

FOR INFORMATIONAL PURPOSES ONLY - DO NOT USE FOR BIDDING

Department of Public Works Nassau County, N.Y.
Bid Sheets for Contract: H66309-01G

Nassau County DPW

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H66309-01G

Item No.	Engineers Estimate	Unit	Item Description			
1S	1	EA	Job Information Sign	For:		
1M	1	LS	Mobilization	For:		
1A*	1	LS	Utility Connection (Force)	For:	Contingent \$100,000.00	
2	49286	CY	Unclassified Excavation	For:		
3	1169	CY	Trench, Culvert and Bridge Excavation	For:		
5D	22873	CY	Selected Granular Fill	For:		
7	43146	SY	Preparing Fine Grade	For:		
9	487	CY	Topsoil	For:		
10A	2200	SF	Temporary Sheet piling and Bracing	For:		
10A-1	600	SF	Excavation Protection System	For:		
12P-15	2463	LF	Smooth Interior Corrugated Polyethylene Drainage Pipe - 15"	For:		
12H	820	LF	Cleaning Existing Drainage System	For:		
13A MOD	10	CY	Catch Basins	For:		
13C	8	EA	Area Drain	For:		
14	27	EA	Connections to Existing Drainage Facilities	For:		
16SS-3	9	EA	Change Elevations of Drain Manholes and Drop Inlets - Minor Adjustments	For:		
16SS-4	2	EA	Change Elevations of Drain Manholes and Drop Inlets - Major Adjustments	For:		

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Item No.	Engineers Estimate	Unit	Item Description			
17A	28	CY	Class A Concrete For Structures	For:		
19	3979	CY	Screened Gravel, Loose Measure	For:		
22C-2	98	TON	Base Course Asphalt Concrete - Type Dense Base	For:		
24	69	CY	Cement Concrete Pavement	For:		
24V	3	CY	Concrete Valley Gutter	For:		
26	5456	LF	Concrete Curb	For:		
26F	616	LF	Concrete Curb - Type Flush	For:		
26SP-D	1495	LF	Concrete Curb - Mountable	For:		
27	26546	SF	Cement Concrete Sidewalk	For:		
27DW	649	SF	Detectable Warning Surface	For:		
28	857	SF	Cement Concrete Driveways and Driveway Aprons	For:		
33	48	LB	Bar Reinforcement for Structures	For:		
34	1000	LB	Miscellaneous Metals	For:		
36C	78	TON	Asphalt Concrete Truing and Leveling Course - TYPE 1A (Top & Binder)	For:		
36D	9668	TON	Asphalt Concrete Top & Binder - TYPE 1A (Top and Binder)	For:		
58A	856	LF	Saw Cutting Existing Non-Roadway Asphalt	For:		
58RPC	393	LF	Saw Cutting Existing Roadway Pavement & Concrete	For:		

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Item No.	Engineers Estimate	Unit	Item Description			
99-12 MOD	1007	LF	Precast Concrete Leaching Basin - 12' Diameter	For:		
102	1	LS	Work Zone Traffic Control	For:		
102D	194	DAY	Flashing Arrow Board	For:		
102PVMS	194	DAY	Portable Variable Message Sign	For:		
116A	5515	SY	Profiling and Removal of Asphalt Pavement	For:		
122	9	EA	Test Holes	For:		
133X	1	LS	Clean and Fill Joints and Cracks	For:		
136S	4	DAY	Survey Stakeout (PER DAY)	For:		
141	3983	LF	Silt Fence	For:		
141B	19	EA	Silt Protection for Surface Inlet Drainage Structures	For:		
141C	5	EA	Silt Protection for Curb Inlet Drainage Structures	For:		
158A	77010	SF	Geotextile Cloth	For:		
175	45993	SY	Stabilized Mix-In-Place Recycled Base Course	For:		
175AE	1106	GAL	Asphalt Emulsion	For:		
199*	1	LS	Interim Payments (Force)	For:	\$180,000.00	
199A*	1	LS	Asphalt Price Adjustment (Force)	For:	\$20,000.00	
260	1	LS	ELECTRICAL	For:		

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Item No.	Engineers Estimate	Unit	Item Description			
323	812	LF	2'-6" WROUGHT IRON FENCE	For:		
329	17063	SF	LANDSCAPE ISLANDS PLANTING WORK	For:		
362	122	CY	Triple Shredded Mulch	For:		
364-C	8	EA	Tree Pruning (12" to <24" Caliper)	For:		
364-E	1	EA	Tree Pruning (36" to <48" Caliper)	For:		
368	451	SY	Topsoil and Grass Seed	For:		
372-A	9	EA	TREE REMOVAL -A- (<6" Caliper)	For:		
372-B	7	EA	TREE REMOVAL -B- (6" - <12" Caliper)	For:		
377	17	EA	Temporary Tree and Plant Protection	For:		
442W	16700	LF	Epoxy Reflectorized Pavement Markings (WHITE)	For:		
442W-1	1670	LF	Epoxy Reflectorized Pavement Markings - HAND WORK (WHITE)	For:		
442Y	2500	LF	Epoxy Reflectorized Pavement Markings (Yellow)	For:		
442Y-1	250	LF	Epoxy Reflectorized Pavement Markings - HAND WORK (Yellow)	For:		
450	161	EA	Furnish and Install Post Mounted Signs	For:		
451	38	EA	Furnish and Install Post Mounted Handicap Parking Signs	For:		
570	280	LF	METAL (FENCING & RAILING)	For:		
639.210053	1	LS	CPM (Critical Path Method) Schedule with Monthly Update (MIN BID \$15,000.00)	For:		

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Item No.	Engineers Estimate	Unit	Item Description			
762	141	LBS	Integral Color Pigment for Concrete	For:		
763	506	SF	Imprinting on Concrete Pavement or Sidewalk	For:		

*Force Bid

MINIMUM BID PRICE ITEMS

CERTAIN PAY ITEMS IN THE ITEMIZED PROPOSAL REQUIRE BIDS AT OR ABOVE THE PUBLISHED MINIMUM PRICE. THESE ITEMS AND RESPECTIVE MINIMUM BID PRICES ALLOWED ARE SHOWN BELOW. IF A BID IS ENTERED BELOW THE PUBLISHED MINIMUM PRICE SHOWN, THE AMOUNT BID FOR SUCH ITEM WILL BE RAISED BY THE DEPARTMENT TO THE PUBLISHED MINIMUM PRICE.

ITEM NUMBER	DESCRIPTION	UNIT	MINIMUM UNIT BID PRICE
639.210053	CPM (CRITICAL PATH METHOD) SCHEDULE WITH MONTHLY UPDATE	LS	\$ 15,000.00

ITEM 1A UTILITY CONNECTION

1. **DESCRIPTION**

Under this allowance item the Contractor shall be reimbursed for additional work not specified in the plans associated with water and/or electrical connections. Work shall be coordinated and approved by the owner's representative prior to starting.

The provisions in items 3, 59, 60, 61s, 62, and 260 shall apply.

2. **MATERIALS**

The provisions in items 3, 59, 60, 61s, 62, and 260 shall apply.

3. **CONSTRUCTION DETAILS**

The provisions in items 3, 59, 60, 61s, 62, and 260 shall apply.

4. **METHOD OF MEASUREMENT AND BASIS OF PAYMENT**

The work shall be measured for payment on a lump sum basis for work satisfactorily completed in accordance with the Contract documents and as directed by the Owners Representative. Monthly payments will be made in proportion to the amount of work performed under this item as determined by the Engineer.

END OF SECTION

COUNTY OF NASSAU
DEPARTEMENT OF PUBLIC WORKS
**ITEM 99- 12 MOD- MODIFIED PRECAST CONCRETE LEACHING BASIN 12'
DIAMETER**

1. DESCRIPTION

All provisions of the item 99-10 shall apply.

2. MATERIAL

All provisions of the item 99-10 shall apply.

3. METHOD

All provisions of the item 99-10 shall apply.

4. METHOD OF MEASUREMENT

All provisions of the item 99-10 shall apply.

5. METHOD OF MEASUREMENT

The unit price bid for lineal foot for this item shall include the cost of furnishing all labor, materials, tools, equipment and incidentals including reinforcement and concrete block necessary to satisfactorily complete the required work. Metal frames, grates, covers and step irons furnished and installed in the work will be paid for under the item Miscellaneous Metals. Excavation shall be paid under Item 2 – Unclassified Excavation. Backfill shall be paid under Item 5D – Selected Granular Fill. Collar Material for all drywells shall be paid for under Item 19 – Screened Gravel, Loose Measure.

END OF SECTION

99-12-1

ITEM 133X – CLEANING AND FILLING JOINTS AND CRACKS

1. **DESCRIPTION**

Under this allowance item the Contractor shall perform cleaning and sealing of transverse and longitudinal joints in concrete pavement as ordered by the Engineer.

2. **MATERIAL**

All provisions of the items 133A and 133B shall apply.

3. **METHOD**

All provisions of the items 133A and 133B shall apply.

4. **METHOD OF MEASUREMENT AND BASIS FOR PAYMENT**

The work shall be measured for payment on a lump sum basis for work satisfactorily completed in accordance with the Contract documents and as directed by the Owners Representative. Monthly payments will be made in proportion to the amount of work performed under this item as determined by the Engineer.

END OF SECTION

ITEM 136S SURVEY STAKEOUT (USE PER DAY)

1. **DESCRIPTION**

All provisions of the item 136 shall apply.

2. **MATERIALS**

All provisions of the item 136 shall apply.

3. **CONSTRUCTION DETAILS**

All provisions of the item 136 shall apply.

4. **METHOD OF MEASUREMENT AND BASIS OF PAYMENT**

The quantity to be paid under this item will be the number of days that the Survey Stakeout is being performed. The unit price shall include the cost of furnishing all labor, equipment, instruments, materials and other incidentals necessary to satisfactorily complete the required project including but not limited to surveying, stakeout and retie of the control points. Monthly payments will be made in proportion to the amount of work performed under this item as determined by the Engineer.

END OF SECTION

1. DESCRIPTION

Under this item the provisions of Item No. Section 260519, Item No. Section 260523, Item No. Section 260526, Item No. Section 260533, Item No. Section 260543, and Item No. Section 260553 shall apply

2. MATERIALS

Under this item the provisions of Item No. Section 260519, Item No. Section 260523, Item No. Section 260526, Item No. Section 260533, Item No. Section 260543, and Item No. Section 260553 shall apply

3. METHOD

Under this item the provisions of Item No. Section 260519, Item No. Section 260523, Item No. Section 260526, Item No. Section 260533, Item No. Section 260543, and Item No. Section 260553 shall apply

4. METHOD OF MEASUREMENT AND BASIS FOR PAYMENT

The work shall be measured for payment on a lump sum basis for work satisfactorily completed in accordance with the Contract documents and as directed by the Owners Representative. Monthly payments will be made in proportion to the amount of work performed under this item as determined by the Engineer.

END OF SECTION

**ITEM NO. SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER
CONDUCTORS AND CABLES**

1. DESCRIPTION

1.1 SUMMARY

A. Section Includes:

1. Copper building wire rated 600 V or less.
2. Connectors, splices, and terminations rated 600 V and less.

1.2 ACTION SUBMITTALS

- A. Product Data:** For each type of product.
- B. Product Schedule:** Indicate type, use, location, and termination locations.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.**

2. MATERIALS

2.1 COPPER BUILDING WIRE

- A. Description:** Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.
- B. Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
1. Belden Inc.
 2. Cerro Wire LLC.
 3. General Cable; Prysmian Group North America.
 4. Southwire Company.
 5. WESCO.
- C. Standards:**
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
 2. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

**ITEM NO. SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER
CONDUCTORS AND CABLES**

- D. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.
- E. Conductor Insulation:
 - 1. Type THHN and Type THWN-2: Comply with UL 83.
 - 2. Type THW and Type THW-2: Comply with NEMA WC-70/ICEA S-95-658 and UL 83.

2.2 CONNECTORS AND SPLICES

- A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. 3M Electrical Products.
 - 2. Hubbell Incorporated, Power Systems.
 - 3. Ideal Industries, Inc.
 - 4. ILSCO.
 - 5. O-Z/Gedney; Emerson Electric Co., Automation Solutions, Appleton Group.
- C. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.
- D. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.
 - 1. Material: Copper.
 - 2. Type: One hole with standard barrels.
 - 3. Termination: Compression.

3. METHOD

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

**ITEM NO. SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER
CONDUCTORS AND CABLES**

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway.
- B. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.
- C. Exposed Branch Circuits, Including in Crawlspace: Type THHN/THWN-2, single conductors in raceway.
- D. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.5 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

**ITEM NO. SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER
CONDUCTORS AND CABLES**

- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 FIELD QUALITY CONTROL

- A. Perform tests and inspections.

- 1. Perform each of the following visual and electrical tests:

- a. Inspect exposed sections of conductor and cable for physical damage and correct connection according to the single-line diagram.
 - b. Test bolted connections for high resistance using one of the following:
 - 1) A low-resistance ohmmeter.
 - 2) Calibrated torque wrench.
 - 3) Thermographic survey.
 - c. Inspect compression-applied connectors for correct cable match and indentation.
 - d. Inspect for correct identification.
 - e. Inspect cable jacket and condition.
 - f. Continuity test on each conductor and cable.
 - g. Uniform resistance of parallel conductors.

- B. Cables will be considered defective if they do not pass tests and inspections.

- C. Prepare test and inspection reports to record the following:

- 1. Procedures used.
 - 2. Results that comply with requirements.
 - 3. Results that do not comply with requirements, and corrective action taken to achieve compliance with requirements.

END OF SECTION

ITEM NO. SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

1. DESCRIPTION

1.1 SUMMARY

- A. Section includes grounding and bonding systems and equipment.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

2. MATERIALS

2.1 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

2.2 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Burndy; Hubbell Incorporated, Construction and Energy.
 - 2. ILSCO.
 - 3. O-Z/Gedney; Emerson Electric Co., Automation Solutions, Appleton Group.
 - 4. Siemens Industry, Inc., Energy Management Division.

2.3 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:

ITEM NO. SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

1. Solid Conductors: ASTM B3.
2. Stranded Conductors: ASTM B8.

2.4 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Conduit Hubs: Mechanical type, terminal with threaded hub.

3. METHOD

3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- B. Grounding Conductors: Green-colored insulation with continuous yellow stripe.
- C. Conductor Terminations and Connections:
 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
 3. Connections to Structural Steel: Welded connectors.

3.2 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
 1. Feeders and branch circuits.
 2. Receptacle circuits.

3.3 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

ITEM NO. SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

- B. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.
 - 1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
 - 2. Make connections with clean, bare metal at points of contact.

3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
 - 2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
- C. Grounding system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.
- E. Report measured ground resistances that exceed the following values:
 - 1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 25 ohms.
- F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION

ITEM NO. SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

1. DESCRIPTION

1.1 SUMMARY

A. Section Includes:

1. Metal conduits and fittings.
2. Nonmetallic conduits and fittings.
3. Handholes and boxes for exterior underground cabling.

1.2 DEFINITIONS

A. GRC: Galvanized rigid steel conduit.

1.3 ACTION SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, hinged-cover enclosures.

2. MATERIALS

2.1 METAL CONDUITS AND FITTINGS

A. Metal Conduit:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Allied Tube & Conduit; Atkore International.
 - b. O-Z/Gedney; Emerson Electric Co., Automation Solutions, Appleton Group.
 - c. Western Tube; Zekelman Industries.
 - d. Wheatland Tube; Zekelman Industries.
2. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
3. GRC: Comply with ANSI C80.1 and UL 6.
4. EMT: Comply with ANSI C80.3 and UL 797.
5. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

ITEM NO. SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

B. Metal Fittings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Allied Tube & Conduit; Atkore International.
 - b. Electri-Flex Company.
 - c. O-Z/Gedney; Emerson Electric Co., Automation Solutions, Appleton Group.
 - d. Wheatland Tube; Zekelman Industries.
2. Comply with NEMA FB 1 and UL 514B.
3. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
4. Fittings, General: Listed and labeled for type of conduit, location, and use.
5. Fittings for EMT:
 - a. Material: Steel.
 - b. Type: compression.
6. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.

- C. Joint Compound for GRC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS AND FITTINGS

A. Nonmetallic Conduit:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Cantex Inc.
 - b. CertainTeed Corporation; Saint-Gobain North America.
 - c. Raco Taymac Bell; Hubbell Incorporated, Commercial and Industrial.
2. Listing and Labeling: Nonmetallic conduit shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
3. Fiberglass:
 - a. Comply with NEMA TC 14.
 - b. Comply with UL 2515 for aboveground raceways.

ITEM NO. SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

- c. Comply with UL 2420 for belowground raceways.
4. RNC: Type EPC-80-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

B. Nonmetallic Fittings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Cantex Inc.
 - b. CertainTeed Corporation; Saint-Gobain North America.
 - c. Raco Taymac Bell; Hubbell Incorporated, Commercial and Industrial.
2. Fittings, General: Listed and labeled for type of conduit, location, and use.
3. Fittings for RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
4. Solvents and Adhesives: As recommended by conduit manufacturer.

2.3 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. General Requirements for Handholes and Boxes:

1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Armorcast Products Company.
 - b. Oldcastle Infrastructure Inc.; CRH Americas.
 - c. Quazite; Hubbell Incorporated, Power Systems.
2. Standard: Comply with SCTE 77.
3. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
4. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.

ITEM NO. SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

6. Cover Legend: Molded lettering, "ELECTRIC."
7. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

2.4 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

- A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
 1. Tests of materials shall be performed by an independent testing agency.
 2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
 3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012 and traceable to NIST standards.

3. METHOD

3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
 1. Exposed Conduit: GRC.
 2. Concealed Conduit, Aboveground: GRC.
 3. Underground Conduit: RNC, Type EPC-80-PVC,.
 4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
 5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
- B. Minimum Raceway Size: 3/4-inch trade size.
- C. Raceway Fittings: Compatible with raceways and suitable for use and location.
 1. Rigid Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
 2. EMT: Use compression, steel fittings. Comply with NEMA FB 2.10.
 3. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

3.2 INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter.

ITEM NO. SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

- B. Complete raceway installation before starting conductor installation.
- C. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- D. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.
- E. Make bends in raceway using large-radius preformed ells. Field bending shall be according to NFPA 70 minimum radii requirements. Use only equipment specifically designed for material and size involved.
- F. Support conduit within 12 inches of enclosures to which attached.
- G. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- H. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- I. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
- J. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- K. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- L. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- M. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- N. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.

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- O. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 2. Where an underground service raceway enters a building or structure.
 3. Conduit extending from interior to exterior of building.
 4. Where otherwise required by NFPA 70.
- P. Comply with manufacturer's written instructions for solvent welding RNC and fittings.
- Q. Expansion-Joint Fittings:
1. Install in each run of aboveground RMC conduit that is located where environmental temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet.
 2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
 - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
 - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
 - c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
 3. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
 4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
 5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
- R. Liquid-tight Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 36 inches of flexible conduit for luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
- S. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to top of box unless otherwise indicated.
- T. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

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- U. Locate boxes so that cover or plate will not span different building finishes.
- V. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
- W. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as detailed.
2. Install backfill and compact.
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction.
4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete for a minimum of 12 inches on each side of the coupling.
 - b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.
6. Underground Warning Tape: Comply with requirements in Section 260553 "Identification for Electrical Systems."

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

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- C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.
- D. Install handholes with bottom below frost line, below grade.
- E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables but short enough to preserve adequate working clearances in enclosure.
- F. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

END OF SECTION

ITEM NO. SECTION 260543 - UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

1. DESCRIPTION

1.1 SUMMARY

A. Section Includes:

1. Metal conduits and fittings, including GRC and PVC-coated steel conduit.
2. Rigid nonmetallic duct.
3. Duct accessories.
4. Precast concrete handholes.
5. Polymer concrete handholes and boxes with polymer concrete cover.
6. Fiberglass handholes and boxes with polymer concrete cover.
7. Fiberglass handholes and boxes.

1.2 DEFINITIONS

- A. Direct Buried: Duct or a duct bank that is buried in the ground, without any additional casing materials such as concrete.
- B. Duct: A single duct or multiple ducts. Duct may be either installed singly or as component of a duct bank.
- C. GRC: Galvanized rigid (steel) conduit.
- D. Trafficways: Locations where vehicular or pedestrian traffic is a normal course of events.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include duct-bank materials, including spacers and miscellaneous components.
2. Include duct, conduits, and their accessories, including elbows, end bells, bends, fittings, and solvent cement.
3. Include accessories for handholes and boxes.
4. Include underground-line warning tape.

B. Shop Drawings:

1. Factory-Fabricated Handholes and Boxes Other Than Precast Concrete:
 - a. Include dimensioned plans, sections, and elevations, and fabrication and installation details.
 - b. Include duct entry provisions, including locations and duct sizes.
 - c. Include cover design.

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- d. Include grounding details.
- e. Include dimensioned locations of cable rack inserts, and pulling-in and lifting irons.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: For duct and duct bank. Show duct profiles and coordination with other utilities and underground structures.
 - 1. Include plans and sections, drawn to scale, and show bends and locations of expansion fittings.
 - 2. Drawings shall be signed and sealed by a qualified professional engineer.
- B. Qualification Data: For professional engineer and testing agency responsible for testing nonconcrete handholes and boxes.
- C. Product Certificates: For concrete and steel used in precast concrete handholes, as required by ASTM C858.
- D. Source quality-control reports.
- E. Field quality-control reports.

1.5 MAINTENANCE MATERIALS SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.

1.7 FIELD CONDITIONS

- A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions, and then only after arranging to provide temporary electrical service according to requirements indicated:
 - 1. Notify Construction Manager no fewer than 7 days in advance of proposed interruption of electrical service.
 - 2. Do not proceed with interruption of electrical service without Construction Manager's written permission.

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2. MATERIALS

2.1 METAL CONDUIT AND FITTINGS

- A. GRC: Comply with ANSI C80.1 and UL 6.
- B. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.

2.2 RIGID NONMETALLIC DUCT

- A. Underground Plastic Utilities Duct: Type EPC-80-PVC RNC, complying with NEMA TC 2 and UL 651, with matching fittings complying with NEMA TC 3 by same manufacturer as duct.
- B. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.

2.3 FLEXIBLE NONMETALLIC DUCTS

- A. HDPE Duct: Type EPEC-80 HDPE, complying with NEMA TC 7 and UL 651A.
 - 1. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.

2.4 DUCT ACCESSORIES

- A. Duct Spacers: Factory-fabricated, rigid, PVC interlocking spacers; sized for type and size of duct with which used, and selected to provide minimum duct spacing indicated while supporting duct during concreting or backfilling.
- B. Underground-Line Warning Tape: Comply with requirements for underground-line warning tape specified in Section 260553 "Identification for Electrical Systems."

2.5 PRECAST CONCRETE HANDHOLES AND BOXES

- A. Description: Factory-fabricated, reinforced-concrete, monolithically poured walls and bottom unless open-bottom enclosures are indicated. Frame and cover shall form top of enclosure and shall have load rating consistent with that of handhole or box.
- B. Comply with ASTM C858 for design and manufacturing processes.
- C. Frame and Cover: Weatherproof cast-iron frame, with cast-iron cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.

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- D. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
- E. Cover Legend: Molded lettering, "ELECTRIC."
- F. Configuration: Units shall be designed for flush burial and have open bottom unless otherwise indicated.
- G. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the installation location with the ground-water level at grade.
- H. Knockout Panels: Precast openings in walls, arranged to match dimensions and elevations of approaching duct, plus an additional 12 inches (300 mm) vertically and horizontally to accommodate alignment variations.
 - 1. Center window location.
 - 2. Knockout panels shall be located no less than 6 inches (150 mm) from interior surfaces of walls, floors, or frames and covers of handholes, but close enough to corners to facilitate racking of cables on walls.
 - 3. Knockout panel opening shall have cast-in-place, welded-wire fabric reinforcement for field cutting and bending to tie in to concrete envelopes of duct.
 - 4. Knockout panels shall be framed with at least two additional No. 3 steel reinforcing bars in concrete around each opening.
 - 5. Knockout panels shall be 1-1/2 to 2 inches (38 to 50 mm) thick.
- I. Duct Entrances in Handhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.
 - 1. Type and size shall match fittings to duct to be terminated.
 - 2. Fittings shall align with elevations of approaching duct and be located near interior corners of handholes to facilitate racking of cable.
- J. Handholes 12 inches wide by 24 inches long (300 mm wide by 600 mm long) and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.6 POLYMER CONCRETE HANDHOLES AND BOXES WITH POLYMER CONCRETE COVER

- A. Description: Molded of sand and aggregate, bound together with a polymer resin, and reinforced with steel or fiberglass or a combination of the two.
- B. Standard: Comply with SCTE 77. Comply with tier requirements in "Underground Enclosure Application" Article.
- C. Configuration: Units shall be designed for flush burial and have open bottom unless otherwise indicated.

