.

Progress payment will be made as follows:

- Sixty percent of the bid price of the completed cable plant will be paid upon completion of installation and satisfactory completion of the post-installation tests.
- Twenty-five percent of the bid price will be paid upon satisfactory completion of all subsystem tests as described in the Special Provisions.
- Fifteen percent of the bid price will be paid upon satisfactory completion of Final System Acceptance.
ITEM 683.950 – SMALL FORM-FACTOR PLUGGABLE (SFP) TRANSCEIVERS – TYPE 1GB

ITEM 683.950 – SMALL FORM-FACTOR PLUGGABLE (SFP) TRANSCEIVERS – TYPE 10GB

DESCRIPTION
The Contractor shall furnish and install single mode, duplex, small form-factor pluggable modules SFP/SFP+ in the network equipment as shown in the contract documents. Any SFP/SFP+ module must be compatible with the switch model specified or that otherwise exists as part of the project. Unless noted elsewhere in the contract documents each SFP/SFP+ module provided shall include the appropriate fiber optic patch cable, factory terminated UPC with end connectors that match the connected equipment.

Distances between SFP/SFP+ module’s will be provided as part of the project plan in order for the contractor to be cost effective when specifying transceiver type.

MATERIALS
All material furnished, assembled, fabricated or installed shall be new, corrosion resistant and in strict accordance with all the details shown in the Contract Documents and in this Special Specification.

The type of SFP/SFP+ module’s necessary to fulfill these specification requirements are dependent on the SWITCH make and model that is currently in use at the Traffic Management Center or other facility. The Contractor will be required to obtain the existing equipment information prior to provisioning any module to ensure compatibility. This information can be obtained by contacting the local NYSDOT Traffic Center.

The following distances can vary based on transceiver manufacturer. Please verify that the proposed SFP/SFP+ modules meet the project distance requirements.

1-GB TRANSCEIVERS:
LX/LH – Shall be used where distances between transceivers is equal to or less than 10 km.
EX - Shall be used where distances between transceivers is greater than 10 km.
The LH shall fully comply with the IEEE 802.3z 1000BaseLX standard.

10-GB TRANSCEIVERS:
LR – Shall be used where distances between transceivers is equal to or less than 10 km.
ER - Shall be used where distances between transceivers is greater than 10 km.
ITEM 683.95060204 – SMALL FORM-FACTOR PLUGGABLE (SFP) TRANSCEIVERS – TYPE 1GB

CONSTRUCTION DETAILS
The Contractor shall install SFP modules in the equipment as designated in the plans. All cables shall be neatly routed within the equipment cabinet and each cable shall have a unique identification at each connection point with tags specifically designed for cable identification.

Documentation Requirements
The Contractor shall submit to the Engineer a copy of the manufacturers documentation for each type of SFP provided indicating its compatibility with the equipment it is being installed in.

The SFP documentation shall, as a minimum, include the following:

a. Make, model, and compatibility information with the existing or proposed equipment.

b. Complete installation and operation procedures for each SFP.

c. Complete performance specifications (functional, electrical, mechanical and environmental) of the unit.

Testing Requirements
After installation of the equipment in the field and prior to integration of the equipment into the system, the Contractor shall perform an Operational Test in the field for each of the SFP modules installed in each switch. The test shall demonstrate as a minimum the ability of the connected device to connect to each field device and transmit and receive Ethernet data between each of the field equipment and field hub or central as applicable.

If the Operational Test fails, the SFP shall be repaired, or replaced, and the test shall be rerun for that site. If a component has been modified as a result of a failure, that component shall be replaced in all like units and the test shall be rerun for each unit.

METHOD OF MEASUREMENT
The SFP will be measured for payment as the number of each specified in the Contract Documents satisfactorily installed and tested.

BASIS OF PAYMENT
The unit price bid for each SFP shall include the cost of furnishing all patch cables, labor, materials and tools and equipment necessary to complete the work and to make the networked components fully operational and tested.

