Project Manual

ITHACA COMMONS REPAIR AND UPGRADE

Ithaca, New York

Surface Improvements Package
100% Bid Set – December 12, 2013

Owner:

CITY OF ITHACA
215 East State Street
Ithaca, NY 14850

Architect:

SASAKI ASSOCIATES, INC.
64 Pleasant Street
Watertown, Massachusetts 02472

SA 06682.00

SASAKI

DOCUMENT 000110

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SECTION 011000

SUMMARY

PART 1 GENERAL

1.00 GENERAL PROVISIONS

A. Attention is directed to the PROCUREMENT AND CONTRACTING REQUIREMENTS and all Sections within DIVISION 01, GENERAL REQUIREMENTS, which are made a part of this Section of the Specifications.

1.01 SUMMARY

A. This Section includes the following:

1. Project identification and Description of the Work of this Contract.
2. Type of the Contract.
3. Work under other contracts.
4. Use of premises.
5. Occupancy requirements.
6. Work restrictions.
7. Specification formats and conventions.

1.02 PROJECT IDENTIFICATION AND DESCRIPTION OF WORK OF THE CONTRACT

A. Project Identification: The name of the Project on Contract Documents is ITHACA COMMONS, Ithaca Commons Surface Improvements, Ithaca, New York.

B. Description of Work of the Contract: City of Ithaca, New York is proposing to redesign East State Street and North Tioga Street as indicated on the Drawings.

1. This Contract, referred to as the “Surface Improvements Package”, is the third of three contracts to be let.
2. The site work to be completed includes demolition of all remaining paving within the Limit of Work (LOW), protection of two existing trees and hand removal of site walls and paving in the vicinity of the tree protection area, and abandonment of existing public utilities. The site work includes the installation of new electrical system, water connections, paving, planting, lighting, site furnishings and pavilions.

C. Construction Documents will be issued as "Construction Packages" so that work can proceed. At this point in time, three Construction Packages are planned, as follows:

1. Construction Package No. 1 – Demo Package
2. Construction Package No. 2 – Utilities Package
3. Construction Package No. 3 – Surface Improvements

1.03 TYPE OF CONTRACT

A. Project will be a Lump Sum Contract with Unit Prices for those items for which indefinite quantities can be expected and, therefore, pre-agreed prices per unit of work are established as means to determine adjustments to the Contract Price after actual quantities are determined.

1.04 WORK UNDER OTHER CONTRACTS

A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract. Coordinate the Work of this Contract with work performed under separate contracts.

B. Briefly without limitation, the work of this Contract includes coordination with other Contractors performing the following work under separate contracts with the Owner:

1. Previous demolition work.
2. Previous utility work.
3. NYSEG gas main installation.
4. NYSEG electric installation.
5. Public art installation.
6. Security / Surveillance System Installation.
7. Play structure installation.
8. Other Utility Services, including but not limited to Verizon, Tompkins Trust Company, NYSEG, Time Warner Cable, and Finger Lakes Technology Group.
9. Outstanding work by Ritter & Paratore Contracting Inc. (Contract #1 – Demolition)
10. Outstanding work by Vacri Construction Corporation (Contract #2 – Utilities)
11. Adjacent Private Construction Activities including but not limited to Harold Square, House of Shalimar, 104 E State, and Marriott Hotel.
12. Traffic signal installation at intersections of State Street with Cayuga and Aurora Streets.
13. Work by City of Ithaca Department of Public Works.

1.05 USE OF PREMISES

A. General: Contractor shall have full use of the area within the LOW, (unless otherwise indicated on the Drawings) for construction operations, including use of Project site, during construction period. Contractor's use of premises is limited only by Owner's right to perform work or to retain other contractors on portions of Project.

B. Use of Site: Limit use of premises to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Limits: Confine construction operations to areas within the Limits of Work areas as indicated on Drawings.
2. Driveways and Entrances: Keep driveways and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
   a. Schedule deliveries to minimize use of driveways and entrances.
   b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

C. SANITATION: Use special care in maintaining the Work areas free from food debris and food wrappers. Provide covered trash containers and be responsible for the sanitary collection and prompt removal of such trash in these containers on a daily basis.

D. FLAMMABLE LIQUID STORAGE: All flammable liquids and/or gas shall be stored and used in accordance with applicable State and Federal regulations.

E. ALCOHOLIC BEVERAGES: Alcoholic beverages shall not be brought to or consumed on the premises. Intoxicated personnel will not be permitted on the premises.

F. SECURITY: Contractors shall be responsible for security of their own materials from theft and vandalism. This includes the personal tools and materials of the men working for the Contractor and subcontractors.