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- D. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
- E. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
- F. Cover Legend: Molded lettering, "ELECTRIC."
- G. Direct-Buried Wiring Entrance Provisions: Knockouts equipped with insulated bushings or end-bell fittings, selected to suit box material, sized for wiring indicated, and arranged for secure, fixed installation in enclosure wall.
- H. Duct Entrance Provisions: Duct-terminating fittings shall mate with entering duct for secure, fixed installation in enclosure wall.
- I. Handholes 12 inches wide by 24 inches long (300 mm wide by 600 mm long) and larger shall have factory-installed inserts for cable racks and pulling-in irons.

2.7 FIBERGLASS HANDHOLES AND BOXES WITH POLYMER CONCRETE FRAME AND COVER

- A. Description: Sheet-molded, fiberglass-reinforced, polyester resin enclosure joined to polymer concrete top ring or frame.
- B. Standard: Comply with SCTE 77. Comply with tier requirements in "Underground Enclosure Application" Article.
- C. Configuration: Units shall be designed for flush burial and have open bottom unless otherwise indicated.
- D. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
- E. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
- F. Cover Legend: Molded lettering, "ELECTRIC."
- G. Direct-Buried Wiring Entrance Provisions: Knockouts equipped with insulated bushings or end-bell fittings, selected to suit box material, sized for wiring indicated, and arranged for secure, fixed installation in enclosure wall.
- H. Duct Entrance Provisions: Duct-terminating fittings shall mate with entering duct for secure, fixed installation in enclosure wall.
- I. Handholes 12 inches wide by 24 inches long (300 mm wide by 600 mm long) and larger shall have factory-installed inserts for cable racks and pulling-in irons.

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2.8 FIBERGLASS HANDHOLES AND BOXES

- A. Description: Molded of fiberglass-reinforced polyester resin, with covers made of cast iron.
- B. Standard: Comply with SCTE 77. Comply with tier requirements in "Underground Enclosure Application" Article.
- C. Configuration: Units shall be designed for flush burial and have open bottom unless otherwise indicated.
- D. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
- E. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
- F. Cover Legend: Molded lettering, "ELECTRIC."
- G. Direct-Buried Wiring Entrance Provisions: Knockouts equipped with insulated bushings or end-bell fittings, selected to suit box material, sized for wiring indicated, and arranged for secure, fixed installation in enclosure wall.
- H. Duct Entrance Provisions: Duct-terminating fittings shall mate with entering duct for secure, fixed installation in enclosure wall.
- I. Handholes 12 inches wide by 24 inches long (300 mm wide by 600 mm long) and larger shall have factory-installed inserts for cable racks and pulling-in irons.

2.9 SOURCE QUALITY CONTROL

- A. Test and inspect precast concrete utility structures according to ASTM C1037.
- B. Nonconcrete Handhole and Pull-Box Prototype Test: Test prototypes of manholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
 - 1. Tests of materials shall be performed by an independent testing agency.
 - 2. Strength tests of complete boxes and covers shall be by an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
 - 3. Testing machine pressure gages shall have current calibration certification, complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

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3. METHOD

3.1 PREPARATION

- A. Coordinate layout and installation of duct, duct bank, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field. Notify Architect if there is a conflict between areas of excavation and existing structures or archaeological sites to remain.
- B. Coordinate elevations of duct and duct-bank entrances into handholes, and boxes with final locations and profiles of duct and duct banks, as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations as required to suit field conditions and to ensure that duct and duct bank will drain to handholes, and as approved by Architect.

3.2 UNDERGROUND DUCT APPLICATION

- A. Duct for Electrical Feeders 600 V and Less: Type EPC-80-PVC RNC, direct-buried unless otherwise indicated.
- B. Duct for Electrical Branch Circuits: Type EPC-80-PVC RNC, direct-buried unless otherwise indicated.
- C. Stub-ups: Concrete-encased GRC.

3.3 UNDERGROUND ENCLOSURE APPLICATION

- A. Handholes and Boxes for 600 V and Less:
 - 1. Units in Roadways and Other Deliberate Traffic Paths: Precast concrete. AASHTO HB 17, H-20 structural load rating.
 - 2. Units in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Precast concrete, AASHTO HB 17, H-20, Fiberglass enclosures with polymer concrete frame and cover, SCTE 77, Tier 15 structural load rating.
 - 3. Cover design load shall not exceed the design load of the handhole or box.

3.4 EARTHWORK

- A. Restoration: Replace area immediately after backfilling is completed or after construction vehicle traffic in immediate area is complete.

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- B. Restore surface features at areas disturbed by excavation, and re-establish original grades unless otherwise indicated. Replace removed sod immediately after backfilling is completed.
- C. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching.
- D. Cut and patch existing pavement in the path of underground duct, duct bank, and underground structures.

3.5 DUCT AND DUCT-BANK INSTALLATION

- A. Where indicated on Drawings, install duct, spacers, and accessories into the duct-bank configuration shown. Duct installation requirements in this Section also apply to duct bank.
- B. Install duct according to NEMA TCB 2.
- C. Slope: Pitch duct a minimum slope of 1:300 down toward handholes and away from buildings and equipment. Slope duct from a high point between two manholes, to drain in both directions.
- D. Joints: Use solvent-cemented joints in duct and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent duct do not lie in same plane.
- E. Sealing: Provide temporary closure at terminations of duct with pulled cables. Seal spare duct at terminations. Use sealing compound and plugs to withstand at least 15-psig (1.03-MPa) hydrostatic pressure.
- F. Pulling Cord: Install 200-lbf- (1000-N-) test nylon cord in empty ducts.
- G. Direct-Buried Duct and Duct Bank:
 - 1. Excavate trench bottom to provide firm and uniform support for duct.
 - 2. Width: Excavate trench 12 inches (300 mm) wider than duct on each side.
 - 3. Width: Excavate trench 3 inches (75 mm) wider than duct on each side.
 - 4. Depth: Install top of duct at least 24 inches (900 mm) below finished grade unless otherwise indicated.
 - 5. Set elevation of bottom of duct bank below frost line.
 - 6. Support ducts on duct spacers coordinated with duct size, duct spacing, and outdoor temperature.
 - 7. Spacer Installation: Place spacers close enough to prevent sagging and deforming of duct, with not less than five spacers per 20 feet (6 m) of duct. Place spacers within 24 inches (600 mm) of duct ends. Stagger spacers approximately 6 inches (150 mm) between tiers. Secure spacers to earth and to ducts to prevent floating

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during concreting. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.

8. Install duct with a minimum of 3 inches (75 mm) between ducts for like services and 6 inches (150 mm) between power and communications duct.
 9. Elbows: Install manufactured duct elbows for stub-ups, at building entrances, and at changes of direction in duct direction unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
 10. Install manufactured GRC elbows for stub-ups, at building entrances, and at changes of direction in duct.
 - a. Couple RNC duct to GRC with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete.
 - b. Stub-ups to Outdoor Equipment: Extend concrete-encased GRC horizontally a minimum of 60 inches (1500 mm) from edge of base. Install insulated grounding bushings on terminations at equipment.
 - c. Place minimum 3 inches (75 mm) of sand as a bed for duct. Place sand to a minimum of 6 inches (150 mm) above top level of duct.
 - d. Place minimum 6 inches (150 mm) of engineered fill above concrete encasement of duct.
- H. Underground-Line Warning Tape: Bury nonconducting underground line specified in Section 260553 "Identification for Electrical Systems" no less than 12 inches (300 mm) above all concrete-encased duct and duct banks and approximately 12 inches (300 mm) below grade. Align tape parallel to and within 3 inches (75 mm) of centerline of duct bank. Provide an additional warning tape for each 12-inch (300-mm) increment of duct-bank width over a nominal 18 inches (450 mm). Space additional tapes 12 inches (300 mm) apart, horizontally.

3.6 INSTALLATION OF HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting duct, to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of duct, and seal joint between box and extension as recommended by manufacturer.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.5-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas and trafficways, set cover flush with finished grade. Set covers of other handholes 1 inch (25 mm) above finished grade.
- D. Field cut openings for duct according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

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- E. For enclosures installed in asphalt paving and subject to occasional, nondeliberate, heavy-vehicle loading, form and pour a concrete ring encircling, and in contact with, enclosure and with top surface screeded to top of box cover frame. Bottom of ring shall rest on compacted earth.

- 1. Concrete: 3000 psi (20 kPa), 28-day strength with a troweled finish.

3.7 GROUNDING

- A. Ground underground ducts and utility structures according to Section 260526 "Grounding and Bonding for Electrical Systems."

3.8 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Demonstrate capability and compliance with requirements on completion of installation of underground duct.
 - 2. Test handhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Section 260526 "Grounding and Bonding for Electrical Systems."
- B. Correct deficiencies and retest as specified above to demonstrate compliance.
- C. Prepare test and inspection reports.

3.9 CLEANING

- A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of duct until duct cleaner indicates that duct is clear of dirt and debris. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.

END OF SECTION

ITEM NO. SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

1. DESCRIPTION

1.1 SUMMARY

A. Section Includes:

1. Color and legend requirements for raceways, conductors, and warning labels and signs.
2. Labels.
3. Tags.
4. Signs.
5. Cable ties.
6. Paint for identification.
7. Fasteners for labels and signs.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for electrical identification products.

B. Identification Schedule: For each piece of electrical equipment and electrical system components to be an index of nomenclature for electrical equipment and system components used in identification signs and labels. Use same designations indicated on Drawings.

2. MATERIALS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with ASME A13.1 and IEEE C2.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

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2.2 COLOR AND LEGEND REQUIREMENTS

- A. Raceways and Cables Carrying Circuits at 600 V or Less:
 - 1. Black letters on an orange field.
 - 2. Legend: Indicate voltage.
- B. Color-Coding for Phase- Identification, 600 V or Less: Use colors listed below for ungrounded branch-circuit conductors.
 - 1. Color shall be factory applied.
 - 2. Colors for 208/120-V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.
 - 3. Colors for 240-V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - 4. Color for Neutral: White.
 - 5. Color for Equipment Grounds: Green.
- C. Warning Label Colors:
 - 1. Identify system voltage with black letters on an orange background.
 - 2. .
- D. Equipment Identification Labels:
 - 1. Black letters on a white field.
 - 2.

2.3 LABELS

- A. Vinyl Wraparound Labels: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Brady Corporation.
 - b. Panduit Corp.
 - c. Seton Identification Products; a Brady Corporation company.

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- B. Self-Adhesive Wraparound Labels: Preprinted, 3-mil-thick, polyester flexible label with acrylic pressure-sensitive adhesive.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Brady Corporation.
 - b. Ideal Industries, Inc.
 - c. Panduit Corp.
 2. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating, protective shield over the legend. Labels sized such that the clear shield overlaps the entire printed legend.
 3. Marker for Labels: Permanent, waterproof, black ink marker recommended by tag manufacturer.
 4. Marker for Labels: Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.

2.4 TAPES AND STENCILS

- A. Underground-Line Warning Tape:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Brady Corporation.
 - b. Ideal Industries, Inc.
 - c. Seton Identification Products; a Brady Corporation company.
 2. Tape:
 - a. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrica lines.
 - b. Printing on tape shall be permanent and shall not be damaged by burial operations.
 - c. Tape material and ink shall be chemically inert and not subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.
 3. Color and Printing:
 - a. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, ANSI Z535.4, and ANSI Z535.5.
 - b. Inscriptions for Red-Colored Tapes: "ELECTRIC LINE, HIGH VOLTAGE".
 - c. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that

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allows inspection of the continuity of the conductive core; bright colored, compounded for direct-burial service.

- d. Width: 3 inches.
- e. Overall Thickness: 5 mils.
- f. Foil Core Thickness: 0.35 mil.
- g. Weight: 28 lb/1000 sq. ft..
- h. Tensile according to ASTM D882: 70 lbf and 4600 psi.

- B. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

2.5 TAGS

A. Write-on Tags:

- 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Carlton Industries, LP.
 - b. LEM Products Inc.
 - c. Seton Identification Products; a Brady Corporation company.
- 2. Polyester Tags: 0.010 inch thick, with corrosion-resistant grommet and cable tie for attachment.
- 3. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
- 4. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.6 SIGNS

A. Laminated Acrylic or Melamine Plastic Signs:

- 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Brady Corporation.
 - b. Carlton Industries, LP.
 - c. emedco.
- 2. Engraved legend.
- 3. Thickness:
 - a. For signs up to 20 sq. in., minimum 1/16 inch thick.
 - b. For signs larger than 20 sq. in., 1/8 inch thick.
 - c. Engraved legend with black letters on white face.

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- d. Punched or drilled for mechanical fasteners with 1/4-inch grommets in corners for mounting.
- e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.7 CABLE TIES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. HellermannTyton.
 - 2. Ideal Industries, Inc.
 - 3. Panduit Corp.
- B. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.
 - 1. Minimum Width: 3/16 inch.
 - 2. Tensile Strength at 73 Deg F according to ASTM D638: 12,000 psi.
 - 3. Temperature Range: Minus 40 to plus 185 deg F.
 - 4. Color: Black, except where used for color-coding.
- C. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.
 - 1. Minimum Width: 3/16 inch.
 - 2. Tensile Strength at 73 Deg F according to ASTM D638: 12,000 psi.
 - 3. Temperature Range: Minus 40 to plus 185 deg F.
 - 4. Color: Black.

2.8 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

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3. METHOD

3.1 PREPARATION

- A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.2 INSTALLATION

- A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.
- B. Install identifying devices before installing acoustical ceilings and similar concealment.
- C. Verify identity of each item before installing identification products.
- D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.
- E. Apply identification devices to surfaces that require finish after completing finish work.
- F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.
- G. System Identification for Raceways and Cables under 600 V: Identification shall completely encircle cable or conduit. Place identification of two-color markings in contact, side by side.
 - 1. Secure tight to surface of conductor, cable, or raceway.
- H. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.
- I. Accessible Fittings for Raceways: Identify the covers of each junction and pull box of the following systems with the wiring system legend and system voltage. System legends shall be as follows:
 - 1. "POWER."
 - 2. "LIGHTING"
- J. Vinyl Wraparound Labels:
 - 1. Secure tight to surface of raceway or cable at a location with high visibility and accessibility.
 - 2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.

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- K. Self-Adhesive Wraparound Labels: Secure tight to surface at a location with high visibility and accessibility.
- L. Self-Adhesive Labels:
 - 1. On each item, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
 - 2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high label; where two lines of text are required, use labels 2 inches high.
- M. Snap-around Color-Coding Bands: Secure tight to surface at a location with high visibility and accessibility.
- N. Heat-Shrink, Preprinted Tubes: Secure tight to surface at a location with high visibility and accessibility.
- O. Marker Tapes: Secure tight to surface at a location with high visibility and accessibility.
- P. Self-Adhesive Vinyl Tape: Secure tight to surface at a location with high visibility and accessibility.
 - 1. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.
- Q. Tape and Stencil: Comply with requirements in painting Sections for surface preparation and paint application.
- R. Underground Line Warning Tape:
 - 1. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches overall.
 - 2. Limit use of underground-line warning tape to direct-buried cables.
 - 3. Install underground-line warning tape for direct-buried cables and cables in raceways.
- S. Write-on Tags:
 - 1. Place in a location with high visibility and accessibility.
 - 2. Secure using general-purpose cable ties.
- T. Laminated Acrylic or Melamine Plastic Signs:
 - 1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

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2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high sign; where two lines of text are required, use labels 2 inches high.
- U. Cable Ties: General purpose, for attaching tags, except as listed below:
1. Outdoors: UV-stabilized nylon.

3.3 IDENTIFICATION SCHEDULE

- A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.
- B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.
- C. Accessible Fittings for Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive labels containing the wiring system legend and system voltage. System legends shall be as follows:
 1. "LIGHTING"
 2. "POWER."
- D. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, and manholes, use self-adhesive wraparound labels to identify the phase.
 1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
- E. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive labels with the conductor or cable designation, origin, and destination.
- F. Control-Circuit Conductor Termination Identification: For identification at terminations, provide self-adhesive labels with the conductor designation.
- G. Conductors to Be Extended in the Future: Attach write-on tags to conductors.
- H. Locations of Underground Lines: Underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.
- I. Instructional Signs: Self-adhesive labels, including the color code for grounded and ungrounded conductors.
- J. Operating Instruction Signs: Self-adhesive labels.

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K. Equipment Identification Labels:

1. Indoor Equipment: Self-adhesive label.
2. Outdoor Equipment: Laminated acrylic or melamine sign.
3. Equipment to Be Labeled:
 - a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be in the form of a self-adhesive, engraved, laminated acrylic or melamine label.
 - b. Enclosures and electrical cabinets.
 - c. Transformers: Label that includes tag designation indicated on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.

END OF SECTION

1. DESCRIPTION

Under this item the Contractor shall install metal fencing of the style specified, where shown on the plans.

2. MATERIALS

Structural Performance: Design, engineer, fabricate, and install the following metal fabrications to withstand not less than the following structural loads without exceeding the allowable design working stress of the materials involved, including anchors and connections as per Section BC 1607.7 of the 2014 NYC Building Code. Apply each load to produce the maximum stress in each respective component of each metal fabrication. In cases where local requirements are more stringent they shall apply. Where railings support fixtures or other imposed loads, allowance shall be made for the additional loads.

Lightning-Protection System: Maximum grounding-resistance value of 25 ohms under normal dry conditions.

Steel and Iron:

- A. Bars: Hot-rolled, carbon steel complying with ASTM A29/A29M, Grade 1010.
- B. Steel rods: ASTM A108
- C. Plates, Shapes, and Bars: ASTM A36/A36M.
- D. Cast Iron: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M unless otherwise indicated.
- E. Steel Sheet, Cold Rolled: ASTM A1008/A1008M, either commercial steel or structural steel, exposed.

Decorative Steel Fences: Fences made from solid steel bars and shapes. Unless indicated on plans the following sizes will be used.

- A. Posts: Square steel bar.
 - 1. Line Posts - Solid: 1-3/4 by 1-3/4 inches square steel bar
 - 2. End and Corner Posts - Solid: 1-3/4 by 1-3/4 inches square steel bar.
- B. Rails:
 - 1. Square steel bar: 1-3/4 inches by 1/2 inches solid bar.
- C. Pickets: 3/4-inch- square solid steel bar
 - 1. Terminate tops of pickets at top rail for flush top appearance
 - 2. Picket Spacing: 3-3/4 inches clear opening, maximum.

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(Continued)

- D. Fasteners: Stainless-steel carriage bolts and tamperproof nuts.
- E. Fabrication: Assemble fences into sections by welding pickets to rails.
 - 1. Fabricate sections with clips welded to rails for field fastening to posts.
 - 2. Drill posts and clips for fasteners before finishing to maximum extent possible.
- F. Fabrication: Fabricate bar grating infill into sections of size indicated.
 - 1. Fabricate rails with clips welded to rails for field fastening to posts.
 - 2. Drill posts and bar grating for fasteners before finishing to maximum extent possible.
- G. Finish exposed welds to comply with NOMMA Guideline 1, Finish #4 - good-quality, uniform undressed weld with minimal splatter.
- H. Finish for Bar Grating Infill: Powder coating.
- I. Finish for Steel Items: Primed and Shop painted.

Coating Materials

- A. Shop Primers for Steel: Provide primers that comply with Section 099113 "Exterior Painting."
- B. Shop Primer for Steel: Manufacturer's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.
- C. Epoxy Zinc-Rich Primer for Uncoated Steel: Complying with MPI #20 and compatible with coating specified to be applied over it.

Miscellaneous Materials

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Concrete: Normal-weight, air-entrained, ready-mix concrete complying with requirements in Section 033000 "Cast-in-Place Concrete" with a minimum 28-day compressive strength of 3000 psi, 3-inch slump, and 1-inch maximum aggregate size or dry, packaged, normal-weight concrete mix complying with ASTM C387/C387M mixed with potable water according to manufacturer's written instructions].
- C. Nonshrink Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M and specifically recommended by manufacturer for exterior applications.

Grounding Materials

- A. Comply with requirements of Section 260526 "Grounding and Bonding for Electrical Systems."

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(Continued)

- B. Grounding Conductors: Size as indicated on Drawings. Bare, solid wire for No. 6 AWG and smaller; stranded wire for No. 4 AWG and larger.
 - 1. Material above Finished Grade: Copper.
 - 2. Material on or below Finished Grade: Copper.
 - 3. Bonding Jumpers: Braided copper tape, 1-5/8 inch wide and 1/16 inch thick, woven of No. 30 AWG bare copper wire, terminated with copper ferrules.
- C. Grounding Connectors and Grounding Rods: Comply with UL 467.
 - 1. Connectors for Below-Grade Use: Exothermic-welded type.
 - 2. Grounding Rods: Copper-clad steel.
 - a. Size: 5/8 by 96 inches .

Steel Finishes

- A. Surface Preparation: Clean surfaces according to SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning." After cleaning, apply a conversion coating compatible with the organic coating to be applied over it.
- B. Powder Coating: Immediately after cleaning, apply manufacturer's standard two-coat finish consisting of epoxy primer and TGIC polyester topcoat to a minimum total dry film thickness of not less than 8 mils . Comply with coating manufacturer's written instructions.
 - 1. Color and Gloss: As selected by Architect from manufacturer's full range during construction.
- C. Primer Application: Apply zinc-rich epoxy primer immediately after cleaning, to provide a minimum dry film thickness of 2 mils per applied coat, to surfaces that are exposed after assembly and installation, and to concealed surfaces.
- D. Shop-Painted Finish: Comply with Section 099113 "Exterior Painting."
- E. High-Performance Coating: Apply intermediate and polyurethane topcoats to prime-coated surfaces. Comply with coating manufacturer's written instructions and with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Apply at spreading rates recommended by coating manufacturer.
 - 1. Match approved Samples for color, texture, and coverage. Remove and refinish, or recoat work that does not comply with specified requirements.

Grout and anchoring cement

- F. Nonshrink Metallic Grout: Premixed, factory-packaged, ferrous aggregate grout complying with Federal Specification CE CRD-C 621 or ASTM C1107 specifically recommended by manufacturer for heavy-duty loading applications of type specified in this section.

ITEM NO. 323 – 2'-6" WROUGHT IRON FENCE

(Continued)

- G. Nonshrink Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, non-gaseous grout complying with Federal Specification CE CRD-C 621 or ASTM C1107. Provide grout specifically recommended by manufacturer for interior and exterior applications of type specified in this section. .
- H. Erosion-Resistant Anchoring Cement: Factory-prepackaged, nonshrink, nonstaining, hydraulic controlled expansion cement formulation for mixing with water at project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without need for protection by a sealer or waterproof coating and is recommended for exterior use by manufacturer.
- I. Products: Subject to compliance with requirements, provide one of the following (or approved equal):
 - 1. Nonshrink Metallic Grouts:
 - "Hi Flow Grout", Euclid Chemical Co.
 - "Masterflo 885 and Embeco 636", Master Builders
 - "Met-Ox", ChemMasters Specialty Construction Products
 - 2. Nonshrink Nonmetallic Grouts:
 - "NS Grout", Euclid Chemical Co.
 - "Crystex", L & M Construction Chemicals, Inc.
 - "Masterflow 713", Master Builders
 - "Five Star Grout", Five Star

3. **METHOD**

Coordination

- A. Coordinate installation of anchorages for decorative metal items. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

Examination

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of decorative metal.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

Action Submittals

- A. Product Data: For each type of product.
- B. Shop Drawings: For fencing and gates.
 - 1. Include plans, elevations, sections, post spacing, and mounting attachment details, and grounding details.
- C. Samples: For each fence material and for each color specified.

ITEM NO. 323 – 2'-6" WROUGHT IRON FENCE

(Continued)

1. Provide Samples [12 inches] in length for linear materials.
2. Provide Samples [12 inches] square for bar grating

Information Submittals

- A. Field quality-control reports.
- B. Product Test Reports: For decorative metallic-coated-steel picket fences, including finish, indicating compliance with referenced standard and other specified requirements.
- C. Mill Certificates: Signed by manufacturers of stainless-steel certifying that products furnished comply with requirements.
- D. Welding certificates.

Closeout Submittals

- A. Maintenance Data: For gate operators to include in maintenance manuals.