Payment for all documentation, testing and test equipment shall be included under this item.
ITEM 685.20010004 - WHITE EPOXY TRAFFIC PAINT WITH WHITE WET-NIGHT REFLECTIVE ELEMENTS - 20 MILS (GROOVED PAVEMENT METHOD)
ITEM 685.21010004 - YELLOW EPOXY TRAFFIC PAINT WITH YELLOW WET-NIGHT REFLECTIVE ELEMENTS - 20 MILS (GROOVED PAVEMENT METHOD)

DESCRIPTION

Install grooves at locations where long-line pavement markings will be applied on asphalt or concrete pavements, at locations given in the contract documents and as directed by the Engineer, in accordance with this specification. Apply epoxy pavement markings within the grooves with a combination of wet-night reflective elements and standard glass beads in accordance to this specification, the contract documents, the MUTCD with the NYS supplement and as directed by the Engineer.

MATERIALS

- White and Yellow Epoxy Reflectorized §727-03
- Glass Beads for Pavement Markings §727-05

Wet-Night Reflective Elements:
Meeting the following requirements:
- Composed of highly reflective particles having a structural center core surrounded by high refractive index microcrystalline ceramic beads or glass spheres consisting of standard glass beads and wet/night visibility beads, providing wet-night and dry retro-reflectivity
- Refractive index of 1.9 minimum
- Designed to be applied to epoxy pavement marking paint
- Be either clear or yellow tinted as required
- Minimum 300 mcd/m²/lux when tested in accordance with ASTM E2177 Bucket method, test method for measuring wet recovery under standard conditions.
- Appearance in Table 1, below or approved equal:

<table>
<thead>
<tr>
<th>TABLE 1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Product Name</strong></td>
</tr>
<tr>
<td>3M Series 70E - White</td>
</tr>
<tr>
<td>3M Series 71E - Yellow</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>VisiMax – White</td>
</tr>
<tr>
<td>VisiMax - Yellow</td>
</tr>
</tbody>
</table>

Packaging and Shipment. Shipped and packaged in accordance with commercially accepted standards. Clearly display the name of the product, the name and address of the manufacturer, the quantity of material, the date of manufacture, and the date of expiration or the shelf life, on each container or on the shipping invoice.
ITEM 685.2010004 - WHITE EPOXY TRAFFIC PAINT WITH WHITE WET-NIGHT REFLECTIVE ELEMENTS - 20 MILS (GROOVED PAVEMENT METHOD)

ITEM 685.21010004 - YELLOW EPOXY TRAFFIC PAINT WITH YELLOW WET-NIGHT REFLECTIVE ELEMENTS - 20 MILS (GROOVED PAVEMENT METHOD)

Basis of Approval. Approvals will be based upon independent lab analysis and field testing in accordance to this specification. Submit independent lab analysis to Director of Materials and arrange for field testing through the Materials Bureau. If the product passes the requirements of this specification, it will be added to the Table above.

Basis of Acceptance. Wet-Night Reflective Elements will be accepted based on the products appearance on the Table 1, above and the manufacturer’s certification that the product meets the requirements of this specification.

Grooving Equipment:
Meeting the following minimum requirements:
- Free-floating cutting or grinding head providing a consistent groove depth over irregular pavement surfaces.
- Diamond blades or heads only.
- Capable of producing a final pavement surface that has perpendicular vertical sides and a smooth, flat bottom free of ridges

Epoxy Paint Application Equipment: Meeting the requirements of §685-3.04 in addition to the following:
- Equipped with individual tanks for the storage of Standard Glass beads for epoxy paint and Wet-Night Reflective Elements.
- Equipped with Individual dispensers for the simultaneous application of Standard Glass Beads for epoxy paint and Wet-Night Reflective Elements.
- Each dispenser capable of applying beads/elements at a minimum rate of 10 lbs/gal of epoxy resin composition.