G. RODENT AND PEST CONTROL: Provide rodent control as necessary to prevent infestation of construction and storage areas. Employ methods and use materials which will not adversely affect conditions at the site or on adjoining properties. Should rodenticides be considered necessary submit copies of proposed program to Owner and Architect. Use of rodenticide shall comply with manufacturer's published instructions and recommendations. Clearly indicate:

1. Area or areas to be treated.
2. Rodenticides to be used.
3. Manufacturer's printed instructions.
4. Pollution preventive measures to be employed.

H. The Contractor shall be responsible for excluding all but authorized personnel from work sites.

1.06 BUSINESS, PROPERTY OWNERS AND RESIDENTS - OCCUPANCY REQUIREMENTS

A. Full Occupancy: Business owners, property owners and residents will occupy the premises during entire construction period. Cooperate with these parties during construction operations to minimize conflicts and facilitate their usage. Perform the Work so as not to interfere with business owners, property owners and residents' day-to-day operations. Maintain existing exits, unless otherwise indicated.

1. Maintain access to existing walkways, drives, and other adjacent occupied or used facilities. Do not close or obstruct walkways, building entries or facilities without written permission from impacted business owner, property owner or resident.
2. Provide not less than **48** hours' notice to business owners, property owners and residents of activities that will affect their operations.

B. Occupancy of Completed Areas of Construction: Business owners, property owners and residents reserve the right to occupy and utilize completed areas of site before Substantial Completion, provided such occupancy does not interfere with completion of the Work. Such use and partial occupancy shall not constitute acceptance of the total Work.

C. All non-construction areas shall be segregated from construction areas. All dust, weather, and noise barriers shall be neat in appearance and be effective.

D. Doors, access ways and openings around piping and machinery shall not interfere with operation of equipment or utilities nor interfere with legal exits.

E. Any temporary closing of legal exits as required for construction operations, must be approved by the Owner, the Building Inspector and Fire Department.

1.07 WORK RESTRICTIONS

A. On-Site Work Hours: Work shall be generally performed on the site during normal business working hours of 7:00AM to 7:00PM with additional restrictions on concrete and asphalt deliveries (last delivery 3:30PM) and last pours (4:00PM).

B. Existing Utility Interruptions: Do not interrupt utilities serving facilities permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Architect and business owners, property owners and residents not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect's and business owners, property owners and residents' written permission.

C. Maintain a daily sign-in record of all personnel on the job site.

D. Worker Parking: There will be no provisions for worker parking; construction personnel shall abide by all normal City parking regulations. Owners of vehicles parked in unauthorized areas will be subject to being towed at their expense.

1. Vehicles shall not be driven on or parked over tree roots, lawns, or plantings.

E. Construction Vehicle Use On-Site: Construction vehicles shall travel through the site in the direction indicated on the Drawings at all times, unless current work activities prohibit the one-way flow of traffic. Contractor shall minimize the time during which one-way travel as indicated on the Drawings is not possible.

F. Protect personnel from hazardous conditions with orange construction fencing and necessary warning signs.

G. Prior to doing any digging on property, the Contractor must contact Dig Safe and to ensure all underground services are properly located.

H. Job sites are to be maintained clean and free from trash and debris. Construction materials will be maintained neatly stacked and stored in designated areas. Do not store materials on lawns, in flower beds or under trees.

1.08 SPECIFICATION FORMATS AND CONVENTIONS

A. Specification Format: The Specifications are organized into Divisions and Sections using the 50-division format and CSI/CSC's "MasterFormat" numbering system.

1. Section Identification: The Specifications use Section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete because all available Section numbers are not used. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of Sections in the Contract Documents.
2. Division 01: Sections in Division 1 govern the execution of the Work of all Sections in the Specifications.

B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.
   a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

1.09 PERSONNEL STANDARDS

A. The Contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, age or national origin.

B. The Contractor will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all applicants will receive consideration for employment without regard to race, color, religion, sex, age, or national origin; or that it is an "Equal Opportunity Employer".

C. The Contractor will take affirmative action to ensure that applicants are employed, and that employees are treated fairly during employment with regard to race, color, religion, sex, age or national origin. Such action shall include, but not be limited to the following: Employment, upgrading, demotion, or transfer; recruitment, or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship.

D. It is the Contractor's responsibility to ensure the security of the job site. City of Ithaca will not be held liable for missing or damaged materials, tools or equipment.