Quality Assurance

- A. Installer Qualifications: Fabricator of products.
- B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
 1. Include 10-foot length of fence complying with requirements.
 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

Installation, General

- A. Iron Fences and Railings
 1. Provide where indicated on Drawings iron railings, fences, and gates constructed in accordance with the Drawings and Specifications, and as required to support structural loads. Rail systems, including guardrail systems, handrail systems, and infill, shall meet or exceed requirements for structural performance described in Article titled "System Performance Requirements". Materials of fences and railings: medium steel, shapes as indicated on the Drawings.
 2. Posts and braces shall be set in anchoring grout into cast-iron shoes, which shall be embedded in the concrete pavements or blocks. Members shall be centered in sleeve to provide uniform thickness of grout around member. Top 1/2" of material in sleeve is to be polyurethane sealant, pitched to shed water.
 3. Provide galvanizing and finish paint.
- B. Provide anchorage devices and fasteners where needed to secure decorative metal to in-place construction.
- C. Perform cutting, drilling, and fitting required to install decorative metal. Set products accurately in location, alignment, and elevation, measured from established lines and

ITEM NO. 323 – 2'-6" WROUGHT IRON FENCE

(Continued)

levels. Provide temporary bracing or anchors in formwork for items to be built into concrete, masonry, or similar construction.

- D. Fit exposed connections accurately together to form tight, hairline joints or, where indicated, uniform reveals and spaces for sealants and joint fillers. Where cutting, welding, and grinding are required for proper shop fitting and jointing of decorative metal, restore finishes to eliminate evidence of such corrective work.
- E. Do not cut or abrade finishes that cannot be completely restored in the field. Return items with such finishes to the shop for required alterations, followed by complete refinishing, or provide new units as required.
- F. Install concealed gaskets, joint fillers, insulation, and flashings as work progresses.
- G. Restore protective coverings that have been damaged during shipment or installation. Remove protective coverings only when there is no possibility of damage from other work yet to be performed at same location.
 - 1. Retain protective coverings intact; remove coverings simultaneously from similarly finished items to preclude nonuniform oxidation and discoloration.
- H. Field Welding: Comply with applicable AWS specification for procedures of manual shielded metal arc welding and requirements for welding and for finishing welded connections in "Fabrication, General" Article. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.
- I. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
 - 1. Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

Delivery, Storage, and Handling

- A. Store decorative metal in a well-ventilated area, away from uncured concrete and masonry, and protected from weather, moisture, soiling, abrasion, extreme temperatures, and humidity.
- B. Deliver and store cast-metal products in wooden crates surrounded by enough packing material to ensure that products are not cracked or otherwise damaged.
- C. Tag all items to agree with shop drawing designations.
- D. Replace damaged items, with the approval of the Project Architect, and at no additional cost to the Client.

Field Conditions

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with decorative metal by field measurements before fabrication and indicate measurements on Shop Drawings.

ITEM NO. 323 – 2'-6" WROUGHT IRON FENCE

(Continued)

- B. Interface With Other Systems: Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchors, including concrete inserts, sleeves, anchor bolts and miscellaneous items having integral anchors, which will be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.
- C. Coordinate with other trades in scheduling delivery and installation.

Cleaning and Protection

- A. Unless otherwise indicated, clean metals by washing thoroughly with clean water and soap, rinsing with clean water, and drying with soft cloths.
- B. Clean copper alloys according to metal finisher's written instructions in a manner that leaves an undamaged and uniform finish matching approved Sample.
- C. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- D. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099113 "Exterior Painting"
- E. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.
- F. Protect finishes of decorative metal from damage during construction period with temporary protective coverings approved by decorative metal fabricator. Remove protective covering at time of Substantial Completion.
- G. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

4. **METHOD OF MEASUREMENT**

The quantity to be paid for under this item shall be the number of linear feet of fence.

5. **BASIS OF PAYMENT**

The bid price per linear foot shall include the cost of all labor, materials, equipment and other incidentals required to complete the work as specified or indicated.

END OF SECTION

ITEM NO. 329 – LANDSCAPE ISLANDS PLANTING WORK

1. DESCRIPTION

Under this item the provisions of Item No. Section 329113 and Item No. Section 329300 shall apply.

2. MATERIALS

Under this item the provisions of Item No. Section 329113 and Item No. Section 329300 shall apply.

3. METHOD

Under this item the provisions of Item No. Section 329113 and Item No. Section 329300 shall apply.

4. METHOD OF MEASUREMENT

The work included to place the plants and prepare the engineered soils on the site shall be paid for by the Square Foot. In the event that, in the judgment of the Architect or Engineer, plants are not properly, and/or adequately maintained on any part of the Contract on any day, or the Contractor deviates from, or fails to comply with the approved plans, schedules, and modifications or amendments thereto, no payment for plants will be made for those plantings.

5. BASIS OF PAYMENT

The Square Foot price shall include all labor, materials, equipment and the performance of all operations and work necessary to complete the plantings, soil preparation and placement in conformity with the plans and specifications. Payments shall be made monthly after Architect or Engineers approval.

END OF SECTION

1. DESCRIPTION

Under this item the contractor shall prepare and place the Engineered Soil where called out on the plans for the bioswale sections.

2. MATERIALS

PLANTING SOILS SPECIFIED BY COMPOSITION

A. General: Soil amendments, fertilizers, and rates of application specified in this article are guidelines that may need revision based on testing laboratory's recommendations after preconstruction soil analyses are performed.

a. Planting-Soil Type "A": Shall be a soil mixed off-site to produce a growing medium for areas designated as planting bed areas on the Contract Drawings. Medium Sand, Organic Matter/Compost, and Loam material components meeting the requirements specified for these ingredients shall be combined to create a uniform blend that meets the following requirements:

1. Ratio of Loose Compost to Soil: [1:3] by volume.
2. Percent passing a Number 270 sieve (for material passing a Number 10 sieve) shall be between 13 and 18 percent.
3. Percent of material finer than 0.002 mm (for material passing a Number 10 sieve) shall be between 4 and 8 percent.
4. The ratio of the particle size for 80% passing (D80) to the particle size for 30% passing (D30) shall be 6.0 or less. ($D80/D30 < \text{or} = 6.0$).
5. Organic content goal shall be between 6.0 and 8.0 percent.
6. The saturated hydraulic conductivity of the mix shall be not less than 4 inches per hour when compacted to a minimum of 85% Standard Proctor.
7. Mixed soil pH shall be between 6.6 and 7.0.
8. Salinity: Electrical conductivity of a one to two soil to water ratio extract shall be in the range of 0.08 to 0.50 mmhos/cm (dS/m).
9. Provide results for Cation Exchange Capacity in meq/100g when tested by the exchangeable acidity method.
10. Provide results for BpH when tested by the SMP method.
11. The maximum retained on the #10 sieve shall be 20% by weight of the total sample.
12. In addition to the above requirements, the gradation for mixed material passing a Number 10 sieve shall conform to the following:

U.S. Sieve	% Passing	% Passing	Size No.	Minimum	Maximum
10	100 -		18	75	95
35	40		65		
60	27	38	140	16	24
270				13	18
0.002 mm				4	8

ITEM NO. SECTION 329113 – ENGINEERED SOIL PREPARATION

(Continued)

INORGANIC SOIL AMENDMENTS

- A. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:
 - 1. Class: T, with a minimum of 99 percent passing through a No. 8 (2.36-mm) sieve and a minimum of 75 percent passing through a No. 60 (0.25-mm) sieve.
 - 2. Class: O, with a minimum of 95 percent passing through a No. 8 (2.36-mm) sieve and a minimum of 55 percent passing through a No. 60 (0.25-mm) sieve.
 - 3. Form: Provide lime in form of ground dolomitic limestone .
- B. Sulfur: Granular, biodegradable, and containing a minimum of 90 percent elemental sulfur, with a minimum of 99 percent passing through a No. 6 (3.35-mm) sieve and a maximum of 10 percent passing through a No. 40 (0.425-mm) sieve.
- C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.
- D. Perlite: Horticultural perlite, soil amendment grade.
- E. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through a No. 50 sieve.
- F. Sand: Clean, washed, natural or manufactured, free of toxic materials, and according to ASTM C 33/C 33M.

ORGANIC SOIL AMENDMENTS

- A. Compost: Well-composted, stable, and weed-free organic matter produced by composting feedstock, and bearing USCC's "Seal of Testing Assurance," and as follows:
 - 1. Feedstock: Limited to leaves.
 - 2. Reaction pH of 5.5 to 7.
 - 3. Soluble-Salt Concentration shall not exceed 2.0 dS/m.
 - 4. Moisture Content: 35 to 55 percent by weight.
 - 5. Organic-Matter Content: 30 to 40 percent of dry weight.
 - 6. Particle Size: Minimum of 98 percent passing through a 2-inch (50-mm) sieve.
- B. Sphagnum Peat: Partially decomposed sphagnum peat moss, finely divided or of granular texture with 100 percent passing through a 1/2-inch (13-mm) sieve, a pH of 3.4 to 4.8, and a soluble-salt content measured by electrical conductivity of maximum 5 dS/m.
- C. Muck Peat: Partially decomposed moss peat, native peat, or reed-sedge peat, finely divided or of granular texture with 100 percent passing through a 1/2-inch (13-mm) sieve, a pH of 6 to 7.5, a soluble-salt content measured by electrical conductivity of maximum 5 dS/m, having a water-absorbing capacity of 1100 to 2000 percent, and containing no sand.

ITEM NO. SECTION 329113 – ENGINEERED SOIL PREPARATION

(Continued)

- D. Wood Derivatives: Shredded and composted, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture and free of chips, stones, sticks, soil, or toxic materials.
 - 1. Partially Decomposed Wood Derivatives: In lieu of shredded and composted wood derivatives, mix shredded and partially decomposed wood derivatives with ammonium nitrate at a minimum rate of 0.15 lb/cu. ft. (2.4 kg/cu. M) of loose sawdust or ground bark, or with ammonium sulfate at a minimum rate of 0.25 lb/cu. ft. (4 kg/cu. m) of loose sawdust or ground bark.
- E. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, debris, and material harmful to plant growth.

FERTILIZERS

- A. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.
- B. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
 - 1. Retain one of two "Composition" subparagraphs below; compositions are examples only. Revise to suit Project. If using fertilizer mix as a soil amendment, revise mix to remedy deficiencies found in soil tests. Coordinate unit of measurement for composition with unit of measurement for application. Insert a "Products" Subparagraph in lieu of both "Composition" subparagraphs if a list of locally available commercial fertilizers is known and preferred over specifying fertilizer composition.
 - 2. Composition: 1 lb/1000 sq. ft. (0.5 kg/100 sq. m) of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.
 - 3. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified testing agency.
- C. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
 - 1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.
 - 2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified testing agency.
- D. Chelated Iron: Commercial-grade FeEDDHA for dicots and woody plants, and commercial-grade FeDTPA for ornamental grasses and monocots.

3. METHOD

ACTION SUBMITTALS

- E. Product Data: For each type of product.
 - 1. Include recommendations for application and use.
 - 2. Include test data substantiating that products comply with requirements.
 - 3. Include sieve analyses for aggregate materials.
 - 4. Material Certificates: For each type of imported soil and amendment, and fertilizer delivery to the site, according to the following:
 - a. Manufacturer's qualified testing agency's certified analysis of standard products.
 - b. Analysis of fertilizers, by a qualified testing agency, made according to AAPFCO methods for testing and labeling and according to AAPFCO's SUIP #25.
 - c. Analysis of nonstandard materials, by a qualified testing agency, made according to SSSA methods, where applicable.
- F. Samples: For each bulk-supplied material, 1-gal. (4-L) volume of each in sealed containers labeled with content, source, and date obtained. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of composition, color, and texture.

INFORMATIONAL SUBMITTALS

- A. Qualification Data: For each testing agency.
- B. Preconstruction Test Reports: For preconstruction soil analyses specified in "Preconstruction Testing" Article.
- C. Field quality-control reports.

QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent, state-operated, or university-operated laboratory; experienced in soil science, soil testing, and plant nutrition; with the experience and capability to conduct the testing indicated; and that specializes in types of tests to be performed.
 - 1. Laboratories:
 - 1.1 Nutrient Testing Laboratories, Ltd. DBA Chemical Consulting of Babylon
41 East Main Street, Babylon Village, New York 11702
(631) 587 0632 – phone; (631) 587 0827 – fax
 - 1.2) Hummel & Company, Inc.

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(Continued)

- 35 King Street, P.O. Box 606, Trumansburg, NY 14886
(607) 387 5694 – phone; (607) 837 9499 – fax
1.3) Woods End Research Laboratory PO Box 297,
Mt. Vernon, Maine 04352
(207) 293 2457 – phone; (207) 293 2488 – Fax
1.4) Or approved equal.

2. Retain "Multiple Laboratories" Subparagraph below if required or customary in Project area. Laboratories often specialize in types of testing.
3. Multiple Laboratories: At Contractor's option, work may be divided among qualified testing laboratories specializing in physical testing, chemical testing, and fertility testing.

PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: The contractor shall engage a qualified testing agency to perform preconstruction soil analyses on existing, on-site soil. Results shall be submitted to the Engineer-of-record for approval.
 4. Notify Architect 14 days in advance of the dates and times when laboratory samples will be taken.
- B. Preconstruction Soil Analyses: For each unamended soil type, perform testing on soil samples and furnish soil analysis and a written report containing soil-amendment and fertilizer recommendations by a qualified testing agency performing the testing according to "Soil-Sampling Requirements" and "Testing Requirements" articles.
 1. Have testing agency identify and label samples and test reports according to sample collection and labeling requirements.

SOIL-SAMPLING REQUIREMENTS

- A. General: Extract soil samples according to requirements in this article.
- B. Sample Collection and Labeling: Have samples taken and labeled by Owner or soil scientist (CPSS) certified by SSSA or soil classifier (CPSC) certified by SSSA or soil scientist (RPSS) registered by the National Society of Consulting Soil Scientists or state-certified, -licensed, or -registered soil scientist under the direction of the testing agency.
 1. Number and Location of Samples: Minimum of three representative soil samples from varied locations where directed by soil specialist for each soil to be used or amended for landscaping purposes.
 2. Procedures and Depth of Samples: According to USDA-NRCS's "Field Book for Describing and Sampling Soils.
 3. Division of Samples: Split each sample into two, equal parts. Send half to the testing agency and half to Owner for its records.

ITEM NO. SECTION 329113 – ENGINEERED SOIL PREPARATION

(Continued)

4. Labeling: Label each sample with the date, location keyed to a site plan or other location system, visible soil condition, and sampling depth.

TESTING REQUIREMENTS

- A. General: Perform tests on soil samples according to requirements in this article.
- B. Physical Testing:
 1. Soil Texture: Soil-particle, size-distribution analysis by the following methods according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods":
 - a. Sieving Method: Report sand-gradation percentages for very coarse, coarse, medium, fine, and very fine sand; and fragment-gradation (gravel) percentages for fine, medium, and coarse fragments; according to USDA sand and fragment sizes.
 - b. Hydrometer Method: Report percentages of sand, silt, and clay.
 2. Total Porosity: Calculate using particle density and bulk density according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
 3. Water Retention: According to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
 4. Saturated Hydraulic Conductivity: According to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods"; at 85% compaction according to ASTM D 698 (Standard Proctor).
- C. Chemical Testing:
 1. CEC: Analysis by sodium saturation at pH 7 according to SSSA's "Methods of Soil Analysis - Part 3- Chemical Methods."
 2. Clay Mineralogy: Analysis and estimated percentage of expandable clay minerals using CEC by ammonium saturation at pH 7 according to SSSA's "Methods of Soil Analysis - Part 1- Physical and Mineralogical Methods."
 3. Metals Hazardous to Human Health: Test for presence and quantities of RCRA metals including aluminum, arsenic, barium, copper, cadmium, chromium, cobalt, lead, lithium, and vanadium. If RCRA metals are present, include recommendations for corrective action.
 4. Phytotoxicity: Test for plant-available concentrations of phytotoxic minerals including aluminum, arsenic, barium, cadmium, chlorides, chromium, cobalt, copper, lead, lithium, mercury, nickel, selenium, silver, sodium, strontium, tin, titanium, vanadium, and zinc.
- D. Fertility Testing: Soil-fertility analysis according to standard laboratory protocol of SSSA NAPT NCR-13 or SSSA NAPT NEC-67 or SSSA NAPT SERA-6 or SSSA NAPT WERA-103, including the following:
 1. Percentage of organic matter.
 2. CEC, calcium percent of CEC, and magnesium percent of CEC.
 3. Soil reaction (acidity/alkalinity pH value).

ITEM NO. SECTION 329113 – ENGINEERED SOIL PREPARATION

(Continued)

4. Buffered acidity or alkalinity.
 5. Nitrogen ppm.
 6. Phosphorous ppm.
 7. Potassium ppm.
 8. Manganese ppm.
 9. Manganese-availability ppm.
 10. Zinc ppm.
 11. Zinc availability ppm.
 12. Copper ppm.
 13. Sodium ppm and sodium absorption ratio.
 14. Soluble-salts ppm.
 15. Presence and quantities of problem materials including salts and metals cited in the Standard protocol. If such problem materials are present, provide additional recommendations for corrective action.
 16. Other deleterious materials, including their characteristics and content of each.
- E. Organic-Matter Content: Analysis using loss-by-ignition method according to SSSA's "Methods of Soil Analysis - Part 3- Chemical Methods."
- F. Recommendations: Based on the test results, state recommendations for soil treatments and soil amendments to be incorporated to produce satisfactory planting soil suitable for healthy, viable plants indicated. Include, at a minimum, recommendations for nitrogen, phosphorous, and potassium fertilization, and for micronutrients.
1. In "Fertilizers and Soil Amendment Rates" and "Soil Reaction" subparagraphs below, the SI (metric) equivalent of 1000 sq. ft. (93 sq. m) is stated as 100 sq. m for convenience of application. Insert other units of area or volume to suit Project.
 2. Fertilizers and Soil Amendment Rates: State recommendations in weight per 1000 sq. ft. (100 sq. m) for 6-inch (150-mm) depth of soil
 3. Soil Reaction: State the recommended liming rates for raising pH or sulfur for lowering pH according to the buffered acidity or buffered alkalinity in weight per 1000 sq. ft. (100 sq. m) for 6-inch (150-mm) depth of soil.

DELIVERY, STORAGE, AND HANDLING

- A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and compliance with state and Federal laws if applicable.
- B. Bulk Materials:
1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
 2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
 3. Do not move or handle materials when they are wet or frozen.
 4. Accompany each delivery of bulk fertilizers and soil amendments with appropriate certificates.

EXECUTION GENERAL

- A. Place planting soil and fertilizers according to requirements in other Specification Sections.
- B. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in planting soil.
- C. Proceed with placement only after unsatisfactory conditions have been corrected.

PREPARATION OF UNAMENDED, ON-SITE SOIL BEFORE AMENDING

- A. Excavation: Excavate soil from designated area(s) to a depth of 6 inches (150 mm) and stockpile until amended.
- B. Unacceptable Materials: Clean soil of concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials that are harmful to plant growth.
- C. Unsuitable Materials: Clean soil to contain a maximum of **8** percent by dry weight of stones, roots, plants, sod, clay lumps, and pockets of coarse sand.
- D. Screening: Pass unamended soil through a 2-inch (50-mm) sieve to remove large materials.

PLACING AND MIXING PLANTING SOIL OVER EXPOSED SUBGRADE

- A. General: Apply and mix unamended soil with amendments on-site to produce required planting soil. Do not apply materials or till if existing soil or subgrade is frozen, muddy, or excessively wet.
- B. Subgrade Preparation: Till subgrade to a minimum depth of 6 inches (150 mm). Remove stones larger than 2 inches (50 mm) in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
 - 1. Apply, add soil amendments, and mix approximately half the thickness of unamended soil over prepared, loosened subgrade according to "Mixing" Paragraph below. Mix thoroughly into top 4 inches (100 mm) of subgrade. Spread remainder of planting soil.
- C. Mixing: Spread unamended soil to total depth of 4 inches (100 mm), but not less than required to meet finish grades after mixing with amendments and natural settlement. Do not spread if soil or subgrade is frozen, muddy, or excessively wet.

ITEM NO. SECTION 329113 – ENGINEERED SOIL PREPARATION

(Continued)

1. Amendments: Apply soil amendments, except compost, and fertilizer, if required, evenly on surface, and thoroughly blend them with unamended soil to produce planting soil.
 - a. Mix lime and sulfur with dry soil before mixing fertilizer.
 - b. Mix fertilizer with planting soil no more than seven days before planting.
 2. Lifts: Apply and mix unamended soil and amendments in lifts not exceeding 8 inches (200 mm) in loose depth for material compacted by compaction equipment, and not more than 4 inches (100 mm) in loose depth for material compacted by hand-operated tampers.
- D. Compaction: Compact each blended lift of planting soil to **75** percent of maximum Standard Proctor density according to ASTM D 698 and tested in-place.
- E. Finish Grading: Grade planting soil to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

PLACING MANUFACTURED PLANTING SOIL OVER EXPOSED SUBGRADE

- A. General: Apply manufactured soil on-site in its final, blended condition. Do not apply materials or till if existing soil or subgrade is frozen, muddy, or excessively wet.
- B. Subgrade Preparation: Till subgrade to a minimum depth of 6 inches (150 mm). Remove stones larger than 2 inches (50 mm) in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
1. Apply approximately half the thickness of planting soil over prepared, loosened subgrade. Mix thoroughly into top 2 inches (50 mm) of subgrade. Spread remainder of planting soil.
- C. Application: Spread planting soil to total depth 6 inches (150 mm) but not less than required to meet finish grades after natural settlement. Do not spread if soil or subgrade is frozen, muddy, or excessively wet.
1. Lifts: Apply planting soil in lifts not exceeding 8 inches (200 mm) loose depth for material compacted by compaction equipment, and not more than 4 inches (100 mm) in loose depth for material compacted by hand-operated tampers.
- D. Compaction: Compact each lift of planting soil to 75 percent of maximum Standard Proctor density according to ASTM D 698.
- E. Finish Grading: Grade planting soil to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

ITEM NO. SECTION 329113 – ENGINEERED SOIL PREPARATION

(Continued)

BLENDING PLANTING SOIL IN PLACE

- A. General: Mix amendments with in-place, unamended soil to produce required planting soil. Do not apply materials or till if existing soil or subgrade is frozen, muddy, or excessively wet.
- B. Preparation: Till unamended, existing soil in planting areas to a minimum depth of 4 inches (100 mm). Remove stones larger than 2 inches (50 mm) in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
- C. Mixing: Apply soil amendments, except compost, and fertilizer, if required, evenly on surface, and thoroughly blend them into full depth of unamended, in-place soil to produce planting soil.
 - 1. Mix lime with dry soil before mixing fertilizer.
 - 2. Mix fertilizer with planting soil no more than seven days before planting.
- D. Compaction: Compact blended planting soil to 75 to 82 percent of maximum Standard Proctor density according to ASTM D 698.
- E. Finish Grading: Grade planting soil to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform the following tests and inspections:
 - 1. Owner field Compaction Test: Test planting-soil compaction after placing each lift and at completion using a densitometer or soil-compaction meter calibrated to a reference test value based on laboratory testing according to ASTM D 698. Space tests at no less than one for each 2000 sq. ft. (200 sq. m) of in-place soil or part thereof.
 - 2. Contractor Testing: Material testing to confirm that materials on-site and as delivered comply with specified requirements shall be by Contractor's Soil Testing Laboratory/Agency as additionally specified in Part 1 Article "Quality Assurance".
- C. Soil will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.
- E. Label each sample and test report with the date, location keyed to a site plan or other location system, visible conditions when and where sample was taken, and sampling depth.

ITEM NO. SECTION 329113 – ENGINEERED SOIL PREPARATION

(Continued)

PROTECTION

- A. Protection Zone: Identify protection zones according to Section 015639 "Temporary Tree and Plant Protection."
- B. Protect areas of in-place soil from additional compaction, disturbance, and contamination. Prohibit the following practices within these areas except as required to perform planting operations:
 - 1. Storage of construction materials, debris, or excavated material.
 - 2. Parking vehicles or equipment.
 - 3. Vehicle traffic.
 - 4. Foot traffic.
 - 5. Erection of sheds or structures.
 - 6. Impoundment of water.
 - 7. Excavation or other digging unless otherwise indicated.
- C. If planting soil or subgrade is overcompacted, disturbed, or contaminated by foreign or deleterious materials or liquids, remove the planting soil and contamination; restore the subgrade as directed by Architect and replace contaminated planting soil with new planting soil.