Supply the Engineer with two accurate, easily readable gauges with which to verify groove depth. Provide the gauges no less than one week prior to the anticipated beginning of the grooving operation. Include the manufacturer’s instructions for the gauges use, if such instructions are necessary for proper understanding of the gauge’s function.

CONSTRUCTION DETAILS

General
Before any pavement marking work is begun, submit a schedule of operations for approval by the Engineer. At least five (5) days prior to the start or work, provide the Engineer with the manufacturer's written instructions for:
- Grinding pavement
- Applying epoxy paint with wet-night reflective elements including but not be limited to, material mixing ratios, application rates and temperatures.

Provide and retain an on site manufacturer’s representative to provide guidance regarding the grooving equipment, construction methods, and oversight of wet-night reflective elements...
application. Retain the services of the manufacturer’s representative until release by the Engineer.

When grinding and pavement markings operations are carried out under traffic, provide all necessary flags, markers, signs, etc. in accordance with the MUTCD to maintain and protect traffic, and to protect marking operations and the markings until thoroughly set as per manufacturer’s procedures.

**Grooving Operation**
Do not grind grooves over longitudinal pavement joints. Locate the grooves at least 4 to 5 inches away from longitudinal pavement joints when possible.

Install grooves in such a manner as to prevent damage to the surrounding pavement and pavement joints. Repair all damaged pavement surfaces that result from improper installation, or installation of grooves in unauthorized areas. Remove and repair damaged pavement surfaces to meet the pavement condition prior to grinding areas at no additional cost to the State. Groove edge lines, skip lines and double center lines at the locations specified in the contract documents.

Install a groove of the following dimensions, into the pavement:
- Groove Width: Pavement Marking Width plus 1 inch.
- 5 inches width for 4 inch markings
- 7 inches width for 6 inch markings
- Depth: 0.080 inch ± 0.020 inch

Grind segments in broken lines and dotted lines to provide the specified depth along the entire specified length of the marking.

Conduct pavement cutting operations and pavement cleaning work in such a manner as to minimize airborne dust and similar debris and prevent a hazard to workers, motor vehicle operation, or nuisance to property.

Verify the specified groove depth at the start of the grooving operation and periodically throughout the operation. Regrind areas where any groove depth measurement does not meet the minimum specified depth. Repair grooves that exceed the specified maximum to the satisfaction of the Engineer, at no additional cost to the State. This may include relaying a full width section of pavement as deemed necessary by the Engineer.

When necessary, establish marking line points at thirty (30) foot intervals throughout the length of the pavement or as directed by the Engineer.

**Wet Saw Blade Operation:**
When water is used to cool the saw blades, flush the groove with high pressure water immediately following the cut to avoid build-up and hardening of the slurry in the groove.
ITEM 685.2010004 - WHITE EPOXY TRAFFIC PAINT WITH WHITE WET-NIGHT REFLECTIVE ELEMENTS - 20 MILS (GROOVED PAVEMENT METHOD)

ITEM 685.21010004 - YELLOW EPOXY TRAFFIC PAINT WITH YELLOW WET-NIGHT REFLECTIVE ELEMENTS - 20 MILS (GROOVED PAVEMENT METHOD)

Allow the surface to dry, to satisfaction of the Engineer, before application of any pavement markings. If the Engineer determines that the groove surfaces have become contaminated during the dry time, it must be cleaned again as per this specification.

Dry Saw Blade Operation:
After grooving with dry saw blades, immediately vacuum all debris and dust from the recess. Collect all debris resulting from the pavement cutting operation, by vacuuming the pavement cut and adjacent pavement surface.

Disposal of Waste Material:
Remove and collect debris resulting from the grooving/grinding operation prior to opening the roadway to traffic and prior to the application of a surface preparation adhesive. Dispose of collected debris in accordance with §107-10 Managing Surplus Material and Waste.

Allow the surface to dry before application of any pavement markings when using water or other lubricants for grinding or cleaning the grooves, allow the surface to dry to the satisfaction of the Engineer before application of any pavement markings. If the Engineer determines that the groove surfaces become contaminated during the dry time, it must be cleaned again as per this specification.