CLEANING

- A. Protect areas adjacent to planting-soil preparation and placement areas from contamination. Keep adjacent paving and construction clean and work area in an orderly condition.
- B. Remove surplus soil and waste material including excess subsoil, unsuitable materials, trash, and debris and legally dispose of them off Owner's property unless otherwise indicated.
 - 1. Dispose of excess subsoil and unsuitable materials on-site where directed by Owner.

END OF SECTION

1. **DESCRIPTION**

Under this item the contractor shall install landscape plantings as shown on the plans.

2. **MATERIALS**

PLANT MATERIAL

- A. General: Furnish nursery-grown plants true to genus, species, variety, and cultivar, stem form, shearing, and other features indicated in Plant List, Plant Schedule, or Plant Legend indicated on Drawings and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

1. Trees with damaged, crooked, or multiple leaders; tight vertical branches where bark is squeezed between two branches or between branch and trunk ("included bark"); crossing trunks; cut-off limbs more than 3/4 inch in diameter; or with stem girdling roots are unacceptable.
2. Collected Stock: Do not use plants harvested from the wild, from native stands, from an established landscape planting, or not grown in a nursery unless otherwise indicated.
3. Provide plants of size Branching Height: For Single-stem trees branching height shall be 7'-0" and not more than 1/2 tree height. Limbing up shall not deform natural form of the tree.
4. Multiple-Stem Trees: Multiple-stem trees with multiple basal or low branched stems, and well-balanced crown, of height and caliper indicated, conforming to ANSI Z60.1 for type of trees required. Unless specified otherwise multiple-stem trees shall have 3 to 5 stems minimum.

5. Depth of Planting: The depth of planting must be checked for all trees being tagged at the nursery. If the root/trunk flare is not visible, the root/trunk (the intersection of the trunk and the buttress roots) must be located. Any tree with significant adventitious root growth or evidence of girdling roots shall be subject to rejection by the Commissioner on a case by case basis. Any soil above the root/trunk flare shall be removed prior to digging. After the removal of any excess soil above the root/trunk flare, the tree shall be hand dug and drum laced.

- B. s, grades, and ball or container sizes complying with ANSI Z60.1 for types and form of plants required. Plants of a larger size may be used if acceptable to Architect, with a proportionate increase in size of roots or balls.
- C. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which begins at root flare according to ANSI Z60.1. Root flare shall be visible before planting.
- D. Labeling: Label each plant of each variety, size, and caliper with a securely attached, waterproof tag bearing legible designation of common name and full scientific name,

ITEM NO. SECTION 329300 – PLANTS

(Continued)

including genus and species. Include nomenclature for hybrid, variety, or cultivar, if applicable for the plant.

- E. If formal arrangements or consecutive order of plants is indicated on Drawings, select stock for uniform height and spread, and number the labels to assure symmetry in planting.
- F. Annuals and Biennials, and Perennials: Provide healthy, disease-free plants of species and variety shown or listed, with well-established root systems reaching to sides of the container to maintain a firm ball, but not with excessive root growth encircling the container. Provide only plants that are acclimated to outdoor conditions before delivery[and that are in bud but not yet in bloom.

FERTALIZERS

- A. Planting Tablets: Tightly compressed chip-type, long-lasting, slow-release, commercial-grade planting fertilizer in tablet form. Tablets shall break down with soil bacteria, converting nutrients into a form that can be absorbed by plant roots.
 - 1. Size: 21-gram tablets.
 - 2. Nutrient Composition: 20 percent nitrogen, 10 percent phosphorous, and 5 percent potassium, by weight plus micronutrients.

MULCHES

- A. Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following:
 - 3. Type: Shredded hardwood or Ground or shredded bark.
 - 4. Size Range: 3 inches maximum, 1/2 inch minimum
 - 5. Color: Natural.
- B. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through a 1-inch sieve; soluble-salt content of [2 to 5] dS/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:
 - 6. Organic Matter Content: 50 to 60 percent of dry weight.
 - 7. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.
- C. If Mineral Mulch selected and approved by the Architect during construction phase: Hard, durable stone, washed free of loam, sand, clay, and other foreign substances, of the following type, size range, and color:
 - 8. Type: Rounded riverbed gravel or smooth-faced stone.
 - 9. Size Range: 1-1/2 inches maximum, 3/4 inch minimum.

10. Color: Uniform tan-beige color range acceptable to Architect.

WEED-CONTROL BARRIERS

- A. Nonwoven Geotextile Filter Fabric: Polypropylene or polyester fabric, 3 oz./sq. yd. (101g/sq. m) minimum, composed of fibers formed into a stable network so that fibers retain their relative position. Fabric shall be inert to biological degradation and resist naturally encountered chemicals, alkalis, and acids.
- B. Composite Fabric: Woven, needle-punched polypropylene substrate bonded to a nonwoven polypropylene fabric, 4.8 oz./sq. yd. .

PESTICIDES

- A. General: Pesticide registered and approved by the EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.
- B. Pre-Emergent Herbicide (Selective and Nonselective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.
- C. Post-Emergent Herbicide (Selective and Nonselective): Effective for controlling weed growth that has already germinated.

TREE-STABILIZATION MATERIAL

- A. Trunk-Stabilization Materials:
 - 1. Upright and Guy Stakes: Rough-sawn, sound, new hardwood, free of knots, holes, cross grain, and other defects, 2-by-2-inch nominal by length indicated, pointed at one end.
 - 2. Wood Deadmen: Timbers measuring 8 inches in diameter and 48 inches long, treated with specified wood pressure-preservative treatment.
 - 3. Flexible Ties: Wide rubber or elastic bands or straps of length required to reach stakes or turnbuckles.
 - 4. Guys and Tie Wires: ASTM A641/A641M, Class 1, galvanized-steel wire, two-strand, twisted, 0.106 inch in diameter.
 - 5. Tree-Tie Webbing: UV-resistant polypropylene or nylon webbing with brass grommets.
 - 6. Guy Cables: Five-strand, 3/16-inch- diameter, galvanized-steel cable, with zinc-coated turnbuckles a minimum of 3 inches long, with two 3/8-inch galvanized eyebolts.
 - 7. Flags: Standard surveyor's plastic flagging tape, white, 6 inches long.
 - 8. Proprietary Staking-and-Guying Devices: Proprietary stake or anchor and adjustable tie systems to secure each new planting by plant stem; sized as indicated and according to manufacturer's written recommendations.

B. Root-Ball Stabilization Materials:

1. Upright Stakes and Horizontal Hold-Down: Rough-sawn, sound, new hardwood or softwood, free of knots, holes, cross grain, and other defects, 2-by-2-inch nominal by length indicated; stakes pointed at one end.
2. Wood Screws: ASME B18.6.1.
3. Proprietary Root-Ball Stabilization Devices: Proprietary at- or below-grade stabilization systems to secure each new planting by root ball and that do not encircle the trunk; sized according to manufacturer's written recommendations unless otherwise indicated.

TREE-WATERING DEVICES

- A. Watering Pipe: PVC pipe 4 inches in diameter, site-cut to length as required, and with snug-fitting removable cap.
- B. Slow-Release Watering Device: Standard product manufactured for drip irrigation of plants and emptying its water contents over an extended time period manufactured from UV-light-stabilized nylon-reinforced polyethylene sheet, PVC, or HDPE plastic.
 1. Color: As selected by Architect from manufacturer's full range.

MISCELLANEOUS PRODUCTS

- A. In this article, insert products such as tree protection devices (tree guards), landscape rock, and planters if not included elsewhere. Coordinate with other Sections to avoid duplication.
- B. Antidesiccant: Water-insoluble emulsion, permeable moisture retarder, film forming, for trees and shrubs. Deliver in original, sealed, and fully labeled containers and mix according to manufacturer's written instructions.
- C. Burlap: Non-synthetic, biodegradable.
- D. Planter Drainage Gravel: Washed, sound crushed stone or gravel complying with ASTM D448 for Size No. 8
- E. Planter Filter Fabric: Nonwoven geotextile manufactured for separation applications and made of polypropylene, polyolefin, or polyester fibers or combination of them.
- F. Mycorrhizal Fungi: Dry, granular inoculant containing at least 5300 spores per lb of vesicular-arbuscular mycorrhizal fungi and 95 million spores per lb of ectomycorrhizal fungi, 33 percent hydrogel, and a maximum of 5.5 percent inert material.

3. METHOD

ITEM NO. SECTION 329300 – PLANTS

(Continued)

COORDINATION

- A. Coordination with Turf Areas (Lawns): Plant trees, shrubs, and other plants after finish grades are established and before planting turf areas unless otherwise indicated.
 - 1. When planting trees, shrubs, and other plants after planting turf areas, protect turf areas, and promptly repair damage caused by planting operations.

ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Plant Materials: Include quantities, sizes, quality, and sources for plant materials.
 - 2. Plant Photographs: Include color photographs in digital and 3- by 5-inch print format of each required species and size of plant material as it will be furnished to Project. Take photographs from an angle depicting true size and condition of the typical plant to be furnished. Include a scale rod or other measuring device in each photograph. For species where more than 20 plants are required, include a minimum of three photographs showing the average plant, the best quality plant, and the worst quality plant to be furnished. Identify each photograph with the full scientific name of the plant, plant size, and name of the growing nursery.
- B. Samples for Verification: For each of the following:
 - 1. Trees and Shrubs: 5 Samples of each variety and size delivered to site for review. Maintain approved Samples on-site as a standard for comparison.
 - 2. Organic Mulch: [1-pint] [1-quart] volume of each organic mulch required; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of color, texture, and organic makeup.
 - 3. Mineral Mulch: 2 lb of each mineral mulch required, in sealed plastic bags labeled with source of mulch. Sample shall be typical of the lot of material to be delivered and installed on-site; provide an accurate indication of color, texture, and makeup of the material.
 - 4. Weed Control Barrier: 12 by 12 inches .
 - 5. Proprietary Root-Ball-Stabilization Device: One unit.
 - 6. Slow-Release, Tree-Watering Device: One unit of each size required.
 - 7. Root Barrier: Width of panel by 12 inches .

INFORMATIONAL SUBMITTALS

- A. Qualification Data: For landscape Installer. Include list of similar projects completed by Installer demonstrating Installer's capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of owners' contact persons.
- B. Product Certificates: For each type of manufactured product, from manufacturer, and complying with the following:

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(Continued)

1. Manufacturer's certified analysis of standard products.
 2. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.
- C. Pesticides and Herbicides: Product label and manufacturer's application instructions specific to Project.
- D. Sample Warranty: For special warranty.

CLOSEOUT SUBMITTALS

- A. Maintenance Data: Recommended procedures to be established by Owner for maintenance of plants during a calendar year. Submit before expiration of required maintenance periods.

QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape installer whose work has resulted in **successful installation and establishment of Bioswales and Parking Lot Landscapes** of a similar type and scale to this project within the last three years.
1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
 2. Experience: Five years' experience in landscape installation in addition to requirements in Section 014000 "Quality Requirements."
 3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
 4. Personnel Certifications: Installer's field supervisor shall have certification in one of the following categories from the Professional Landcare Network:
 - a. Landscape Industry Certified Technician - Exterior.
 - b. Landscape Industry Certified Horticultural Technician.
 5. Pesticide Applicator: State licensed, commercial.
- B. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.
1. Selection of plants purchased under allowances is made by Architect, who tags plants at their place of growth before they are prepared for transplanting.
- C. Measurements: Measure according to ANSI Z60.1. Do not prune to obtain required sizes.
1. Trees and Shrubs: Measure with branches and trunks or canes in their normal position. Take height measurements from or near the top of the root flare for field-grown stock and container-grown stock. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip to tip. Take caliper

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measurements 6 inches above the root flare for trees up to 4-inch caliper size, and 12 inches above the root flare for larger sizes.

2. Other Plants: Measure with stems, petioles, and foliage in their normal position.

- D. Plant Material Observation: Architect may observe plant material either at place of growth or at site before planting for compliance with requirements for genus, species, variety, cultivar, size, and quality. Architect may also observe trees and shrubs further for size and condition of balls and root systems, pests, disease symptoms, injuries, and latent defects and may reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.

1. Notify Architect of sources of planting materials 14 days in advance of delivery to site.

DELIVERY, STORAGE, AND HANDLING

- A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws if applicable.

- B. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Accompany each delivery of bulk materials with appropriate certificates.

- C. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.

- D. Handle planting stock by root ball.

- E. Store bulbs, corms, and tubers in a dry place at 60 to 65 deg F until planting.

- F. Apply antidesiccant to trees and shrubs using power spray to provide an adequate film over trunks (before wrapping), branches, stems, twigs, and foliage to protect during digging, handling, and transportation.

1. If deciduous trees or shrubs are moved in full leaf, spray with antidesiccant at nursery before moving and again two weeks after planting.

- G. Wrap trees and shrubs with burlap fabric over trunks, branches, stems, twigs, and foliage to protect from wind and other damage during digging, handling, and transportation.

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- H. Deliver plants after preparations for planting have been completed, and install immediately. If planting is delayed more than six hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.
 - 1. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
 - 2. Do not remove container-grown stock from containers before time of planting.
 - 3. Water root systems of plants stored on-site deeply and thoroughly with a fine-mist spray. Water as often as necessary to maintain root systems in a moist, but not overly wet condition.

FIELD CONDITIONS

- A. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.
- B. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.
 - 1. Spring Planting:
 - 1) Deciduous trees and shrubs: March 15 to May 1
 - 2) Evergreen trees and shrubs: March 30 to June 1
 - 3) Groundcovers: April 15 to June 15
 - 4) Perennials: after danger of frost between April 15 to June 1
 - 2. Fall Planting:
 - 1) Deciduous trees and shrubs: October 15 to November 30
 - 2) Evergreens trees and shrubs: September 1 to October 1
 - 3) Groundcovers: September 1 to October 15
 - 4) Perennials: September 1 to October 15 or first frost
- C. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements.
- D. The following species are fall planting hazards and shall be planted in the Spring only. Planting at times other than Spring season shall be done at Contractor's risk, and shall not relieve Contractor of the obligation of Warranty/Guarantee obligations.
 - a. Trees:

Betula

Carpinus

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Celtis
Cercidiphyllum
Crataegus
Fagus
Halesia
Koelreuteria
Liquidamber
Liriodendron
Malus
Nyssa
Ostrya
Prunus
Pyrus
Quercus –except Q. palustris
Salix
Sorbus
Styrax
Tilia tomentosa
Ulmus parviflora
Zelkova

SUBSTANTIAL COMPLETION

- A. Contractor shall submit a written request to the Client for a formal inspection of the planting work for Substantial Completion.
- B. At the time of inspection all plant material must be alive, healthy, installed as specified, and show positive signs of strong vigorous growth to be accepted

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(Continued)

- C. All plant material shall be free of disease and pests. All plant material shall be free of broken or damaged limbs & branches.
- D. If plants are dead, dying, unhealthy, not located as per the Contract Documents or approved location of the Client, or if workmanship is unacceptable, written notice will be given to the Contractor in the form of a punch list which itemizes all remedial work required to obtain Substantial Completion.
- E. This work may include plant replacement or guarantee service and must be carried out prior to issuance of the Certificate of Substantial Completion.
- F. Coordinate Substantial Completion with irrigation work.

WARRANTY

Warrant **ALL** planting materials, for the guarantee period of 24 months for all new plant materials and guarantee Service of plantings for 24 months after substantial completion against defects including death and unsatisfactory growth, except for defects resulting from incidents that are beyond Contractor's control. **All material shall be replaced in kind** at no additional cost to the Client.

1. Failures include, but are not limited to, the following:
 - a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner.
 - b. Structural failures including plantings falling or blowing over.
 - c. Faulty performance of **tree stabilization** and other materials beyond normal weathering.
2. At the end of the guarantee period, plant materials shall be healthy, vigorous, and free of pests and disease. Plant materials shall be free of dead and dying branches and branch tips and shall bear foliage of normal density, size, and color for the species.
3. During the guarantee period, the contractor will maintain all plant materials as specified herein, and as noted in the approved guarantee \$service schedule, and will replace, at no additional cost to the Client, any and all plant material which has died or which is, in the opinion of the Client, in unhealthy or unsightly condition. The meadow will be replaced, including re-doing the initial site preparation, if it has been overtaken with weeds.
4. There will be no limit to the number of times replacements are made of individual plants.
5. Guarantee all replaced material for a period of 24 months after the date of replacement.
6. Approximately one month prior to the expiration of the guarantee period, the Contractor shall arrange a site inspection by the Client.
 - a. At this time the Contractor will prepare a list of all remedial work required,

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- including plant replacement or guarantee service, to be approved by Client.
- b. This work shall be carried out before the end of the guarantee period, unless weather conditions cause delays, in which case such work shall be carried out as soon as is practical.
7. If replacement plantings are required, there will be a final inspection at the end of the guarantee period for the plant replacements, to be coordinated with the Client.
7. Prior to end of Guarantee period, the Contractor shall include the following remedial actions as a minimum:
- a. Remove all tree staking and support.
 - b. Rake out any plant saucers, unless directed by Client.
 - c. All trees that are leaning shall be straightened.
 - d. Remove and replace dead planting materials immediately unless required to plant in the succeeding planting season due to weather.
 - e. Replace planting materials that are more than 25% dead or in an unhealthy condition at the end of the guarantee period.
 - f. Replace trees having lost their central leader or exhibit crown dieback at the end of the guarantee period.
 - g. Replace plants in kind with previously tagged specimens.
 - h. Replacement plant materials shall closely match adjacent specimens of the same species and subject to the all requirements in this Specification. All areas damaged or soiled by replacement planting operations are to be fully restored to their original condition at no additional cost to the Client
 - i. There shall be no limit of replacement of each plant material, in the case of failure during the guarantee period.
- J. If settlement has occurred, reset the grades in the planting areas to the final grades shown on the grading plans of the Contract Documents
8. At the end of the guarantee period the Contractor shall remove all tree wraps, ties, stakes, and guying wires from the trees and the site. Tree wraps should not be on the tree trunks during the active growing season. The guarantee shall expire only when all requirements of the section have been met.
9. All of the materials and labor required for guarantee service and replacements during the guarantee period shall be included in the Contractor's bid price.

PLANT SERVICE

- A. Maintenance service of all plant material shall begin immediately after plant installation, and shall continue for 24 months after the date of Substantial Completion. Maintenance Data: Recommended procedures to be coordinated with/ or established by Owner for maintenance of plants during a calendar year.
- B. Guarantee service shall include, but not limited to the following:
 - 1. Maintain all plant material by pruning, cultivating, mulching, regular watering, removal of dead material, furnishing and applying such sprays

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as are necessary to keep plantings free of insects and disease, weeding, fertilizing, tightening and repairing stakes and guy supports, and resetting to proper grades or vertical position, as required to establish healthy, viable plantings. Restore or replace damaged tree wrappings. Planting areas shall be kept free of weeds, grass, and other undesirable vegetative growth.

2. Coordinate with irrigation system installer for all adjustments to irrigation as required.
3. Defective work shall be corrected as soon as possible after it becomes apparent and the weather season permits. The Client shall be the sole judge of the condition of the plants.

FINAL ACCEPTANCE

- A. Following the completion of all remedial work and replacement plantings, the Contractor shall request the Client in writing for a formal inspection of the landscape work for Final Acceptance. The request shall be received 10 calendar days before the anticipated date for final inspection.
 1. If replacement plantings are required, Final Acceptance will be provisional upon a final inspection at the end of the Guarantee period for the plant replacements.

EXAMINATION

- A. Examine areas to receive plants, with Installer present, for compliance with requirements and conditions affecting installation and performance of the Work.
 1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
 2. Verify that plants and vehicles loaded with plants can travel to planting locations with adequate overhead clearance.
 3. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
 4. Uniformly moisten excessively dry soil that is not workable or which is dusty.
- B. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

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PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.
- B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
- C. Lay out individual tree and shrub locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested, and obtain Architect's acceptance of layout before excavating or planting. Make minor adjustments as required.
- D. Lay out plants at locations directed by Architect. Stake locations of individual trees and shrubs and outline areas for multiple plantings.

PLANTING AREA ESTABLISHMENT

- A. General: Prepare planting area for soil placement and mix planting soil according to Section 329113 "Soil Preparation".
- B. Placing Planting Soil: Place and mix planting soil in-place over exposed subgrade.
- C. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.
- D. Application of Mycorrhizal Fungi: At time directed by Architect, broadcast dry product uniformly over prepared soil at application rate according to manufacturer's written recommendations.

EXCAVATION FOR TREES AND SHRUBS

- A. Planting Pits and Trenches: Excavate circular planting pits.
 - 1. Excavate planting pits with sides sloping inward at a 45-degree angle. Excavations with vertical sides are unacceptable. Trim perimeter of bottom leaving center area of bottom raised slightly to support root ball and assist in drainage away from center. Do not further disturb base. Ensure that root ball will sit on undisturbed base soil to prevent settling. Scarify sides of planting pit smeared or smoothed during excavation.
 - 2. Excavate approximately three times as wide as ball diameter for balled and burlapped or container-grown stock.
 - 3. Excavate at least 12 inches wider than root spread and deep enough to accommodate vertical roots for bare-root stock.
 - 4. Do not excavate deeper than depth of the root ball, measured from the root flare to the bottom of the root ball.
 - 5. If area under the plant was initially dug too deep, add soil to raise it to the correct level and thoroughly tamp the added soil to prevent settling.

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6. Maintain angles of repose of adjacent materials to ensure stability. Do not excavate subgrades of adjacent paving, structures, hardscapes, or other new or existing improvements.
 7. Maintain supervision of excavations during working hours.
 8. Keep excavations covered or otherwise protected after working hours.
 9. If drain tile is indicated on Drawings or required under planting areas, excavate to top of porous backfill over tile.
- B. Backfill Soil: Subsoil and topsoil removed from excavations may not be used as backfill soil unless otherwise indicated.
- C. Obstructions: Notify Architect if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.
1. Hardpan Layer: Drill 6-inch- diameter holes, 24 inches apart, into free-draining strata or to a depth of 10 feet , whichever is less, and backfill with free-draining material.
- D. Drainage: Notify Architect if subsoil conditions evidence unexpected water seepage or retention in tree or shrub planting pits.
- E. Fill excavations with water and allow to percolate away before positioning trees and shrubs.

TREE, SHRUB, AND VINE PLANTING

- A. Inspection: At time of planting, verify that root flare is visible at top of root ball according to ANSI Z60.1. If root flare is not visible, remove soil in a level manner from the root ball to where the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements.
- B. Roots: Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.
- C. Balled and Burlapped Stock: Set each plant plumb and in center of planting pit or trench with root flare 2 inches above adjacent finish grades.
1. Backfill: Install only those new soils that have been sampled, tested and approved by the Architect or excavated soil material that has been properly identified, separated and approved by the Architect for reuse.
 2. After placing some backfill around root ball to stabilize plant, carefully cut and remove burlap, rope, and wire baskets from tops of root balls and from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
 3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
 4. Place planting tablets equally distributed around each planting pit when pit is approximately one-half filled. Place tablets beside the root ball about 1 inch (25 mm) from root tips; do not place tablets in bottom of the hole.

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- a. Quantity: Per manufacturer's recommendations.
- 5. Continue backfilling process. Water again after placing and tamping final layer of soil.
- D. Balled and Potted, and Container-Grown Stock: Set each plant plumb and in center of planting pit or trench.
 - 1. Backfill: Planting soil at the same grade relative to finish grade of tree location to that at which the plant was grown. Allow for settlement.
 - 2. Carefully remove root ball from container without damaging root ball or plant.
 - 3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
 - 4. Place planting tablets equally distributed around each planting pit when pit is approximately one-half filled. Place tablets beside the root ball about 1 inch (25 mm) from root tips; do not place tablets in bottom of the hole.
- a. Quantity: Per manufacturer's recommendations
- 5. Continue backfilling process. Water again after placing and tamping final layer of soil.
- E. Watering Pipe: During backfilling, install watering pipe 4 feet deep into the planting pit outside the root ball with top of pipe 1 inch above the mulched surface.
- F. Slopes: When planting on slopes, set the plant so the root flare on the uphill side is flush with the surrounding soil on the slope; the edge of the root ball on the downhill side will be above the surrounding soil. Apply enough soil to cover the downhill side of the root ball.

TREE, SHRUB, AND VINE PRUNING

- A. Remove only dead, dying, or broken branches. Do not prune for shape.
- B. Prune, thin, and shape trees, shrubs, and vines as directed by Architect.
- C. Prune, thin, and shape trees, shrubs, and vines according to standard professional horticultural and arboricultural practices. Unless otherwise indicated by Architect, do not cut tree leaders; remove only injured, dying, or dead branches from trees and shrubs; and prune to retain natural character.
- D. Do not apply pruning paint to wounds.

TREE STABILIZATION

- A. Trunk Stabilization by Upright Staking and Tying: Install trunk stabilization as follows unless otherwise indicated:

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1. Upright Staking and Tying: Stake trees of 2- through 5-inch caliper. Stake trees of less than 2-inch caliper only as required to prevent wind tip out. Use a minimum of two stakes of length required to penetrate at least 18 inches below bottom of backfilled excavation and to extend indicated on Drawings[at least 72 inches above grade. Set vertical stakes and space to avoid penetrating root balls or root masses.
 2. Upright Staking and Tying: Stake trees with two stakes for trees up to 12 feet high and 2-1/2 inches or less in caliper; three stakes for trees less than 14 feet high and up to 4 inches in caliper. Space stakes equally around trees.
 3. Support trees with bands of flexible ties at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree.
 4. Support trees with two strands of tie wire, connected to the brass grommets of tree-tie webbing at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree.
- B. Trunk Stabilization by Staking and Guying: Install trunk stabilization as follows unless otherwise indicated on Drawings. Stake and guy trees more than 14 feet in height and more than 3 inches in caliper unless otherwise indicated.
1. Site-Fabricated, Staking-and-Guying Method: Install no fewer than three guys spaced equally around tree.
 - a. Securely attach guys to stakes 30 inches long, driven to grade. Adjust spacing to avoid penetrating root balls or root masses. Provide turnbuckle or compression spring for each guy wire and tighten securely.
 - b. For trees more than [6 inches in caliper] anchor guys to wood deadmen buried at least 36 inches below grade. Provide turnbuckle or compression spring for each guy wire and tighten securely.
 - c. Support trees with bands of flexible ties at contact points with tree trunk and reaching to turnbuckle or compression spring. Allow enough slack to avoid rigid restraint of tree.
 - d. Support trees with [guy cable] [or] [multiple strands of tie wire], connected to the brass grommets of tree-tie webbing at contact points with tree trunk and reaching to [turnbuckle] or [compression spring]. Allow enough slack to avoid rigid restraint of tree.
 - e. Attach flags to each guy wire, 30 inches above finish grade.
 - f. Paint turnbuckles or compression springs with luminescent white paint.
 2. Proprietary Staking and Guying Device: Install staking and guying system sized and positioned as recommended by manufacturer unless otherwise indicated and according to manufacturer's written instructions.
- C. Root-Ball Stabilization: Install at- or below-grade stabilization system to secure each new planting by the root ball unless otherwise indicated.
1. Wood Hold-Down Method: Place vertical stakes against side of root ball and drive them into subsoil; place horizontal wood hold-down stake across top of root ball and screw at each end to one of the vertical stakes.
 - a. Install stakes of length required to penetrate at least to the dimension indicated on Drawings below bottom of backfilled excavation. Saw stakes off at horizontal stake.

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- b. Install screws through horizontal hold-down and penetrating at least 1 inch into stakes. Predrill holes if necessary to prevent splitting wood.
 - c. Install second set of stakes on other side of root trunk for larger trees.
 - 2. Proprietary Root-Ball Stabilization Device: Install root-ball stabilization system sized and positioned as recommended by manufacturer unless otherwise indicated and according to manufacturer's written instructions.
- D. Palm Bracing: Install bracing system at three or more places equally spaced around perimeter of trunk to secure each palm until established unless otherwise indicated.
- 1. Site-Fabricated Palm-Bracing Method:
 - a. Place battens over padding and secure battens in place around trunk perimeter with at least two straps, tightened to prevent displacement. Ensure that straps do not contact trunk.
 - b. Place diagonal braces and cut to length. Secure upper ends of diagonal braces with galvanized nails into battens or into nail-attached blocks on battens. Do not drive nails, screws, or other securing devices into palm trunk; do not penetrate palm trunk in any fashion. Secure lower ends of diagonal braces with stakes driven into ground to prevent outward slippage of braces.
 - 2. Proprietary Palm-Bracing Device: Install palm-bracing system sized and positioned as recommended by manufacturer unless otherwise indicated and according to manufacturer's written instructions.

ROOT-BARRIER INSTALLATION

- A. Install root barrier where trees are planted within 48 inches of paving or other hardscape elements, such as walls, curbs, and walkways, unless otherwise indicated on Drawings.
- B. Align root barrier vertically and run it linearly along and adjacent to the paving or other hardscape elements to be protected from invasive roots.
- C. Install root barrier continuously for a distance of 60 inches in each direction from the tree trunk, for a total distance of 10 feet per tree. If trees are spaced closer, use a single continuous piece of root barrier.
 - 1. Position top of root barrier according to manufacturer's written recommendations.
 - 2. Overlap root barrier a minimum of 12 inches at joints.
 - 3. Do not distort or bend root barrier during construction activities.
 - 4. Do not install root barrier surrounding the root ball of tree.

GROUND COVER AND PLANT PLANTING

- A. Set out and space ground cover and plants other than trees, shrubs, and vines as indicated on Drawings in even rows with triangular spacing.
- B. Use planting soil for backfill.

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- C. Dig holes large enough to allow spreading of roots.
- D. For rooted cutting plants supplied in flats, plant each in a manner that minimally disturbs the root system but to a depth not less than two nodes.
- E. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.
- F. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.
- G. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

PLANTING AREA MULCHING

- A. Install weed-control barriers before mulching according to manufacturer's written instructions. Completely cover area to be mulched, overlapping edges a minimum of **12 inches** and secure seams with galvanized pins.
- B. Mulch backfilled surfaces of planting areas and other areas indicated.
 - 1. Trees and Treelike Shrubs in Turf Areas: Apply organic (unless otherwise noted on plans) mulch ring of 2-inch average thickness, with 12-inch radius around trunks or stems. Do not place mulch within [3 inches] of trunks or stems.
 - 2. Organic Mulch in Planting Areas: Apply 2-inch average thickness of organic mulch [extending 12 inches beyond edge of individual planting pit or trench and over whole surface of planting area, and finish level with adjacent finish grades. Do not place mulch within 3 inches of trunks or stems.
 - 3. Mineral Mulch in Planting Areas: Apply 2-inch average thickness of mineral mulch [extending 12 inches beyond edge of individual planting pit or trench] [and] [over whole surface of planting area], and finish level with adjacent finish grades. Do not place mulch within 6 inches of trunks or stems.

INSTALLING SLOW-RELEASE WATERING DEVICE

- A. Provide one device for each tree.
- B. Place device on top of the mulch at base of tree stem and fill with water according to manufacturer's written instructions.

PLANT MAINTENANCE

- A. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, adjusting and repairing tree-stabilization devices, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings.

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- B. Fill in, as necessary, soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.
- C. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use integrated pest management practices when possible to minimize use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.
- D. Refer to Article 1.17.

PESTICIDE APPLICATION

- A. Apply pesticides and other chemical products and biological control agents according to authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.
- B. Pre-Emergent Herbicides (Selective and Nonselective): Apply to tree, shrub, and ground-cover areas according to manufacturer's written recommendations. Do not apply to seeded areas.
- C. Post-Emergent Herbicides (Selective and Nonselective): Apply only as necessary to treat already-germinated weeds and according to manufacturer's written recommendations.

CLEANING AND PROTECTION

- A. During planting, keep adjacent paving and construction clean and work area in an orderly condition. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.
- B. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off Owner's property.
- C. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.
- D. After installation and before Substantial completion remove nursery tags, nursery stakes, tie tape, labels, wire, burlap, and other debris from plant material, planting areas, and Project site.
- E. At time of Substantial Completion, verify that tree-watering devices are in good working order and leave them in place. Replace improperly functioning devices.

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MAINTENANCE SERVICE

- A. Maintenance Service for Trees and Shrubs: Provide maintenance by skilled employees of landscape Installer. Maintain as required in "Plant Maintenance" Article. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established, but for not less than maintenance period below:
 - 1. Maintenance Period: 24 months from date of Substantial Completion.
- B. Maintenance Service for Ground Cover and Other Plants: Provide maintenance by skilled employees of landscape Installer. Maintain as required in "Plant Maintenance" Article. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established, but for not less than maintenance period below:
 - 1. Maintenance Period: 24 months from date of Substantial Completion.

END OF SECTION

ITEM NO. 570 – METAL (FENCING AND RAILING)

1. **DESCRIPTION**

Under this item the Contractor shall install metal fencing of the style specified, where shown on the plans.

2. **MATERIALS**

Structural Performance: Design, engineer, fabricate, and install the following metal fabrications to withstand not less than the following structural loads without exceeding the allowable design working stress of the materials involved, including anchors and connections as per Section BC 1607.7 of the 2014 NYC Building Code. Apply each load to produce the maximum stress in each respective component of each metal fabrication. In cases where local requirements are more stringent they shall apply. Where railings support fixtures or other imposed loads, allowance shall be made for the additional loads.

Lightning-Protection System: Maximum grounding-resistance value of 25 ohms under normal dry conditions.

Steel and Iron:

- A. Bars: Hot-rolled, carbon steel complying with ASTM A29/A29M, Grade 1010.
- B. Steel rods: ASTM A108
- C. Plates, Shapes, and Bars: ASTM A36/A36M.
- D. Cast Iron: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M unless otherwise indicated.
- E. Steel Sheet, Cold Rolled: ASTM A1008/A1008M, either commercial steel or structural steel, exposed.

Decorative Steel Fences: Fences made from solid steel bars and shapes. Unless indicated on plans the following sizes will be used.

- A. Posts: Square steel bar.
 - 1. Line Posts - Solid: 1-3/4 by 1-3/4 inches square steel bar
 - 2. End and Corner Posts - Solid: 1-3/4 by 1-3/4 inches square steel bar.
- B. Rails:
 - 1. Square steel bar: 1-3/4 inches by 1/2 inches solid bar.
- C. Pickets: 3/4-inch- square solid steel bar
 - 1. Terminate tops of pickets at top rail for flush top appearance
 - 2. Picket Spacing: 3-3/4 inches clear opening, maximum.

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(Continued)

- D. Fasteners: Stainless-steel carriage bolts and tamperproof nuts.
- E. Fabrication: Assemble fences into sections by welding pickets to rails.
 - 1. Fabricate sections with clips welded to rails for field fastening to posts.
 - 2. Drill posts and clips for fasteners before finishing to maximum extent possible.
- F. Fabrication: Fabricate bar grating infill into sections of size indicated.
 - 1. Fabricate rails with clips welded to rails for field fastening to posts.
 - 2. Drill posts and bar grating for fasteners before finishing to maximum extent possible.
- G. Finish exposed welds to comply with NOMMA Guideline 1, Finish #4 - good-quality, uniform undressed weld with minimal splatter.
- H. Finish for Bar Grating Infill: Powder coating.
- I. Finish for Steel Items: Primed and Shop painted.

Coating Materials

- A. Shop Primers for Steel: Provide primers that comply with Section 099113 "Exterior Painting."
- B. Shop Primer for Steel: Manufacturer's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.
- C. Epoxy Zinc-Rich Primer for Uncoated Steel: Complying with MPI #20 and compatible with coating specified to be applied over it.

Miscellaneous Materials

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Concrete: Normal-weight, air-entrained, ready-mix concrete complying with requirements in Section 033000 "Cast-in-Place Concrete" with a minimum 28-day compressive strength of 3000 psi, 3-inch slump, and 1-inch maximum aggregate size or dry, packaged, normal-weight concrete mix complying with ASTM C387/C387M mixed with potable water according to manufacturer's written instructions].
- C. Nonshrink Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M and specifically recommended by manufacturer for exterior applications.

Grounding Materials

- A. Comply with requirements of Section 260526 "Grounding and Bonding for Electrical Systems."

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(Continued)

- B. Grounding Conductors: Size as indicated on Drawings. Bare, solid wire for No. 6 AWG and smaller; stranded wire for No. 4 AWG and larger.
 - 1. Material above Finished Grade: Copper.
 - 2. Material on or below Finished Grade: Copper.
 - 3. Bonding Jumpers: Braided copper tape, 1-5/8 inch wide and 1/16 inch thick, woven of No. 30 AWG bare copper wire, terminated with copper ferrules.
- C. Grounding Connectors and Grounding Rods: Comply with UL 467.
 - 1. Connectors for Below-Grade Use: Exothermic-welded type.
 - 2. Grounding Rods: Copper-clad steel.
 - a. Size: 5/8 by 96 inches .

Steel Finishes

- A. Surface Preparation: Clean surfaces according to SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning." After cleaning, apply a conversion coating compatible with the organic coating to be applied over it.
- B. Powder Coating: Immediately after cleaning, apply manufacturer's standard two-coat finish consisting of epoxy primer and TGIC polyester topcoat to a minimum total dry film thickness of not less than 8 mils . Comply with coating manufacturer's written instructions.
 - 1. Color and Gloss: As selected by Architect from manufacturer's full range during construction.
- C. Primer Application: Apply zinc-rich epoxy primer immediately after cleaning, to provide a minimum dry film thickness of 2 mils per applied coat, to surfaces that are exposed after assembly and installation, and to concealed surfaces.
- D. Shop-Painted Finish: Comply with Section 099113 "Exterior Painting."
- E. High-Performance Coating: Apply intermediate and polyurethane topcoats to prime-coated surfaces. Comply with coating manufacturer's written instructions and with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Apply at spreading rates recommended by coating manufacturer.
 - 1. Match approved Samples for color, texture, and coverage. Remove and refinish, or recoat work that does not comply with specified requirements.

Grout and anchoring cement

- F. Nonshrink Metallic Grout: Premixed, factory-packaged, ferrous aggregate grout complying with Federal Specification CE CRD-C 621 or ASTM C1107 specifically recommended by manufacturer for heavy-duty loading applications of type specified in this section.

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(Continued)

- G. Nonshrink Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, non-gaseous grout complying with Federal Specification CE CRD-C 621 or ASTM C1107. Provide grout specifically recommended by manufacturer for interior and exterior applications of type specified in this section. .
- H. Erosion-Resistant Anchoring Cement: Factory-prepackaged, nonshrink, nonstaining, hydraulic controlled expansion cement formulation for mixing with water at project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without need for protection by a sealer or waterproof coating and is recommended for exterior use by manufacturer.
- I. Products: Subject to compliance with requirements, provide one of the following (or approved equal):
 - 1. Nonshrink Metallic Grouts:
 - “Hi Flow Grout”, Euclid Chemical Co.
 - “Masterflo 885 and Embeco 636”, Master Builders
 - “Met-Ox”, ChemMasters Specialty Construction Products
 - 2. Nonshrink Nonmetallic Grouts:
 - “NS Grout”, Euclid Chemical Co.
 - “Crystex”, L & M Construction Chemicals, Inc.
 - “Masterflow 713”, Master Builders
 - “Five Star Grout”, Five Star

3. **METHOD**

Coordination

- A. Coordinate installation of anchorages for decorative metal items. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

Examination

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of decorative metal.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

Action Submittals

- A. Product Data: For each type of product.
- B. Shop Drawings: For fencing and gates.
 - 1. Include plans, elevations, sections, post spacing, and mounting attachment details, and grounding details.
- C. Samples: For each fence material and for each color specified.

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(Continued)

1. Provide Samples [12 inches] in length for linear materials.
2. Provide Samples [12 inches] square for bar grating

Information Submittals

- A. Field quality-control reports.
- B. Product Test Reports: For decorative metallic-coated-steel picket fences, including finish, indicating compliance with referenced standard and other specified requirements.
- C. Mill Certificates: Signed by manufacturers of stainless-steel certifying that products furnished comply with requirements.
- D. Welding certificates.

Closeout Submittals

- A. Maintenance Data: For gate operators to include in maintenance manuals.

Quality Assurance

- A. Installer Qualifications: Fabricator of products.
- B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
 1. Include 10-foot length of fence complying with requirements.
 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

Installation, General

- A. Iron Fences and Railings
 1. Provide where indicated on Drawings iron railings, fences, and gates constructed in accordance with the Drawings and Specifications, and as required to support structural loads. Rail systems, including guardrail systems, handrail systems, and infill, shall meet or exceed requirements for structural performance described in Article titled "System Performance Requirements". Materials of fences and railings: medium steel, shapes as indicated on the Drawings.
 2. Posts and braces shall be set in anchoring grout into cast-iron shoes, which shall be embedded in the concrete pavements or blocks. Members shall be centered in sleeve to provide uniform thickness of grout around member. Top 1/2" of material in sleeve is to be polyurethane sealant, pitched to shed water.
 3. Provide galvanizing and finish paint.
- B. Provide anchorage devices and fasteners where needed to secure decorative metal to in-place construction.
- C. Perform cutting, drilling, and fitting required to install decorative metal. Set products accurately in location, alignment, and elevation, measured from established lines and

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(Continued)

levels. Provide temporary bracing or anchors in formwork for items to be built into concrete, masonry, or similar construction.

- D. Fit exposed connections accurately together to form tight, hairline joints or, where indicated, uniform reveals and spaces for sealants and joint fillers. Where cutting, welding, and grinding are required for proper shop fitting and jointing of decorative metal, restore finishes to eliminate evidence of such corrective work.
- E. Do not cut or abrade finishes that cannot be completely restored in the field. Return items with such finishes to the shop for required alterations, followed by complete refinishing, or provide new units as required.
- F. Install concealed gaskets, joint fillers, insulation, and flashings as work progresses.
- G. Restore protective coverings that have been damaged during shipment or installation. Remove protective coverings only when there is no possibility of damage from other work yet to be performed at same location.
 - 1. Retain protective coverings intact; remove coverings simultaneously from similarly finished items to preclude nonuniform oxidation and discoloration.
- H. Field Welding: Comply with applicable AWS specification for procedures of manual shielded metal arc welding and requirements for welding and for finishing welded connections in "Fabrication, General" Article. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.
- I. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
 - 1. Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

Delivery, Storage, and Handling

- A. Store decorative metal in a well-ventilated area, away from uncured concrete and masonry, and protected from weather, moisture, soiling, abrasion, extreme temperatures, and humidity.
- B. Deliver and store cast-metal products in wooden crates surrounded by enough packing material to ensure that products are not cracked or otherwise damaged.
- C. Tag all items to agree with shop drawing designations.
- D. Replace damaged items, with the approval of the Project Architect, and at no additional cost to the Client.

Field Conditions

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with decorative metal by field measurements before fabrication and indicate measurements on Shop Drawings.

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(Continued)

- B. Interface With Other Systems: Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchors, including concrete inserts, sleeves, anchor bolts and miscellaneous items having integral anchors, which will be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.
- C. Coordinate with other trades in scheduling delivery and installation.

Cleaning and Protection

- A. Unless otherwise indicated, clean metals by washing thoroughly with clean water and soap, rinsing with clean water, and drying with soft cloths.
- B. Clean copper alloys according to metal finisher's written instructions in a manner that leaves an undamaged and uniform finish matching approved Sample.
- C. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- D. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099113 "Exterior Painting"
- E. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.
- F. Protect finishes of decorative metal from damage during construction period with temporary protective coverings approved by decorative metal fabricator. Remove protective covering at time of Substantial Completion.
- G. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

4. **METHOD OF MEASUREMENT**

The quantity to be paid for under this item shall be the number of linear feet of fence.

5. **BASIS OF PAYMENT**

The bid price per linear foot shall include the cost of all labor, materials, equipment and other incidentals required to complete the work as specified or indicated.

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(Continued)

END OF SECTION

DESCRIPTION

This work shall consist of preparing, maintaining and submitting a Progress Schedule using the Critical Path Method on Oracle-Primavera P6 software which demonstrates complete fulfillment of all work shown in the contract documents. All work to prepare and maintain the CPM Progress Schedule shall be performed using the scheduling software application. The Contractor shall regularly revise and update the Progress Schedule, and use it in planning, coordinating and performing all work. Schedule activities shall accurately depict the entire scope of work to be performed to complete the project including, but not limited to, all work to be performed by the Contractor, subcontractors, fabricators, suppliers, consultants, the Department, and others, contributing to the project. In preparing and maintaining the Progress Schedule, the Contractor shall take into account submittal requirements and proper submittal review times, coordination of submittals by subcontractors for fabricating and delivering materials and equipment, availability and abilities of workers, availability of construction equipment, weather conditions and site specific restrictions in operations.

DEFINITIONS

Activity - A discrete, identifiable task or event that usually has an expected duration, has a definable Start Date and/or Finish Date, and can be used to plan, schedule, and monitor a project.

Activity, Controlling - The first incomplete activity on the critical path.

Activity, Critical - An activity on the critical path.

Actual Start date- At the activity level, the Actual Start date represents the point in time that meaningful work actually started on an activity.

Actual Finish date - At the activity level, the Actual Finish date represents the point in time that work actually ended on an activity (Note: in some applications areas, the activity is considered “finished” when work is “substantially complete.”)

Backward Pass – Calculation of the late start and late finish dates for each activity, based on the start or finish dates of successor activities as well as the duration of the activity itself. It is also known as the second pass.

Baseline Progress Schedule - The Progress Schedule submitted by the Contractor and accepted by the Department that shows the plan to complete the construction contract work. The Baseline Progress Schedule represents the Contractor’s plan at the time of Contract Award or Notice to Proceed for completing the project.

Bid Date – The date the contract is let and there is an announcement by the Department of an apparent low bidder.

Completion Date, Contract - The date specified in the Notice To Proceed (NTP) letter for completion of the project or a revised date resulting from properly executed time extensions.

Anticipated Completion Date - The date forecasted by the Progress Schedule for the completion of the contract work.

Constraint - A schedule restriction imposed on the Start or Finish date(s) of an activity that modifies or overrides an activity's relationships.

Contemporaneous Period Analysis Method – A technique for evaluating schedule delays or time savings. The analysis period for the purpose of these provisions shall be the period covered in each regular progress update to the schedule, as they coincide with contract payments to the Contractor.

Contractor's First Day of Work - The day of the Contractor's first day of work which is Notice To Proceed (NTP)

Contractor's Last Day of Work - The Contractor's last day of work which is Contract Completion date.

Contractor Work Day - A calendar day scheduled for active prosecution of the work.

County Work days – Monday through Friday, with the exception of Holidays listed below. Days scheduled for the active prosecution of work activities by NC staff or NC's representatives.

Critical Path – In the Progress Schedule the critical activities shall be those activities being on the longest path. In a project network diagram, it is the series of activities which determines the earliest completion of the project.

Critical Delay - An event, action, or other factor that delays the critical path of the Progress Schedule and extends the time needed for completion of the construction project.

Critical Path Method (CPM) – A network analysis technique used to predict project duration by analyzing which sequence of activities (which path) has the least amount of scheduling flexibility (the least amount of float). A scheduling technique utilizing activities, durations, and interrelationships/dependencies (logic), such that all activities are interrelated with logic ties from the beginning of the project to the completion of the project. Early dates are calculated by means of a forward pass using a specified start date. Late dates are calculated by means of a backward pass starting from a specified completion date (usually the forward pass's calculated project early finish date).

Data Date – The date entered in the Project Details, in the Dates tab, which is used as the starting point to calculate the schedule. Everything occurring earlier than the data date is "as-built" and everything on or after the data date is "planned."

Deliverable – Any measurable, tangible, verifiable outcome, result, or item that must be produced to complete a project or part of a project. Often used more narrowly in reference to an external deliverable, which is a deliverable that is subject to approval by the Department.

Draft Baseline Progress Schedule – An optional schedule submission that reflects an outline of the schedule format and content proposed by the Contractor's Project Scheduler to comply with the schedule provisions in the contract to solicit early comments by the Engineer, prior to the submittal of complete Baseline Progress Schedule.

Duration, Original - The original estimated number of working days (not including holidays or other nonworking periods) in which the work task associated with the activity is expected to be performed. (The

number of calendar days may be different based on the calendar assigned to the activity.) For certain activities such as concrete curing, or others approved by the Engineer, the calendar shall reflect no non-working days.

Duration, Remaining - The estimated time, expressed in working days (not including holidays or other nonworking periods), needed to complete an activity that has started but has not finished.

Early Completion Schedule - A progress schedule will be considered an early completion schedule when the schedule submitted by the Contractor indicates a completion date that is earlier than the specified contract completion date, or the Finish date of any interim Milestone work activity is earlier than the date specified in the contract. This includes, but is not limited to, B-Clock activities, activities subject to Incentive/Disincentive provisions, and/or specific Liquidated Damages provisions, and Lane Rental activities.

Final Baseline Progress Schedule - The original plan against which the Contractor's progress is measured. The Final Baseline Progress Schedule represents the original plan at the award of the contract, of what is expected to happen. Once the Final Baseline Progress Schedule is accepted by the Engineer it is saved and used as a basis to compare against Progress Schedules Updates.