Epoxy Paint Application
Prepare surfaces and apply epoxy paint in accordance to §685 and this specification.

Atmospheric Conditions: In accordance to §685-3.02.

Surface Preparation: In accordance to §685-3.03 and this specification.

Clean the groove by air blasting to remove all loose residue. Include power brooming or manual brooming, if necessary, to remove all loose residue from the groove. Make sure all pavement surfaces are free of oil, dirt, dust, grease, salt, and similar foreign materials at the time of application. The cost of cleaning these contaminants is included in the bid price of this item. If water blasting is used, allow the surface to thoroughly dry to the satisfaction of the Engineer, before application of any epoxy paint.

Application of Epoxy Reflectorized Pavement Markings: In accordance to §685-3.05 and this specification.

Apply the epoxy reflectorized pavement markings within the grooves as centered as possible, at the width, thickness, and pattern designated in the Contract Documents. Do not begin marking operations until applicable surface preparation work is completed and approved by the Engineer, and the atmospheric conditions are acceptable to the Engineer.
ITEM 685.20010004 - WHITE EPOXY TRAFFIC PAINT WITH WHITE WET-NIGHT REFLECTIVE ELEMENTS - 20 MILS (GROOVED PAVEMENT METHOD)

ITEM 685.21010004 - YELLOW EPOXY TRAFFIC PAINT WITH YELLOW WET-NIGHT REFLECTIVE ELEMENTS - 20 MILS (GROOVED PAVEMENT METHOD)

- Apply standard glass beads for epoxy paint at a rate of 10 pounds per gallon and wet-night reflective elements at a rate based on the manufacturer’s recommendations (10 pounds per gallon minimum), to the hot epoxy paint using a double drop system.

Defective Epoxy Pavement Markings
Repair defective markings, as determined by the Engineer and at no additional cost to the State, in accordance to §685-3.06.

METHOD OF MEASUREMENT

The Engineer will measure the length in feet of grooves satisfactorily installed. The Engineer will measure grooves with a plan width greater than the standard 4 in. using the following method:

\[
\text{Plan Width of Groove (inches) } \times \text{ Feet} \div 4 \text{ inches}
\]

Epoxy paint striping will be measured in feet along the centerline of the pavement stripe and will be based on a 4-in wide stripe. Measurement for striping with a width greater than the basic 4 inches, as shown on the plans or directed by the Engineer will be made by the following method:

\[
\text{Plan Width of Stripe (inches) } \times \text{ Feet} \div 4 \text{ inches}
\]

BASIS OF PAYMENT
The unit bid price, shall include all labor, materials, and equipment to complete the work including the cost of grooving, cleaning and waste disposal associated with the preparation, installation and application of epoxy paint with standard glass beads and wet-night reflective elements.
ITEM 800.01000015 – DESIGN BUILD – DESIGN SERVICES

DESCRIPTION. This work shall consist of providing design services in accordance with the contract documents.

MATERIALS. None Specified.

CONSTRUCTION DETAILS. The Design Builder shall provide Design Services by the appropriately qualified and licensed personnel in accordance with the requirements in the contract documents.

METHOD OF MEASUREMENT. Design Build - Design Services will be measured for payment on a lump sum basis.

BASIS OF PAYMENT. The lump sum price bid for Design Build - Design Services shall include the cost of furnishing all labor, equipment and incidentals to satisfactorily complete the work. Progress payments will be made in accordance with the contract documents.
ITEM 800.02000015 – DESIGN BUILD – CONSTRUCTION INSPECTION SERVICES

**DESCRIPTION.**  This work shall consist of providing Construction Inspection Services in accordance with the contract documents.

**MATERIALS.**  None Specified.

**CONSTRUCTION DETAILS.**  The Design Builder shall provide Construction Inspection Services by the appropriately qualified and licensed personnel in accordance with the requirements in the contract documents.