Float Suppression - Utilization of zero free float constraints which allows an activity to start as late as possible by using all of its' available free float. This technique allows activities to appear more critical than if the activity's total float was based on early dates. Assigning zero free float prevents true sharing of total float between Department and the Contractor. Utilization of overly generous activity durations and overly restrictive calendar non-working periods are also considered to cause float suppression.

Float, Free - The amount an activity can slip without delaying the immediate successor activities. Free Float is the property of an activity and not the network path.

Float, Total - The amount of time an activity (or chain of activities) can be delayed from its early start without delaying the contract completion date. Float is a mathematical calculation and can change as the project progresses and changes are made to the project plan. Total Float is calculated and reported for each activity in a network, however, Total Float is an attribute of a network path and not associated with any one specific activity along that path.

Fragnet – A subdivision of a project network diagram usually representing some portion of the project.

Global data – Data classified by Oracle-Primavera software as Global, including Project Codes, Global Activity Codes, Global Calendars, Resource Calendars, Global Filters, Resources, Global Reports, User Defined Fields and Unit of Measure.

Key Plans - Key Plans are graphic representations made by the Contractor's Project Scheduler on paper copies of the appropriate contract plan sheets that reflect the Contractor's planned breakdown of the project for scheduling purposes to efficiently communicate the Contractor's activity coding scheme to County scheduling staff. The key plans prepared by the Contractor shall clearly define the boundaries of the work for each designated Area, the operations contained in various Stages of work, and work in the Work Zone Traffic Control (WZTC) Phases. The alphanumeric codes on the key plans shall match the code values for the activity code "Area", "Stage", and "WZTC Phase" in the Progress Schedule.

Longest Path - The sequence of activities through the Progress Schedule network that establishes the Scheduled Completion Date

Look-Ahead Schedule – A three week time segment generated from the accepted Progress Schedule that shows the actual work progressed during the previous one week and forecasts the work planned for next two week

period following the Data Date, and includes any major materials to be delivered and any lane closings or anticipated shifts in WZTC.

Milestone – An activity with zero duration that typically represents a significant event, usually the beginning and end of the project, milestones set forth in the contract proposal, construction stages, a major work package, or the contract interim time-related clauses.

Monthly Status Report – The report generated monthly from the updated Progress Schedule in an electronic Adobe Acrobat PDF format that reflects a Data Date for that Progress Schedule Update period. The report shall be formatted to fit ANSI Size D paper (610 mm x 914 mm) (24 inch x 36 inch), listing all work activities from the data date to contract completion, using the NYSDOT Status Report Layout or as ordered by the Engineer, sorted by Early Start Date, Total Float in increasing order, showing the Activity ID, Activity Description, Original Duration, Remaining Duration, Total Float, Early Start date, Early Finish date, Start date, Finish date and Calendar ID.

Narrative Report - A descriptive report submitted with each Progress Schedule. The required contents of this report are set forth in this specification.

Open End - The condition that exists when an activity has either no predecessor or no successor, or when an activity's only predecessor relationship is a finish-to-finish relationship or only successor relationship is a start-to-start relationship.

Predecessor - An activity that is defined by Schedule logic to precede another activity. A predecessor may control the Start Date or Finish Date of its successor.

Progress Schedule – A general Oracle-Primavera P6 Schedule as defined by this Specification.

Progress Schedule Update – Changes to the Progress Schedule that reflect the status of activities that have commenced or have been completed, including the following items: (a) Actual Start date and or Actual Finish date as appropriate; (b) Remaining Duration for activities commenced and not complete; and (c) Suspend or Resume dates for activities commenced and not complete.

Progress Schedule Revision – Revisions to the Progress Schedule ensure it accurately reflects the current means and methods of how the project is anticipated to progress, including modifications made to any of the following items: (a) changes in logic connections between activities; (b) changes in constraints; (c) changes to activity descriptions; (d) activity additions or deletions; (e) changes in activity code assignments; (f) changes in activity Productivity Rates; and (g) changes in calendar assignments.

Project Scheduler – The person that is responsible for developing and maintaining the Progress Schedule.

Projects Planned Start Date – The date entered in the Project Details, in the Dates tab, that reflects the Contractor's planned start of work (based on contract requirements, and reasonable expectation for a Notice to Proceed) at the time the bid was submitted to the Department.

Projects Must Finish By Date – A date constraint entered in the Project Details, in the Dates tab, that reflects the Contract Completion Date set in the Contract Documents or through a formal contract extension of time.

Recovery Schedule – A schedule depicting the plan for recovery of significant time lost on the project. This separate CPM schedule submission shall provide the resolution and include appropriate changes in network logic, calendar adjustments, or resource assignments.

Relationships - The interdependence among activities. Relationships link an activity to its predecessors and successors. Relationships are defined as:

Finish to Start - The successor activity can start only when the current activity finishes.

Finish to Finish – The finish of the successor activity depends on the finish of the current activity.

Start to Start – The start of the successor activity depends on the start of the current activity.

Start to Finish – The successor activity cannot finish until the current activity starts.

Resources, Contract Pay Item – Contract Pay Item resources shall be identified as a Material resource type. When required, Contract Pay Item resources are developed for each Pay Item in the contract, with the Resource ID matching the contract Pay Item and the Resource Name matching the description of the contract Pay Item.

Resources, Equipment – Equipment resources shall be identified as a Nonlabor resource type. A unique identifier shall be used in the Resource Name or Resource Notes to distinguish this piece of equipment from a similar make and model of equipment used on the project.

Resources, Labor – Labor resources shall be identified as a Labor resource type. Labor Resources shall identify resources that encompass direct labor at the Crew level.

Scheduling/Leveling Report – The report generated by the software application when a user “Schedules” the project. It documents the settings used when scheduling the project, along with project statistics, errors/warnings, scheduling/leveling results, exceptions, etc.

Substantial Completion - the day, determined by the Engineer, when all of the following have occurred:

1. The public (including vehicles and pedestrians) has full and unrestricted use and benefit of the facilities both from the operational and safety standpoint, and
2. All safety features are installed and fully functional, including, but not limited to, illumination, signing, striping, barrier, guard rail, impact attenuators, delineators, and all other safety appurtenances, and
3. Only minor incidental work, replacement of temporary substitute facilities or correction or repair remains for the Physical Completion of the Contract, and
4. The Contractor and Engineer mutually agree that all work remaining will be performed with short term lane closures to minimize delays, disruption, or impediment to the traveling public. No overnight lanes closures will be allowed.

Successor - An activity that is defined by Schedule logic to succeed another activity. The Start Date or Finish Date of a successor may be controlled by its predecessor.

Time Impact Analysis - A technique to demonstrate the comparison of a time impact of a Progress Schedule revision prior to a change in the Contract work, against the current accepted Progress Schedule. It is also known as a “What-If” analysis.

Work Breakdown Structure (WBS) - A deliverable-oriented grouping of project elements, which organizes and defines the total scope of the project. Each descending level represents an increasingly detailed definition of project components or work packages.

Work Days – A calendar day (Monday through Friday) on which NC offices are open to the public for business NC recognized public holidays are not workdays. Days scheduled for the active prosecution of work activities by NC staff or the NC’s representatives. (NC Workday calendar)

Nassau County Holidays	
New Year’s Day	January 1
Martin Luther King Day	3 rd Monday in January
Lincoln’s Birthday	February 12th
President’s Day	3 rd Monday in February
Memorial Day	Last Monday in May

Independence Day	July 4th
Labor Day	1st Monday in September
Columbus Day	2nd Monday in October
Election Day	1st Tuesday in November
Veteran's Day	November 11th
Thanksgiving Day	4th Thursday in November & Following Friday
Christmas Day	December 25th

If the holiday occurs on a Saturday, it may be observed the Friday before. If the holiday occurs on a Sunday, it may be observed the Monday after.

Work Package - A deliverable at the lowest level of the work breakdown structure. A work package contains activities.

MATERIALS

Oracle-Primavera P6 software (as accepted by the Engineer)

CONSTRUCTION DETAILS

A. General. In addition to the attributes of the Progress Schedule provisions as set forth in NYSDOT Specification §108-01, the Contractor shall prepare, furnish, and maintain a computer-generated Progress Schedule using the Critical Path Method (CPM) utilizing Oracle-Primavera scheduling software. The CPM Progress Schedule shall be prepared based on the principles defined by the latest issue of the Construction Planning & Scheduling Manual published by the Associated General Contractors of America, except where superseded by the contract documents such as the CPM Special Notes and this specification.

The Contractor and the Department shall use the Progress Schedule to manage the work, including but not limited to the activities of subcontractors, fabricators, the Department, other involved agencies and authorities, other entities such as utilities and municipalities, and all other relevant parties involved with the project.

No work other than installation of the Engineer's Field Office, mobilization, procurement and administrative activities, installation of construction signs, installation of erosion and pollution protection, clearing and grubbing, field measurements, and survey and stakeout will be permitted to start until the Baseline Progress Schedule has been submitted to the Engineer, and the Engineer determines there are no deficiencies consistent with those identified in paragraph I.1 *Immediate Rejection of Progress Schedule Submissions*.

The purpose of the Progress Schedule, and scheduling provisions in the contract, shall be to:

- a) Ensure that the Contractor and the Department have a detailed plan and resources to complete the project in accordance with contract time requirements;
- b) Provide a means of monitoring the progress of work;
- c) Aid in communication and coordination of activities among all affected parties;
- d) Analyze the effect of changed conditions on any milestone dates or on the contract completion date;
- e) Analyze the effect of change orders for extra work or deductions, and unanticipated delays, on the contract completion date;
- f) Establish a standard methodology for time adjustment analysis based on the principles of the Critical Path Method of scheduling, to analyze delays and resolve construction disputes concerning time;
- g) Determine appropriate extensions or reductions of Contract Time.

In scheduling and executing the work, the Contractor shall:

- a) Sequence the work commensurate with the Contractor's abilities, resources and the contract documents. The scheduling of activities is the responsibility of the Contractor.

- b) Ensure that Progress Schedules prepared by the Project Scheduler for submission to the Department are in compliance with the Contract. The intent should be that Schedule submissions and accompanying Narratives are timely, complete, accurate, and in compliance with the Contract.
- c) Communicate all Contract changes, and decisions or actions taken by the Contractor and all subcontractors, fabricators, etc., that effect the Progress Schedule to the Project Scheduler in a timely manner to allow appropriate development, maintenance, and update of the Progress Schedule.
- d) Include all work contained in the Contract and all work directed in writing by the Engineer. Work activities directed by the Engineer to be added to the Contract shall be included in the next Monthly Progress Schedule submission.
- e) Assure that Progress Schedule Updates reflect the actual dates that work activities started and completed in the field.
- f) Break a schedule activity into multiple activities to reflect a discontinuity in the work if a work activity is suspended in the field and restarted at a later date, and the break between when the work was suspended to when it was resumed is significant compared to the original activity duration.
- g) Ensure the Progress Schedule contains all work constraints and Milestones defined in the Contract.
- h) Schedule the work using such procedures and staging or phasing as required by the Contract. Work designated as part of separate stages may be performed concurrently with other stages where allowed by the Contract or where approved by the Department.

Failure by the Contractor to include any element of work required by the Contract in the accepted progress schedule does not relieve the Contractor from its responsibility to perform such work.

Should the Contractor choose to show activities in the schedule that reflects their plan of work prior to the contract award, the Department does not incur any liability and such work being performed between the letting date and the contract award date shall be considered at risk work.

Errors or omissions on schedules shall not relieve the Contractor from finishing all work within the time limit specified for completion of the contract.

B. Project Scheduler. The Contractor shall designate an individual, entitled the Project Scheduler, who will develop and maintain the construction progress schedule. The Project Scheduler shall be present at the Preconstruction Schedule Meeting, prepared to discuss, in detail, the proposed sequence of work and methods of operation, and how that information will be communicated through the Progress Schedule. The Project Scheduler shall attend all meetings, keep notes which may affect the CPM schedule, including but not limited to those between the Contractor and their Subcontractors and between the Contractor and the Department. The Project Scheduler shall be knowledgeable of the status of all aspects of the work throughout the length of the Contract, including but not limited to original contract work, additional work, new work, and changed conditions of work.

C. Scheduling Software. Oracle-Primavera P6 software and computer system shall be used by the Contractor. The Contractor shall develop, update, and revise the Progress Schedules using Oracle-Primavera P6 software application-

In general, schedules are developed from the Contractor's knowledge of the project, and the means and methods represented in those schedules are based on the Contractor's understanding of the contract documents, and the Contractor's past experience, which are unique to the Contractor. Schedule activity data are therefore the intellectual property of the Contractor and will not be made available to other Contractors. However, all project schedule data are the sole property of the Department.

D. Meetings.

D.1. Preconstruction Schedule Meeting. The Contractor shall contact the Construction Engineer after notification they are the apparent low bidder, but no later than two (2) Work Days following Notification to Proceed (NTP) to schedule a Preconstruction Schedule Meeting. The purpose of this meeting will be to discuss essential matters pertaining to the satisfactory scheduling of project activities, and to resolve any known questions regarding interpretation of the contract requirements for this work.

The Project Scheduler shall be prepared to discuss the following:

- a) The proposed hierarchical Work Breakdown Structure (WBS) for the Progress Schedules. The Project Scheduler shall provide a paper copy at the meeting.
- b) The proposed project calendars.
- c) The proposed project activity codes and various code values for each activity code. The Project Scheduler shall provide a paper copy at the meeting.
- d) The specifics of any contract Time-Related Clauses (A+B Bidding, Incentive/Disincentive, Liquidated Damages, Lane Rental, etc.);
- e) The Contractor's schedule methodology to be employed, proposed work sequence and any proposed deviations from the contract plans with respect to Staging or Work Zone Traffic Control phasing.
- f) The Key Plans shall be provided at the meeting.
- g) The factors that the Contractor determines to control the completion of the project and any milestone activity completion dates contained therein.
- h) The Project Scheduler shall provide an outline for the content of the Narrative report for future Progress Schedule submissions.
- i) Schedule submission protocol for Progress Schedule submissions.

The Contractor shall submit to the Resident Engineer (RE) for review, a minimum of five (5) Work Days prior to the Preconstruction Schedule Meeting, the following: a copy of the Key Plans, a print out of the proposed Work Breakdown Structure, a print out of each of the proposed project Calendars showing the Work Days versus non-work days and hours per day, and a list of the Code Values for each Project Activity Code proposed to be used in the schedules.

The Resident Engineer (RE) will be available to answer questions regarding scheduling, including: the availability of Department supplied electronic file(s) containing sample project schedule information, sample progress schedule narratives, Special Notes for CPM Scheduling, and required standard format for CPM Progress Schedules for contract work.

The Contractor shall schedule meetings as necessary with the Engineer to discuss schedule development and resolve schedule issues, until the Final Baseline Progress Schedule is accepted by the Engineer.

D.2. Progress Meetings. One topic of the regular progress meetings held by the Engineer and attended by the Contractor shall be a review of the monthly Status Report generated from the Progress Schedule. The Contractor shall be represented by the Field Superintendent and Project Scheduler. The Project Scheduler shall bring a copy of the printed plot of the current Status Report to the progress meeting, the report shall show the current anticipated schedule for all remaining work with the critical path activities highlighted.

- a) The review of the Status Report serves as the forum to discuss project progress and delays, suggested remedies, necessary Progress Schedule revisions, coordination requirements, change orders, potential Contractor time extension requests, and other relevant issues. If contract work is falling behind the Progress Schedule, the responsible party (i.e. Contractor) shall be ready to discuss what measures it will take in the next thirty (30) days to put the work back on schedule so as to meet the contract Completion Date specified in the contract.
- b) Items of discussion will include, but are not limited to: project progress; schedule progress; near term and long-term schedule issues, including RFIs, Shop Drawing submittals, permit

work, utility relocations, mitigation work; project issues and risks; proposed solutions; and any relevant technical issues that are schedule related.

- c) At the meeting the Project Scheduler shall compile an action item list that describes who is responsible for existing or pending issues and the date by which the issue needs to be resolved to avoid delays. The Contractor shall forward a copy of the action item list to the Engineer within 2 business days following the meeting.

E. Progress Schedule Submissions:

E.1. Draft Baseline Schedule. The Contractor is encouraged, but not required, to submit a Draft Baseline Progress Schedule that demonstrates a sample of how the Project Scheduler's proposed alphanumeric coding structure and the activity identification system for labeling work activities in the CPM progress schedule will conform to the detailed requirements of this specification.

This submittal may be made anytime following notice to the Contractor that they are the apparent low bidder on the contract.

Critical items for this review should include but are not limited to: the proposed WBS for subsequent progress schedules; the proposed project Calendars; project Planned Start date; project Must Finish By date; major milestone activities (e.g. - Award, Notice to Proceed, Contractor's First Day of Work, Contractor's Last day of Work, Anticipated Completion Date); and between fifty to one hundred summary activities for the major work deliverables of the contract (e.g. - pave EB from STA x to STA y, construct roundabout 1, construct bridge xyz, etc.) that have assigned Activity Ids, Activity Descriptions, Activity Durations, Predecessors, Successors, and Activity Relationships. These summary activities will be broken down into, or supplemented with, individual work activities for the baseline submission.

If any Crew resources are included, the composition of the staffing (the number and titles of the various staff) shall be listed in the Notes tab of the Crew resource, and the composition of the crews shall be included in the narrative. To the extent practicable, the Draft Baseline Progress Schedule should include administrative and procurement activities to be accomplished during the contract; planned submittal, review, and approval dates for shop drawings, working drawings, fabrication drawings, and contractor supplied plans, procedures, and specifications.

Any submission of a Draft Baseline Progress Schedule should be accompanied by a written Narrative that provides details of the Calendar assignments of Working Days versus non-work days, outlines the sequence of planned operations to complete the project work, and provides the proposed Activity Codes and Code values to be assigned to activities in future submissions of project progress schedules.

The review and comment by the Engineer of the sample schedule should assist the Project Scheduler in assuring the first submittal of the Baseline Progress Schedule will be in general conformance with the requirements of the specification and other contract requirements, and that major rework of the Baseline Progress Schedule will not be required. The Engineer will review the logic diagram, coding structure, activity identification system, and Narrative; and provide comments for required changes by the Project Scheduler for implementation in the submission of the Baseline Progress Schedule. The Engineer will provide written comments on major deficiencies within five (5) Workdays of receipt. The Department reviews Draft Baseline Progress Schedules solely for format and will not consider any submission of a Draft Baseline Progress Schedule for approval as an Early Completion Schedule.

E.2. Baseline Progress Schedule– Within ten (10) Work Days of receipt of the contract NTP, the Contractor shall prepare and submit a Baseline Progress Schedule that meets the following requirements:

- a) The schedule shall accurately reflect the proposed approach to accomplish the work outlined in the Contract documents and conforms to all requirements of this specification.
- b) The schedule shall define a complete logical plan that can realistically be accomplished, to execute the work defined in the Contract.
- c) The schedule shall comply with the work constraints and milestones defined in the Contract as well as all other contractual terms and conditions. The schedule shall be consistent in all respects with the

specific interim Time-Related Contract Provisions, and any order of work requirements of the contract documents. The schedule shall meet all interim milestone dates and the contractor's Anticipated Completion Date shall not extend beyond the contract completion date. This submission shall reflect the Contractor's plan at the time of contract award, and prior to the start of any work.

- d) **Float.** No negative float is allowed in the Baseline Progress Schedule submission.
- e) **Data Date.** The contract Award Date shall be entered as the Data Date. If the Contractor submits a Baseline Progress Schedule @ Bid submission, the Data date shall be the date of the schedule submission to the Engineer and not prior to the bid date. Time shall be the end of the work day.
- f) **Activity Codes.** The Progress Schedule shall have assigned, to the maximum extent practicable, the Global Activity Codes Including, but not limited to Responsible Party, Stage and Type of Work. The Contractor shall also use a Project Level activity code named "Subcontractor" with code values identifying each of the approved subcontractors working on relevant activities.
- g) **Project Level Layouts & Filters.** Any "Layouts", "Filters" and "Report" formats that the Contractor develops for the various Progress Schedules submissions to the Engineer shall be saved and made available to all other users of the project schedule with a name that includes the contract D#. The Contractor shall assign appropriate Activity Codes and provide custom Layouts, Filters, and/or report formats necessary to allow the Engineer to generate a report from the each Progress Schedule submission of all submittals required under the contract (i.e., shop drawings, required permits, erection/demolition plans, etc.). The list shall show scheduled submission date, review date, and acceptance date for each submittal and identify the earliest activity affected by each of these submittals. This list shall be generated from each Progress Schedule submission until all such activities are completed.

h) **Schedule Submission**

- i) Within the timeframe indicated in Table 1 column 1, the Contractor shall send an email to the Engineer and Construction Supervisor, notifying them the schedule is ready for review. **In the following table, the Construction supervisor may change the time.**

TABLE 1 (in Work Days)		
Timeframe from receipt of Notice to Proceed to Submission of complete Baseline Schedule. (Column 1)	Timeframe for Engineer's Review (Column 2)	Timeframe from Notice to Proceed to acceptance by the Engineer not to exceed (Column 3)
10	10	40

- ii) The Engineer will review the schedule and return it, accept it with comments, or reject it within the timeframes indicated in Table 1 column 2, following the date of receipt of the Contractor's submission.
- iii) If the schedule is returned with comments, the Contractor shall address all comments and revise the schedule as necessary. The Contractor shall complete the Final Baseline Progress Schedule and obtain the acceptance of the Engineer within the timeframe required in Table 1 column 3.
- iv) If the schedule is accepted without any comments by the Engineer, the Contractor shall copy the schedule and rename it for submission as the Final Baseline Progress Schedule
- v) **In no way does the Baseline Progress Schedule modify the contract documents.**

E.3. Final Baseline Progress Schedule

- a) If the Baseline Progress Schedule is returned to the Contractor with comments, the Contractor shall make a copy of the schedule and rename it as the Final Baseline Progress Schedule with comments addressed and revisions made as necessary. The Contractor shall complete the Final Baseline Progress Schedule and obtain acceptance of the Engineer within the timeframe required in column 3 of Table1,

or within one week of the Contractor's receipt of the final comments by the Engineer, whichever is sooner.

- b) The Engineer shall review the schedule and return it, accepted or with comments, within 5 Work Days following the date of receipt of the Contractor's submission.
- c) The Final Baseline Progress Schedule must be "accepted" or "accepted as noted" by the Engineer prior to the Department evaluating any Contractor disputes associated with time impacts. This does not preclude the Contractor from submitting a dispute while the schedule is being reviewed for acceptance.

E.4. Progress Schedule Updates and Monthly Status Reports:

- a) The Contractor shall perform a Progress Schedule Update, on a minimum, at the end of each month.
- b) The Contractor shall generate a Monthly Status Report at the end each month after performing the Progress Schedule Update and Scheduling the project with a Data Date of day the schedule was updated and submit it to the Engineer by the beginning of business each Monday. The Status Report shall be generated using the activity Layout named Monthly Status Report, with activities grouped by the WBS, sorted by Finish Date. The Gantt Chart shall clearly indicate the project critical (longest) path. Graphical representations shall be shown at a suitable scale to be legible and readable.
- c) **During any time periods within the contract that special time-related contract provisions are in effect, including Incentive/Disincentive Periods, the Engineer may require more frequent Progress Schedule Updates and/or Progress Schedule Status Reports.**

E.5. Monthly-Progress Schedule Submissions.

- a) **First Progress Schedule Submission** – Within three Work Days following acceptance of the Final Baseline Progress Schedule the Contractor shall perform a Progress Schedule Update to reflect the status of all activities where work was performed in the time period between the start of work and acceptance of the Final Baseline Progress Schedule. This shall include actual dates entered in the Actual Start and Actual Finish columns, and percentage of work complete for uncompleted activities, in addition the Contractor shall incorporate any Progress Schedule Revisions that reflect any changes in how future work activities are to be completed.
- b) **Subsequent Progress Schedule Submissions** – The Contractor shall prepare and submit subsequent Progress Schedule submissions on a regular basis based on the **Monthly Progress Schedules Schedule Updates and Revisions**
The Contractor shall submit a copy of the current Progress Schedule that includes all Progress Schedule Revisions and Progress Schedule Updates to reflect the actual and planned prosecution and progress of the contract work. Progress Schedule Updates shall reflect the status of activities that have commenced or have been completed, including the following items: (a) actual dates in activity Actual Start and Actual Finish columns as appropriate; (b) actual Remaining Duration for activities commenced and not complete; and (c) actual activity Suspend or Resume dates for activities commenced and not complete. Progress Schedule Revisions reflect modifications made to activities in the current project baseline schedule in any of the following items: (a) activity Original Duration; (b) changes in logic connections between activities; (c) changes in Constraints; (d) changes to Activity Descriptions; (e) activity additions or deletions; (f) changes in Activity Code assignments; (g) changes in Calendar assignments, and Work Days; (h) Productivity Rates; (i) a list of Notebook Topic additions and changes . All "Out of Sequence" activities noted in the scheduling log shall be corrected to reflect the current construction operations.
- c) As ordered by the Engineer, for any contract time extension requests the Contractor shall include: a Time Impact Analysis (TIA) for any changes to the schedule for future work for such issues as Added Work, VECP, or Changed Conditions; and a Delay Analysis that documents all delays from the Contract Award to the current date that is based on critical path delays that occurred when comparing

subsequent Monthly Progress Schedule submissions and the supporting delay documentation in the Progress Schedule Narratives.

E.6. As-Built Progress Schedule. As ordered by the Engineer, the Contractor shall submit the As-Built Progress Schedule with Actual Start and Actual Finish dates for all activities, within ten (10) Work Days following final acceptance of work by the Commissioner.

E.7. Look-Ahead Schedule. Except during winter shutdown periods the Contractor shall prepare a Look-ahead Schedule as either a plotted report from the current progress schedule, or as a narrative report, and provide it to the EIC on a weekly basis, or if approved by the Engineer on a mutually agreed upon interval. The Look-ahead schedule shall include all work activities planned for the next two week period, and include all work activities progressed in the previous one week period, and should also show: anticipated lane closures, road closures and detours, environmental issues, and utility issues. The Engineer will provide the Project Scheduler with guidelines for determining the begin dates and end dates for the one or two week reporting periods, along with the how the plotted schedule report or narrative report shall be formatted.

The Department generally uses this Look-ahead schedule to facilitate communication with other Federal or State agencies, local municipalities, utility companies, railroads, emergency service providers, public news media and other affected parties.

F. Detailed Progress Schedule Requirements.

F.1. Baseline Progress Schedule. As a minimum, the Contractor shall address the following:

- a) Defining Project details and defaults – Within the Dates tab, the “Planned Start” shall be the Letting Date, the “Data Date” shall be the date of Contract Award, the “Must Finish By” date shall be the contract Completion Date. Within the Settings tab, define the Critical Activities as the “Longest Path”.
- b) Sufficient activities shall be included to assure that there is adequate planning for the entire project. The appropriate number of activities will be largely dependent upon the nature, size, and complexity of the project. In addition to all site construction activities, network activities shall include: activities necessary to depict the procurement/submittal process including shop drawings and sample submittals; the fabrication and delivery of key and long-lead procurement elements; testing of materials, plants, and equipment; settlement or surcharge periods activities; sampling and testing period activities; cure periods; activities related to temporary structures or systems; activities assigned to subcontractors, fabricators, or suppliers; erection and removal of falsework and shoring; major traffic stage switches; activities assigned to the Department and other involved State agencies and authorities, including final inspection; activities to perform punch list work; and activities assigned to other entities such as utilities, municipalities, County government/agencies, and other adjacent contractors. The schedule shall indicate intended submittal dates and depict the review and approval periods as defined in the Contract Documents for Department review.
- c) The following Activity ID’s and Activity Descriptions as shown in Table 2, **subject to changes as approved by the Engineer**, shall be incorporated into all Progress Schedules:

TABLE 2					
Activity ID	Activity Description	Duration (Min)	Predecessor	Logic Tie	Responsible Party
C00005	Preconstruction Schedule Meeting	1 Work Day	M00001	SS	NC
C00011	Prepare & Submit DMWBE Goals	Minimum 1 Contractor Work Day	M00001	SS	Contractor

C00015	DMWBE Utilization Approved	15 Work Days	C000011	FS	NYSDOT/NC
C00030	Submit Proof of Insurance	1 Contractor Work Day	M00001	SS	Contractor
M00025	Contract Award Date	0 - Finish Milestone	00020, C00015	FF	NYSDOT/NC
C00010	Preconstruction Meeting	1 Work Day	M00001	SS	NYSDOT/NC
C00035	Notification to Proceed	5 Work Days	M00025, C00030	FS	NYSDOT/NC
C00040	Prepare/Submit Safety & Health Plan	Minimum 1 Work Day	M00001	SS	Contractor
C00045	Approve Safety & Health Plan	20 Work Days	C00040	FS	NYSDOT/NC
M00050	Contractor's First Day of Work	0 - Start Milestone	C00035, C00045	FS	Contractor
C00055	Set Up Engineer's Field Office	20 Contractor Work Days	C00035	FS	Contractor
C00060	Prepare & Submit Baseline Progress Schedule	10 Work Days from NTP	C00005	FS	Contractor
C00065	Review Baseline Progress Schedule	10 Work Days	C00060, M00025	FS	NYSDOT/NC
C00070	Accept Baseline Progress Schedule	1 County Business Days	C00065	FS	NYSDOT/NC
C00075	Mobilization	20 Contractor Work Days	M00050	SS	Contractor

TABLE 2

Activity ID	Activity Description	Duration (Min)	Predecessor	Logic Tie	Responsible Party
M00100	Field Work Begins	0 - Start Milestone	M00050, C00055, C00060		Contractor
M00900	Substantial Completion	0 - Finish Milestone	See definition	FF	Contractor
C09010	Other Agency Inspection	20 Work Days	M00900	FS	Others
C09020	NYSDOT Final Inspection	20 Work Days	M00900	FS	NYSDOT/NC
C09030	Punchlist Work	20 Contractor Work Days	C09020	FS	Contractor
M00950	Contractor's Last Day of Work	0 - Finish Milestone	C09030	FF	Contractor
M00999	Anticipated Completion Date	0 - Finish Milestone	M00950	FF	Contractor
C09040	Demobilization	10 Contractor Work Days	C09020	FS	Contractor

M00925	Recommendation for Final Acceptance	0 - Finish Milestone	C09040	FF	NYSDOT/NC
M09999	Final Acceptance	0 - Finish Milestone	M00925	FF	NYSDOT/NC

The Logic Tie shown shall be used as a relationship to the predecessor activities contained in the column named Follows.

- d) **Work Breakdown Structure (WBS)** - A multilevel hierarchal WBS shall be incorporated that provides a deliverable-oriented grouping of activities and defines the total scope of the project. The Contractor shall develop a detailed project specific WBS for the Engineer's review and approval. The Engineer shall make the final determination on the number of levels of the WBS, and how the activities shall be grouped to represent the deliverables of the project.

For all projects the first two levels (nodes) of the WBS shall be labeled as follows:

Level 1 - is the project level; and shall have the project name.

Level 2 - shall have three nodes; "PRECONSTRUCTION", "CONSTRUCTION", and "POST CONSTRUCTION";

Level 3- under "PRE-CONSTRUCTION", shall include at least three nodes "GENERAL SUBMITTALS", "SHOP DRAWINGS"; and "PROCUREMENT/FABRICATION/DELIVERY".

Level 3- under "CONSTRUCTION"; shall have three nodes "PRE-CONSTRUCTION", "CONSTRUCTION OPERATIONS", and "POST CONSTRUCTION/CLOSEOUT";

Under the "CONSTRUCTION OPERATIONS" node, the grouping of activities may vary depending on the scope and nature of the project work. The Contractor shall coordinate with the Engineer to determine the best way to represent (group activities) the project deliverables (i.e. Bridge, Roundabout, Highway segment, Interchange, Intersection, etc.) and the various Stages or Phases of work. The Engineer may require sub nodes for AREA (geographic area within the project limits), STAGE, or for a bridge project SUBSTRUCTURE, SUPERSTRUCTURE, and DECK .

Generally Level 4 would be by geographic area within the project limits, Level 5 would be by highway feature (bridge, highway segment, intersection), Level 6 the highway features should be broken into their components (a bridge into components such as Piles, Substructure, Superstructure), and a highway segment into components such as pavement, drainage, earthwork, lighting, traffic signals, etc.

An example Work Breakdown Structure is shown below in Figure 1

FIGURE 1

WBS Code	WBS Name
D269997-WBS	Replace State Route 123 Bridge over RR - BIN 1-2345-6
D269997-WBS.1	PRE-CONSTRUCTION
D269997-WBS.1.1	GENERAL SUBMITTALS
D269997-WBS.1.2	SHOP DRAWINGS
D269997-WBS.1.3	PROCUREMENT / FABRICATION / DELIVERY
D269997-WBS.1.4	PERMITS
D269997-WBS.1.5	UTILITY NOTIFICATIONS
D269997-WBS.2	CONSTRUCTION OPERATIONS
D269997-WBS.2.1	MILESTONES
D269997-WBS.2.2	START-UP / ADMINISTRATIVE
D269997-WBS.2.3	STATE ROUTE 123 BRIDGE OVER RR - BIN 1-2345-6
D269997-WBS.2.3.1	MPT - State Route 123 Bridge over RR
D269997-WBS.2.3.2	Substructure - State Route 123 Bridge over RR
D269997-WBS.2.3.2.1	South Abutment - State Route 123 Bridge over RR
D269997-WBS.2.3.2.2	Center Pier - State Route 123 Bridge over RR
D269997-WBS.2.3.2.3	North Abutment - State Route 123 Bridge over RR
D269997-WBS.2.3.3	Superstructure - State Route 123 Bridge over RR
D269997-WBS.2.3.3.1	Structural Members - State Route 123 Bridge over RR
D269997-WBS.2.3.3.2	Deck - State Route 123 Bridge over RR
D269997-WBS.2.3.3.3	Other Features - State Route 123 Bridge over RR
D269997-WBS.2.3.4	Approaches - State Route 123 Bridge over RR
D269997-WBS.2.3.4.1	South Approach - State Route 123 Bridge over RR
D269997-WBS.2.3.4.2	North Approach - State Route 123 Bridge over RR
D269997-WBS.2.3.5	Demolish Existing Bridge - State Route 123 Bridge over RR
D269997-WBS.2.5	HIGHWAY WORK - STATE ROUTE 123
D269997-WBS.3	POST-CONSTRUCTION / ACCEPTANCE

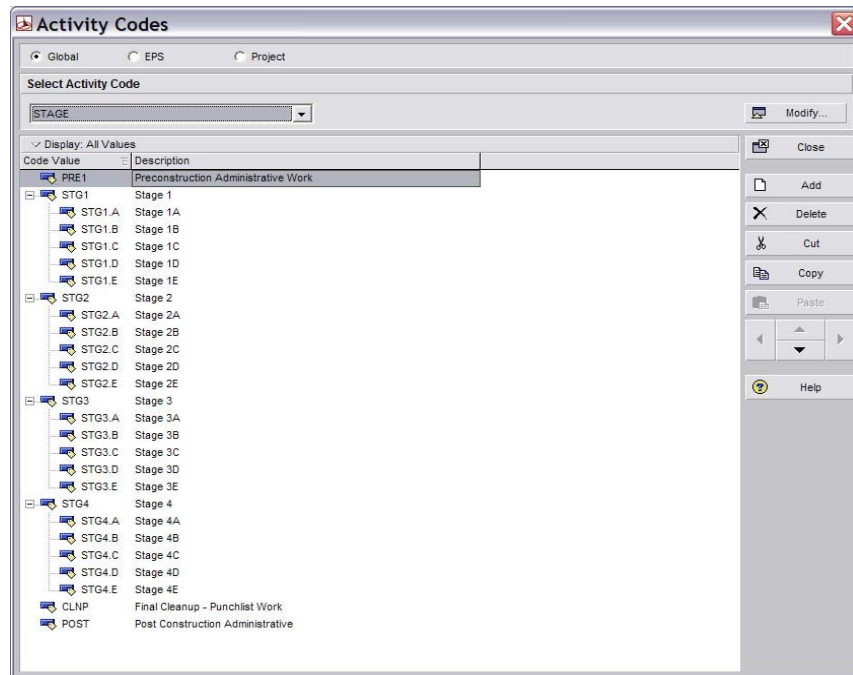
- e) **Activity ID** - Include a unique identification number for each activity. Activity ID numbers shall not be changed, or reassigned for the duration of the contract. Task type Activity IDs shall be prefixed by a “C”. Milestone type activities shall be prefixed by an “M”. .
- f) **Activity Name** - Clearly and uniquely define each activity name with a description of the work that is readily identifiable to inspection staff and the progress of each activity can be measured. Each Activity shall have a narrative description consisting at a minimum of a verb or work function (i.e. form, pour, excavate, etc.), an object (i.e. slab, footing, wall, etc.), and a location (i.e. STA, bridge or retaining wall number, street, etc.). The work related to each Activity shall be limited to one Area of the contract, one Stage of the contract, one WZTC Phase of the contract, and one Responsible Party of the contract. The Activity Name shall not be changed for the duration of the contract without approval of the Engineer.
- g) **Milestone Activities** - Include activities for all contract milestones that define significant contractual events such as Contract Award, Notice to Proceed, Contractor Start Work, Substantial Completion, Physical Completion, Contract Completion, and coordination points with outside entities such as utilities, State agencies, Authorities, municipalities, Time-Related Contract Provisions, etc.
 - The Contract Completion milestone shall have a primary constraint of “Finish on or before” and the contract Completion Date.
 - The Contractor Start Work” Start milestone activity, that will eventually reflect the actual date the Contractor started work authorized under the contract.

- h) **Activity Durations** – Define the Original Duration of each activity in units of whole work days, except for activities of less than one day duration which should be shown in units of tenths of a day. Except submittal/procurement activities, durations shall not exceed 15 work days unless approved by the Engineer. Durations for Department submittal reviews shall meet the requirements set forth in the contract documents. If requested by the Engineer, the Contractor shall justify the reasonableness of planned activity time durations. Task Dependent activities shall not have a zero duration.
- i) **Activity Relationships** - Clearly assign predecessors and successors relationships to each activity, and assign appropriate logic ties between activities (Finish to Start, Start to Start, Finish to Finish, etc.). Do not have any open ended activities, with the exception of the first activity and last activity in the schedule. An activity may only appear once as a predecessor or successor to another specific activity, but may be assigned as a predecessor or successor to many different activities. Do not include inappropriate logic ties with Milestone activities (For a finish milestone activity: a predecessor shall only be assigned a Finish to Finish logic tie, a successor shall only be assigned a Finish to Start or Finish to Finish logic tie. For a start milestone: a predecessor shall only be assigned a Finish to Start or Start to Start logic tie, a successor shall only be assigned with a Start to Start logic tie). Lag time may not exceed 10 days. The Contractor shall not use negative Lag times.
- j) The Contractor shall assign the ‘Submittal’ activity as a predecessor to all Review and Approval type activities to be performed by Department staff.
- k) **Activity Constraint Dates** – The Contractor shall not have any constrained activities, with the exception of contractual dates, unless the Engineer accepts such constraints in writing. Milestone activities shall be included for the Contract Award which shall have a primary constraint of “Finish On” and the date of contract signature by the State Comptroller, and for the Anticipated Contract Completion which shall have a primary constraint of “Finish on or before” and the contract completion date indicated in the contract documents. Only contractual/owner-designated constraints are allowed unless specifically authorized by this specification or the Engineer. . If used, only Constraints of type, “Finish on or Before”, ‘Start on or After”, or when deemed appropriate by the Engineer “As-Late-As-Possible” are acceptable
- l) **Activity Dates** – With the exception of contract Milestone dates, “Actual Start” and “Actual Finish” dates and “Planned Start” and “Planned Finish” dates, activity dates shall be calculated by the project scheduler tool within the Oracle-Primavera software. No Actual Start or Actual Finish dates shall be entered in the Baseline Progress Schedule, with the exception of activities that were completed prior to the Contract Award.
- m) **Calendars** - Use clearly defined calendars that account for expected seasonal weather conditions (including winter shutdown periods) and environmental permit requirements, for the planning and scheduling of activities. Do not incorporate an activity with a description of “Winter Shutdown” that requires constraints. Provide the working days per week, non-working holidays. Also provide the number of shifts per day, and the number of hours per shift by using the Calendar feature, called “Time Periods” in the P6 software. Incorporate any seasonal restrictions to the work within calendars assigned to activities.
- Global calendars used in the progress schedule shall be those established by the Department. There are only two Global Calendars developed and maintained by the Department for use by Contractor’s, they are the following:
 - NYSDOT/NC Milestone/Curing 365 Day / 8 hour
 - NC Work Days, 5 Day Work Week w/ Holidays (see table on page 5)
- All milestone activities in the schedule shall be assigned the standard Global calendar named ‘NYSDOT/NC Milestone/Curing 365 Day / 8 hour’, this calendar should also be assigned to any activities for concrete curing. Activities for shop drawing reviews and other approvals by

Department personnel shall be assigned the Department's standard Global – "NC Work Day, 5 Day Work Week w/Holidays, Field" Calendar that reflects all holidays as listed above.

- Changes desired for these calendars shall require prior approval of the Engineer. Calendars related to specific resources (i.e., Crane, Bidwell, Asphalt Paver) shall be established as Project level Calendars (not Resource calendars), with the Calendar name clearly identifying the resource.
 - All other calendars developed by a Contractor shall be established as Project Calendars, with the calendar name including the contract # and describing the function. All work activities of the Contractor shall be assigned to Project Calendars.
 - **The Baseline Progress Schedule cannot include a calendar that reflects any workers working more than 8 hours in any one calendar day or more than 5 days in any one week.** (§102-10 LABOR AND EMPLOYMENT) Following the contract award the Contractor can add additional calendars in their next Monthly Progress Schedule submission based on an approved overtime dispensation.
- n) Clearly define significant interaction points between the Contractor, the Department, and other entities including but not limited to: Federal, State and local agencies/authorities; and utilities. All activities of the Department, utility companies, adjacent contracts, and other entities that affect progress and influence any contract required dates including durations shall be shown in the schedule. This includes dates related to all Permits or Agreements. The schedule shall give special consideration to sensitive areas such as road closures and parklands and shall indicate any time frames when work is restricted in these sensitive areas as outlined in the permits issued by the regulatory agencies, and provided in the contract documents.
- o) **Activity Resources** – It shall be the Contractor's responsibility to assure the activity logic in the schedule properly reflects their resource limitations. An activity shall not involve multiple crews comprised of the Contractor and a subcontractor, or multiple subcontractors. The level of resource loading of the schedule shall be dependent on the schedule.
- p) **Production Rates** – The Contractor shall enter the quantity of the major item of work for each non administrative activity in the schedule into the field labeled "PR Quantity", the Unit of Measure for that major item in the field labeled "PR Unit", the anticipated production rate of the equipment and labor resources for that activity of work in the field labeled "Production Rate / Day", and the associated duration for that work in the field labeled "PR Duration". These are all Activity level UDF fields, and can be found in the activity Layout named Contractor Production Rates.
- q) **Activity Codes** – The Contractor shall include a well-defined activity coding structure that allows project activities to be sorted and filtered. Activity Codes shall include, but not be limited to: Responsible Party; Stage; Area of Work; Type of Work; Subcontractor; and additionally as required by the Engineer to meet the needs of the specific contract work to facilitate the use and analysis of the schedule.
- 1) Additional Activity Codes developed for specific projects shall be established as Project Activity Codes. As a minimum this shall include the SUBCONTRACTORS.
- r) **Activity Code Values** – Each Activity Code shall be broken down into various Activity Code Values that are then assigned to activities, as shown below in the example of Figure 2

FIGURE 2



- s) **Activity Code Assignments** - For each activity, within the activity details the Contractor shall assign Activity Code values to identify the “Responsible Party” (i.e. – Contractor, NYSDOT, Utility Co, Municipality) for the work to be performed (one and only one responsible party shall be assigned to each activity), the “Stage” of the contract for the work that will be performed, the “Area” where the work is to be performed, the “WZTC Phase”, and the Type of Work (i.e. - Procurement, Paving, Embankment, Excavation, Electrical, Signing, etc.). For activities included in work governed by time related contract provisions, the appropriate “Time Related” activity code shall be utilized. For activities included in work added and/or changed within an Order-On-Contract, the appropriate “Added/Changed Work” code shall be utilized. For all work activities performed by the Contractor or subcontractors/fabricators/suppliers, “Contractor” shall be designated as the Responsible Party
- t) **Interim Milestone Dates with Liquidated Damages and Special Time-Related Contract Provisions** (i.e. – A+B Bidding, Incentive/Disincentive provisions, Lane Rental) – Each time-related contract provision in the contract shall be represented in the progress schedule by having a start and finish milestone, with appropriate predecessors and successors assigned to all schedule activities considered part of that time-related contract provision work including the start and finish milestone activities. In addition, the Start milestone for the time-related contract work shall have predecessors and/or date constraints assigned that include those defined in the contract documents, and the Finish milestone for the time-related contract work shall have successors and/or date constraints assigned that include those defined in the contract documents. All schedule activities associated with each specific time-related contract provision shall be assigned to a separate node within the project WBS and the WBS node description shall be labeled accordingly, in addition these activities shall be assigned the appropriate Time-Related Clauses activity code value. A Level Of Effort activity shall be used for each time related contract provision (i.e. - “Incentive 1 Duration” or “B Clock 1 Duration”), this activity shall have the Start Milestone as a predecessor with a SS relationship and the Finish Milestone as a successor with a FF relationship and the duration of this activity shall be calculated when the project is scheduled.

- u) List of Submittals** – The Contractor shall submit with the Progress Schedule a list of all Submittals (i.e. - Shop Drawings, required permits, Erection/Demolition plans, Health and Safety Plan, etc.) generated from the Baseline Progress Schedule for review and approval by the Engineer. The Contractor shall use a Filter to limit the schedule activities shown in the report to only the prepare/submit, and review/approve activities related to submittals. The report shall be in Adobe PDF format and transmitted to the Engineer by email.

F.2. Monthly Progress Schedules. In addition to the detailed schedule requirements for the submission of the Baseline Progress Schedule, the Contractor shall complete the following additional requirements for these regular Progress Schedule submissions: a) Activity Status -

- i) Durations – the Original Duration shall not be changed without prior written justification by the Contractor, and written approval by the EIC. The Contractor shall edit the Remaining Duration to reflect progress made on work activities and shall not use Duration percentage. If a proposed change to Original Duration is due to additional or changed work to the contract the Contractor shall instead add an activity to reflect this additional work and assign the appropriate Activity Code. The Contractor shall not use zero durations for Task Dependent activities.
 - ii) Started and Finished dates – for each activity where work was begun during the Weekly/Biweekly or Monthly reporting period, the Contractor shall check the box adjacent to Started and enter the date the work began. For each activity where work was completed during the Weekly/Bi-weekly or Monthly reporting period, the Contractor shall check the box adjacent to Finished and enter the date the work was completed.
 - iii) Suspended work – The first time that work has been suspended on a schedule activity, the Contractor shall enter the Suspend and Resume fields within the Project Details under the Status tab. For any subsequent suspensions of work to that activity the Contractor shall break that activity into two or more activities to accurately reflect the suspension and resumption of work dates in the field, and to more accurately reflect the relationship to other work activities.
- b) Calendars – To change a project calendar for activities scheduled in the future, the Contractor shall copy the calendar and use a revised name that includes a reference to which Update the change was incorporated (i.e. - D260000 - Concrete Calendar should be revised to D260000 – 2 - Concrete Calendar to reflect the 2nd Monthly Update when the change was made to the calendar). The reason for the change in the calendar shall be documented in the Narrative.
- c) Resources –
- For each month of the contract the Contractor’s Progress Schedule submission shall include labor, equipment and pay item resources for an additional year of anticipated contract work until all activities in the schedule have resources defined. Until such time that all activities are resource loaded, for any activity that resource limitations are affecting the prosecution of work, as determined by the Engineer, labor and equipment resources shall be entered in the schedule by the Contractor. When the resource assignments are complete for all schedule activities, the Engineer will compare pay item quantities in the schedule with pay item quantities in the Engineer’s estimate to determine if all contract work is represented in the Contractor’s schedule.
- d) Notebook Tab –
- i) Delays - For any activities on the critical path that are delayed during this monthly reporting period, the Contractor in agreement with the Engineer shall enter the dates the activity was delayed and the reason for such delay in the Notebook tab of that activity. The reviewing scheduler will perform the delay analysis and will inform the Contractor accordingly.
 - ii) Activity Changes – For any changes to activity logic, calendar assignments, suspended work, added or revised lag periods or constraints the Contractor shall document the change and reason in a

Notebook Topic for that activity by assigning the appropriate “Progress Submission # Revision” and describing the changes.