**METHOD OF MEASUREMENT.**  Design Build - Construction Inspection Services will be measured for payment on a lump sum basis.

**BASIS OF PAYMENT.**  The lump sum price bid for Design Build - Construction Inspection Services shall include the cost of furnishing all labor, equipment and incidentals to satisfactorily complete the work. Progress payments will be made in accordance with the contract documents.
ITEM 800.03000015 – DESIGN BUILD – QUALITY CONTROL SERVICES

DESCRIPTION. This work shall consist of providing Quality Control Services in accordance with the contract documents.

MATERIALS. None Specified.

CONSTRUCTION DETAILS. The Design Builder shall provide Quality Control Services by the appropriately qualified and licensed personnel in accordance with the requirements in the contract documents.

METHOD OF MEASUREMENT. Design Build - Quality Control Services will be measured for payment on a lump sum basis.

BASIS OF PAYMENT. The lump sum price bid for Design Build - Quality Control Services shall include the cost of furnishing all labor, equipment and incidentals to satisfactorily complete the work. Progress payments will be made in accordance with the contract documents.
DESCRIPTION. This work shall consist of performing construction work in accordance with the contract documents and as directed by the Engineer.

MATERIALS. None Specified.

CONSTRUCTION DETAILS. The Design Builder shall perform construction work in accordance with the contract documents as directed by the Engineer. The Design Builder will maintain and provide agreed price or force account records to document the costs in accordance with DB section 109-9.

METHOD OF MEASUREMENT. Design Build – Force Account Work will be measured for payment on a Dollar Cents basis.

BASIS OF PAYMENT. The price shown for Design Build - Force Account Work shall include the cost of furnishing all labor, materials, equipment and incidentals to satisfactorily complete the work. The total cost shown in the itemized proposal will be considered the price bid even though payment will be made only for actual work performed. The unit price amount is not to be altered in any manner by the bidder. Should the bidder alter the amount shown, the altered figure will be disregarded, and the original price will be used to determine the total amount bid for the contract.

Progress payments will be made in accordance with the contract documents.
ITEM 800.05000015 – DESIGN BUILD – SITE MOBILIZATION

**DESCRIPTION.** This work shall consist of providing necessary bonds, insurance, prefinancing and set up of necessary general plant, including shops, storage areas, office and such sanitary and other facilities as are required by local or state law or regulation.

**MATERIALS.** None Specified.

**CONSTRUCTION DETAILS.** The Design Builder shall provide the above facilities and service for mobilization in a safe and workmanlike manner in conformance with any pertinent local or State Law, regulation or code to the extent and at the time the Contractor deems them necessary for its operations. Good housekeeping shall be maintained.

**METHOD OF MEASUREMENT.** Design Build – Site Mobilization will be measured for payment on a lump sum basis.

**BASIS OF PAYMENT.** The lump sum price bid for Design Build – Site Mobilization shall not exceed four percent (4%) of the total contract bid price for all Construction Work items. Should the bidder exceed the foregoing four percent (4%), the Department will make the necessary adjustment to determine the total amount bid based on the arithmetically correct proposal.

Progress payments in the amount of 4% of the construction work items will be made to the Contractor with the first contract payment made for other contract work at the individual itemized work site.
ITEM 800.0600NN15 – DESIGN BUILD – CONSTRUCTION WORK

DESCRIPTION. This work shall consist of construction work in accordance with the contract documents.

MATERIALS. None Specified.

CONSTRUCTION DETAILS. The Design Builder shall perform all construction work in accordance with the requirements in the contract documents.

METHOD OF MEASUREMENT. Design Build – Construction Work will be measured for payment on a lump sum basis for each location. The individual locations are identified in the contract documents.

BASIS OF PAYMENT. The lump sum price bid for Design Build – Construction Work shall include the cost of furnishing all labor, materials, equipment, management and supervision to satisfactorily complete the work. Progress payments will be made for each construction work location in accordance with the contract documents.

Note: NN in pay item number denotes serialization by location.