- e) **Production Rates** – For all non-administrative that have shifted onto the critical path, or now have less than 20 days of Total Float, the Contractor shall enter the Production Rate information required in paragraph F.1.p. For any activities where the work to be performed is similar in nature to work already performed on the same project and that the Production Rate for the work to be performed is different than the actual Production Rate for work already performed the Engineer may require the Contractor to adjust the Duration for the work to be performed to reflect the more appropriate Production Rate.
- f) **Deleted work** – If work has been deleted the corresponding work activities in the schedule shall be deleted. The Contractor shall not just zero the activity duration since the calendar assigned to the zero duration activity shall still affect the logic of future work activities.
- g) The Project Scheduler can modify the project’s Data Date through the Schedule tool.
- h) The Contractor shall complete the following additional requirements:
 - i) **Data Date** - the “Data Date” shall be the date the Project Scheduler last edits the schedule prior to submission to the Engineer (generally the last working day of the month).
 - ii) **Submission frequency.** The Contractor shall submit the schedule file and Narrative Report to the Engineer **monthly**. The schedule submission to the Engineer shall be made within three (3) Work Days of the last day of the month, whether or not the Engineer has accepted the previous Progress Schedule submission.

G. Detailed Narrative Requirements:

G.1. For the Baseline Progress Schedule. The Contractor shall include a narrative in Microsoft Word and/or Adobe Acrobat format that includes the following topics and attachments:

- a) **Contract Identification.** Include the contract D number, project name, project location, and name of Prime Contractor.
- b) **Key milestone dates.** Include the actual contract Award Date, original and adjusted contract Completion Date, Substantial Completion Date, and anticipated completion of all project work. Also include any contract Interim Milestone dates (I/D, B-Clock, LD, etc.), and scheduled Start and Finish dates for those Milestone activities.
- c) **General approach.** Describe the Contractor’s general approach to construct the Work outlined in the baseline schedule. Address the reasons for the sequencing of work and describe any resource limitations, potential conflicts, and other salient items that may affect the schedule and how they may be resolved.
- d) **Key Plans.** If not provided in the contract plans, or if modified by the Contractor, provide copies of the appropriate contract plan sheets marked up to correlate values on the contract plans (for Area of Work, Stage of Work, and WZTC Phase) to the Contractor’s planned breakdown of the project (i.e.- Activity Codes, Activity Descriptions) for scheduling purposes.
- e) **Logic Justifications.** The justification(s) for each activity with a duration exceeding 15 working days. The justification(s) for Contractor imposed activity constraints proposed in the schedule. The reason for any lags assigned to any activities.
- f) **Calendars.** Include a list of calendars which have been incorporated in the schedule, and for each calendar the general reason for it’s use in the schedule.

- g) **Critical Path issues.** A brief discussion of the critical path shown in Appendix 2, highlighting any potential challenges that are foreseen associated with the critical path work.
- h) **Coordination issues.** Outline any anticipated coordination issues related to work activities by other entities that require additional information from, or action by, the Engineer.
- i) **APPENDIX 1 – Scheduling/Leveling Report.** This appendix in Adobe Acrobat PDF file format, formatted to fit standard ANSI Size A (Letter) size paper (8.5 inch x 12 inch) (215 mm x 279 mm) paper, printed with portrait orientation, shall be included with the narrative as a separate file.

A complete Scheduling/Leveling Report file generated by Contractor's Oracle-Primavera scheduling software application) which includes the Schedule Settings, Statistics, Errors, Warnings, Scheduling/Leveling Results, Exceptions, Activities with unsatisfied constraints, Activities with unsatisfied relationships, and Activities with external dates. The statistics shall include, # of Activities, # of Activities Not Started, # of Activities In Progress, # of Activities Completed, # of Activity Relationships, and # of Activities with Constraints. Total number of activities on the critical path, percent complete, activities without predecessors, activities without successors, and activities out of sequence.

- j) **APPENDIX 2 – Progress Schedule plot.** This appendix in Adobe Acrobat PDF file format, formatted to fit ANSI Size B (Ledger) paper (11 inch x 17 inch) (279 mm x 431 mm) paper, printed with Landscape orientation, shall be included with the narrative as a separate file.

Appendix 2 to the narrative shall be an electronic schedule plot (Adobe Acrobat format), with activities sorted by Start Date in ascending order, Grouping of activities by WBS, and only the "Longest Path" filter applied. This plot shall provide a clear critical path from the Data Date to the last activity in the schedule.

Graphical representations shall be shown at a suitable scale to be legible and readable.

G.2. Monthly Update Progress Schedule. For each Progress Schedule submission, the Contractor shall submit a revised narrative in Microsoft Word or Adobe Acrobat format that includes (but is not limited to) the information from paragraph G.1, and the following **additional** topics:

- k) **Project Progress.** Discuss the progress that was made during the current reporting period, and document any Total Float gained or recovered during the period. For major work items describe the differences between the actual work performed and the work planned for the period as represented in the preceding Progress Schedule submission, including explanations for the deviations.
- l) **Suspended Work.** For all suspended work activities that could otherwise logically be progressed, identify the responsible party prohibiting the progression of the work, as well as the detailed reasons why.
- m) **Project Delays.** Discuss any delays experienced during the current reporting period. Quantify any relative change in Total Float for the project since the last Progress Schedule submission. For each activity on the critical path (include Activity ID's and Activity Descriptions) where work was delayed during the reporting period, provide the following detailed information including:
 - the extent in days (negative float) of the delay, and events that caused the delay.
 - the party(s) responsible for the delay event(s).
 - the other activities in the construction schedule affected by the events.

- the reasonable steps needed to minimize the impact of the delay, and which party needs to take the action(s).

The Contractor is reminded of the requirements of Notice & Recordkeeping as found in NYSDOT §104-06 of the contract specifications and as they relate to Disputed Work. The Contractor shall include a copy of any notice provided to the Engineer for any time-related delay dispute as part of their narrative.

- n) **Project Issues.** List any other problems experienced during this Progress Schedule submission period, the party responsible for the problems, and the Contractor's intentions to resolve the issue(s).
- o) **Schedule changes.**
 - i) List of all added or deleted activities included in this Progress Schedule submission, and the reason(s) for and the impact(s) of such changes.
 - ii) List all changes in activity Original Durations, the justification for such change(s), and the impact(s) of such changes.
 - iii) List all changes in relationships between activities included in this Progress Schedule submission, and the reason(s) for and the impact(s) of such changes.
 - iv) List any addition or deletion of activity or project constraints, and the reason(s) for and the impact(s) of such changes.
 - v) List all changes to the project calendars, and the reason(s) for and the impact(s) of such changes.
- p) List all activities for procurement of long lead time materials that are behind schedule and the reason(s) why.
- q) Description of any changes to the critical path since the last Progress Schedule submission and the impacts of such changes.
- r) The major work elements, as defined in the WBS, to be accomplished during the next monthly work period.
- s) Any potential problems that are anticipated for the next monthly work period and the proposed solutions to such problems. Identify potential problems or risks that either the Department or Contractor may be potentially responsible for. Explain what action the responsible party (i.e. - Department or Contractor) needs to take and the date by which time the action needs to be taken to avoid the problem.
- t) Any planned acceleration of activities that the Contractor anticipates to undertake within the next monthly work period that either the Department directed, or that the Contractor believes is necessary.
- u) The following appendix in Adobe Acrobat PDF file format, formatted to fit ANSI Size E paper (34 inch x 44 inch) (863 mm x 1117 mm) paper, printed with Landscape orientation, shall be included with the narrative as a separate file.
 - APPENDIX 3 – A listing of all work activities as of the data date, using the Appendix 1 activity layout, sorted by Finish date, Total Float in increasing order, showing the Activity ID, Activity Name, Original Duration, Remaining Duration, Actual Duration, Total Float, Early Start date, Start date, Finish date, Late Finish date, and Calendar ID. The grouping of activities shall be by WBS. The Gantt Chart shall clearly indicate all activities in the schedule. Graphical representations shall be shown at a suitable scale to be legible and readable.
 - APPENDIX 4 – A listing of work activities filtered by Notebook Topics assigned as of the data date, sorted by Finish date and Total Float in increasing order, showing the Activity ID, Activity Name, and Notebook Topic. The grouping of activities shall be by WBS.

H. Schedule Submission Methodology. Progress Schedule submissions will only be considered complete when all documents and data have been provided to the Engineer.

H.1. File Naming Convention. The schedule filename shall conform to the requirements of the Department and as defined by the Engineer.

I. Progress Schedule Review and Analysis:

I.1. Immediate Rejection of Progress Schedule Submissions. The following deficiencies in a

Contractor's progress schedule submission shall be grounds for the immediate rejection by the EIC, without further review, analysis and/or comments.

- a) Failure of the Project Scheduler to submit "schedule" of the project, as of the data date.
- b) Failure to attach a copy of the complete Scheduling/Leveling Report
- c) Any activities without predecessors, or activities without successors, appearing in the Scheduling/Leveling Report with the exception of the first and last activity in the schedule.
- d) Any activity constraints appearing in the Scheduling/Leveling Report that have not been approved in writing by the EIC, or that are not specifically allowed by this specification.
- e) Any Activities with Actual Dates > Data Date appearing in the Scheduling/Leveling Report.
- f) Any Milestone Activities with invalid relationships appearing in the Scheduling/Leveling Report.
- g) Failure to have a clearly defined Critical Path from the Data Date to the last activity in the schedule, using the Longest Path method. This would reflect logic errors in the project schedule.
- h) Failure to attach the schedule Narrative and required appendices.
- i) Repeated failure to correct "Out-Of-Sequence" activities.

If any of these deficiencies are found, the Contractor's submission shall be considered deficient, and Engineer will notify the Contractor immediately by return E-mail of the rejection of the schedule submittal.

I.2. Schedule Analysis Method.

Events, actions, and progress that cause delays or gains to the Progress Schedule will be analyzed solely by the "Contemporaneous Period Analysis" method.

I.3. Department Review and Acceptance of Progress Schedules.

The Engineer will review the Monthly Progress Schedule submissions and will prepare a written response (Progress Schedule Review Report) to the Contractor's submission within five (5) Work Days following receipt of the Contractor's complete schedule submission. The Engineer will either "accept" the schedule, "accept as noted", or "reject" the schedule for re-submittal by the Contractor.

If the Progress Schedule submission is not in compliance with contract requirements, the Engineer may reject the submittal and shall forward any comments and requests for schedule revisions to the Project Scheduler by email, with a copy to the Contractor. The Project Scheduler shall address all comments in writing and/or make the requested revisions, and resubmit the revised schedule within three (3) State Business days of the Engineer's reply. If the Engineer determines the revised submission still does not meet the contract requirements, any further revisions required thereafter shall also be submitted for acceptance within (3) Work Days of the request for revisions by the Engineer.

For schedules that are "accepted as noted" the Engineer shall forward any comments, or requests for revisions, to the Contractor by email,. The Project Scheduler shall address all comments in writing and/or make the requested revisions as part of the next scheduled Progress Schedule submission.

The Project Scheduler shall make adjustments to the Progress Schedule in accordance with the Engineer's comments and resubmit copies for review consistent with the requirements of this section.

The Engineer, by accepting the progress Schedule, does not agree that the Progress Schedule is reasonable or that by following the Progress Schedule the Contractor can complete the work in a timely manner. If, after a Progress Schedule has been accepted by the Engineer, either the Contractor or the

Engineer discover that any aspect of the Schedule is on error, or something significant has been omitted, the Contractor shall correct the Progress Schedule in the next Progress Schedule submission and describe this revision in the Narrative report.

Acceptance of progress schedules by the Engineer shall not be construed to imply approval of any particular construction methods or sequence of construction or to relieve the Contractor from its responsibility to provide sufficient materials, equipment and labor to guarantee the completion of the contract in accordance with the contract documents.

Acceptance of the progress schedule by the Engineer does not attest to the validity of assumptions, activities, relationships, sequences, resource allocations, or any other aspect of the progress schedule. Within the contractual constraints, the Contractor is solely responsible for the planning and execution of the work.

Acceptance of the progress schedule by the Engineer shall not be construed to modify or amend the contract agreement or the date of completion therein. Completion dates can only be modified or amended by standard contractual means, Request For Extension of Completion Date.

If any resources are included in the Progress Schedule, it is not intended that the Engineer, by accepting the schedule should use the Contractor's resource data for anything other than determining the reasonableness of achieving the Contractor's production rates. Resources included with the accepted CPM schedule shall not be misconstrued as a cost benchmark for the performance of planned or actual work.

Once the progress schedule has been accepted, the Contractor shall not deviate from it without first notifying the Engineer in writing.

Upon receipt from the Contractor of the corrected schedule, a new review period by the Engineer of five (5) Work Days will begin.

J. Changes to Progress Schedule due to Added/Deleted/Changed Work:

J.1. Changes to the contract. In the event a notice of a change to the contract is received, the appropriate changes to the progress schedule shall be made, as necessary, to incorporate the anticipated added/deleted/changed work and the Contractor shall notify the Engineer in writing within 10 (ten) calendar days if there is any effect of such change to the schedule. Change to the contract includes, but is not limited to, Extra Work, Change Orders, Suspensions of Work Directed by the Engineer, Changed Condition, and Value Engineering Change Proposals. Added, deleted and/or extra work associated with Change Orders shall be reflected in the next Monthly Progress Schedule Submission in anticipation of and prior to the date in which the work physically takes place without regard to the dates when the actual Change Order was approved. The effect of the change to the contract on the projects Critical Path shall be stated. Extra work or additional work that does not affect the controlling operation on the critical path will not be considered as the basis for a time extension. All schedule activities effected by added, deleted or changed work that is included in a signed Order-On-Contract, Field Change Order, or Authorization of Extra Work (with the exception of minor quantity changes that do not impact contract milestones), or work activities performed by the Contractor at risk in anticipation of such Department approval, shall be assigned the appropriate Activity Code (Added/Changed Work) and Code Value (sequentially numbered) to denote which "Changed Contract Work" order number correlates to those activities of work.

J.2. Time Impact Analysis.

For each request of an adjustment of contract time due to an anticipated change to future work in the Progress Schedule, when the Contractor or Engineer consider that an anticipated or approved change to the contract may impact the critical path and contract progress by more than a calendar month, the Contractor shall submit a Time Impact Analysis (TIA). The TIA shall be submitted as part of any Order on Contract (Change Order) and/or VECP if the critical path changes by more than a calendar month. The TIA shall be based on a revised Progress Schedule and shall be submitted as an electronic file (using Microsoft Word for the narrative) containing:

- a) The TIA shall illustrate the impacts of each change or delay on the current scheduled completion date or internal milestone, as appropriate.
- b) The analysis shall use the accepted Monthly Progress Schedule that has a data date closest to and prior to the event as the "Current Baseline", this shall then be compared against the "What-if Project Plan Baseline" for the purpose of the TIA.
- c) If the Engineer determines that the accepted schedule used does not appropriately represent the conditions prior to the event, the accepted schedule shall be updated to the day before the event being analyzed.
- d) The TIA shall include an impacted schedule ("What-if Project Plan Baseline") developed from incorporating the actual or anticipated event into the accepted schedule by adding or deleting activities, or by changing durations or logic of existing activities.
- e) If the impact schedule shows that incorporating the event negatively modifies the critical path and scheduled completion date of the accepted schedule, and the Engineer accepts the impacted schedule, the difference between scheduled completion dates of the two schedules shall be equal to the proposed adjustment of contract time.
- f) The Engineer may construct and utilize an appropriate project schedule or use another recognized method to determine adjustments in contract time until the Contractor provides the TIA.
- g) The Contractor shall submit a TIA within fifteen (15) State Business Days of receiving a written request for a TIA from the Engineer.
- h) The Contractor shall allow the Engineer ten (10) Work Days after receipt to accept or reject the submitted TIA. All accepted TIA schedule changes shall be included in the next Monthly Progress Schedule submission.
- i) If a TIA submitted by the Contractor is rejected by the Engineer, the Contractor shall meet with the Engineer to discuss and resolve issues related to the TIA. If agreement is not reached, the Contractor will give notice in conformance with §104-06 Notice & Recordkeeping, and submit in accordance within the provisions in §105-14.E "Required Content of *Dispute Submissions*".
- j) The Contractor shall only show actual as-built work, not unapproved changes related to the TIA, in subsequent Monthly Progress Schedules submissions. If agreement is reached at a later date, approved TIA schedule changes shall be included in the next Monthly Progress Schedule submission.
- k) Request for a contract time extension will not be processed until the receipt and approval of a Time Impact Analysis. **However, all extension of time will only be considered at the end of the project completion date.**

K. Failure to Submit Progress Schedules and/or Recovery Schedules:

- K.1.No progress payment for this item of work shall be made until the progress schedule is "accepted" or "accepted as noted" by the Engineer.
- K.2.If the Contractor's Progress Schedule submission is rejected due to any deficiency noted in paragraph I.1(a) through (i), it shall be considered an incomplete submission and therefore substantially deficient.
- K.3.If the Contractor's revised Progress Schedule submission does not address the written comments provided by the Engineer and does not include a written explanation with a reasonable rational for not addressing those comments, the submission shall be considered deficient.
- K.4. If the Contractor fails to submit a CPM Progress Schedule conforming to the provisions required under this specification, to the degree that such failure is deemed by the Construction Supervisor to adversely affect the management of the project and/or the administration of the construction contract, liquidated damages will be assessed as determined under Basis of Payment.

L. Recovery Schedule

- L.1 If the latest completion time for any work on the current Progress Schedule results in an activity being delayed ten percent or more of the time beyond the required Contract duration or any specified Milestone duration, as adjusted if appropriate, the Engineer may require the Contractor to submit a Recovery

Schedule and written description of the plan to recover all lost time and maintain the required Completion Date or specified Interim Milestone Date(s).

- L.2. With the Recovery Schedule the Contractor shall submit a narrative that identifies where additional labor and/or equipment resources will be allocated. Alternately, the Contractor may elect to provide the makeup of their Crew resources in the narrative and assign those Crew resources to the appropriate activities in the Progress Schedule. The makeup of the Crew shall include the various Labor classes and equipment that comprise the Crew along with the quantity of each labor class and type of equipment. Equipment resources shall be shown for major or specialty equipment such as tower cranes, piledrivers, barges, asphalt pavers, concrete pavers, dozers, front end loaders, backhoes, rollers, excavators, graders, long line striping truck or other equipment that cannot be rented easily.

The Contractor shall provide a reasonable plan for accomplishing the work of the contract within the current completion date, or to the requested contract extension date. The Engineer will use the Recovery Schedule to evaluate time extensions, with or without charges.

M. Submission of progress schedules with projected Early Completion date(s):

The Contractor may indicate a projected early completion date on any progress schedule submission without compensation

N. Float

During the course of contract execution, Total Float generated due to the efficiencies of either party (Owner or Contractor) will be considered project Float that is not for the sole use of the party generating the float; rather it is a shared commodity to be reasonably used by either party. Any party assigned activity responsibility within the schedule has the full use of the project Float until it is depleted.

METHOD OF MEASUREMENT:

The quantity shall be measured for payment on a Lump Sum basis.

The minimum lump sum bid for this item shall be the unit price shown in the itemized proposal.

Failure of the Contractor to bid at least the minimum amount will result in the Department adjusting the Contractor's bid to include the minimum bid amount for this item.

BASIS OF PAYMENT:

The lump sum price bid for CPM Progress Schedules shall include all labor, material, and equipment necessary to satisfactorily complete the work.

Progress payments will be made at 25 percent of the lump sum price bid upon acceptance of the Final Baseline Progress Schedule and the List of Submittals. 70 percent will be paid in subsequent contract payments, in proportion to the number of months remaining in the original contract duration, less any non-payment for substantial deficiencies. The remaining 5 percent will be paid upon acceptance of the As-built Progress Schedule.

A. Non-Payment. No payment will be made for any Progress Schedule submitted more than twenty-one calendar days late. For each calendar day during which there are substantial deficiencies with the Progress Schedule no payment will be made. The amount of such non-payment will be 1/30th of the Monthly Payment Amount multiplied by the number of days there are substantial deficiencies.

B. Liquidated Damages. Liquidated damages will be assessed for each subsequent calendar day or part thereof that a cited deficiency resulting in non-payment is not corrected or is permitted to recur. Liquidated damages will be assessed at the rate equal to 1/10th of the Monthly Payment Amount.

If an extension of time with the assessment of engineering charges and/or liquidated damages is approved, no additional payment **will** be made for CPM Progress Schedules.

C. Payment will be made under

Item No.	Item	Pay Unit
639.210053	Critical Path Method (CPM) Progress Schedule with Monthly Update	LS

To make the item compatible with the existing Computerized Engineers Estimate System the letters will be replaced as per below.

X=1 (monthly)

N=5 (Nassau) C=3 (County)

Disclaimer: Adopted from NYSDOT Specification 639.21010011

ITEM NO. 762 – INTEGRAL COLOR PIGMENT FOR CEMENT CONCRETE

1. DESCRIPTION

Under this item, the contractor shall furnish and mix color pigment into cement concrete at locations shown on the plans, or as directed by the Engineer.

2. MATERIALS

The pigment shall conform to “Integral Colors” as supplied by “Stampcrete International Ltd.”, of Centereach, N.Y., or approved equal. The color to be used shall be as indicated on the plans or as directed by the Engineer.

3. CONSTRUCTION DETAILS

The pigment shall be added to, and thoroughly mixed into, the cement concrete prior to placement, to insure a consistent color throughout the concrete. Pigment shall be added at a rate of 18 lbs per cubic yard, or in accordance with the manufacturer’s instructions, or as directed by the Engineer.

4. METHOD OF MEASUREMENT

The quantity to be paid under this item will be the number of pounds of pigment added to the cement concrete mix.

5. BASIS OF PAYMENT

The unit price bid shall include the cost of all labor, materials, and equipment necessary to complete the work, including cleaning residue of color pigment from the concrete truck. Imprinting and cement concrete will be paid for under their respective items.

END OF SECTION

ITEM NO. 763 – IMPRINTING ON CONCRETE SIDEWALK

1. **DESCRIPTION**

Under this item the contractor shall modify the surface of newly placed cement concrete pavement or sidewalk to create a pattern as specified in the plan and/or as directed by the Engineer.

2. **CONSTRUCTION DETAILS**

Cement concrete sidewalk shall be placed at locations and dimensions shown on the plans and/or as directed by the Engineer, in accordance with Item No. 27 as described in the Standard Specifications. At the appropriate time in the concrete curing process (as detailed in the specific treatment directions) the concrete surface shall be imprinted, stamped, or rolled such that the specified pattern is obtained. The contractor shall submit the recommended method of operation, containing dimensions of forms and/or rollers, timing of installation, and any other pertinent information to the Engineer for approval. Immediately after the surface finishing has been completed, the Impervious Membrane Method of curing shall be implemented, as detailed in the latest edition of the New York State Department of Transportation Standard Specifications.

Suppliers and/or Installers – Possible technology to complete this work is available from, but not limited to:

- a) Bomanite Corporation, P.O. Box 599, Madera, California 93639
- b) Quick Imprint Systems, P.O. Box 7, Goodman, Mo., 64850
- c) Stampcrete International Ltd., Centereach, N.Y., 11720
- d) Or equal

3. **METHOD OF MEASUREMENT**

The quantity to be paid under this item will be the number of square feet of imprinting on concrete sidewalk, in accordance with the plans and specifications, or as directed by the Engineer.

4. **BASIS OF PAYMENT**

The unit price bid per square foot for this item shall include the cost of furnishing all labor, materials, equipment and incidentals necessary to complete the imprint work to the satisfaction of the Engineer. Concrete sidewalk will be paid for under their respective items.

END OF SECTION

(On Construction firms letterhead)

Date Issued: _____

Dear Resident:

We are sorry to inconvenience you, but in order to proceed with construction for _____ we must close and/or limit your access to your driveway. As work progresses, you will be notified on a daily basis when and how your particular residence will be affected. We assure you that every effort will be made to minimize the impact to you relative to this construction.

Our current schedule calls for the project related work to be performed in your area during the week of _____. A copy of this letter with specific dates and time for this work will be delivered at least twenty-four (24) hours in advance in order that you will have sufficient opportunity to plan for accessibility to your vehicles.

If additional information is necessary, you may contact any of the representatives listed below.

Thank you for your patience.

Contractor	_____	Phone: _____
Inspector	_____	Phone: _____
Project Manager	_____	Phone: _____

(On Construction firms letterhead)

Date Issued: _____

CONSTRUCTION NOTIFICATION
24 HOUR NOTICE

Date & Type of Construction: _____
How will residence be affected: _____
Approximate time of
Construction: _____

Driveway access (will) (will not) be permitted.