E. Vehicles are not to be driven or parked on grassed areas, shrubs, ground cover beds, under trees, or on brick walks. If it becomes necessary to move equipment or vehicles on a lawn, use plywood sheets under the wheels to prevent unnecessary compaction. Consult City representative before driving on these areas. Any damage done will be repaired, at the Contractor's expense, to the satisfaction of the Owner.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 014339

MOCK-UP REQUIREMENTS

PART 1 GENERAL

1.00 GENERAL PROVISIONS

A. Attention is directed to the PROCUREMENT AND CONTRACTING REQUIREMENTS and all Sections within DIVISION 01, GENERAL REQUIREMENTS, which are made a part of this Section of the Specifications.

1.01 SUMMARY

A. Furnish and install mock-ups suitable to illustrate finish colors, materials and methods of construction. Maintain mock-ups as standard of colors, patterns, materials, performance and workmanship for entire project.

B. Contractor shall use the Emerson Transmission site for mock-up construction and exhibition for the entire life of the Contract.

1.02 RELATED REQUIREMENTS

A. Examine Contract Documents for requirements that affect Work of this Section. Other Specification Sections that directly relate to Work of this Section include, but are not limited to:

1. Section 044302 Granite
2. Section 055213 Metal Handrails and Railings
3. Section 079200 Exterior Sealants
4. Section 321313 Portland Cement Concrete Pavement
5. Section 321413 Concrete Unit Paving
6. Section 321440 Granite Paving
7. Section 329449 Green Screen

1.03 SUBMITTALS

A. Shop Drawings of Mock-Ups: Provide large scale shop drawings for fabrication, installation and erection of all parts of each mock-up. Provide plans, elevations, and details of anchorage, connections and accessory items.

B. Photographs of Mock-Ups: Submit photographs of mock-ups after completion of installation and acceptance of each mock-up.

C. Samples: Refer to individual Specification Sections for submittal requirements of mock-up components and coordinate accordingly

1.04 QUALITY ASSURANCE

A. Design Modifications: Make design modifications to work only as required to meet performance requirements and to coordinate the work. Indicate proposed design modifications on shop drawings. Maintain original design concept without altering profiles and alignments indicated.

1.05 MOCK-UP SCHEDULE

A. Contractor shall prepare “Mock-Up Site” immediately following mobilization to allow the maximum quantity of time for Architect’s viewing and examination.

B. Mock-ups shall be completed for Architect’s examination at least 45 days prior to scheduled start of construction or fabrication, as applicable for each type of work, unless otherwise specified.

C. Contractor shall be responsible for all mock-ups required under each individual specification section.

PART 2 PRODUCTS

2.01 MATERIALS AND PRODUCTS

A. Provide materials, components, and products for exterior and interior assembly as specified in individual specification sections.

PART 3 EXECUTION

3.01 GENERAL

A. Refer to Specification Sections for specific requirements regarding condition of surfaces, mockup size, erection, and erection tolerances.

3.02 MOCK-UP PROCEDURES

A. Provide mock-ups and field samples of finishes at project as required by individual Specification Sections.

1. Mock-ups shall not be used in final, completed work.
2. Architect may reject, or withhold action on mock-ups requiring coordination with other mock-ups until related mock-ups are constructed and reviewed by Architect.

B. Contractor shall erect field samples and mock-ups at the Project “Mock-Up Site”, at location acceptable to Architect. Size of individual mock-up, protection of mock-up and removal and disposal of mock-up shall be as specified in individual Specification Section.

C. Contractor's Preparation of Mock-ups: Place permanent label or title block on each mock-up for identification. Indicate Project Name, Architect's Project Number, Specification Section number and title, date of mock-up, name and address of Owner, name and address of Architect, name and address of Contractor, name and address of subcontractor and/or supplier, name of manufacturer, Drawing number and detail reference.

1. Modify and customize mock-ups as required to show interface with adjacent work and attachment to structures or building.

3.03 PROTECTION OF MOCK-UPS

A. Mock-ups shall be adequately protected from damage until they are no longer necessary.

3.04 REMOVAL AND DISPOSAL OF MOCK-UPS

A. Demolish and remove mock-ups from site at completion of the Project. Legally dispose of demolished mock-up materials.

END OF SECTION

SECTION 014533

CODE REQUIRED SPECIAL INSPECTIONS AND PROCEDURES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.02 GENERAL REQUIREMENTS

A. Special Inspections and Testing shall be in accordance with Chapter 17 of the Building Code of New York State, adopted 2002.

B. The program of Special Inspection and Testing is a Quality Assurance program intended to ensure that the work is performed in accordance with the Contract Documents.

C. This Specification Section is intended to inform the Contractor of the Owner's quality assurance program and the extent of the Contractor's responsibilities. This Specification Section also serves to inform the Special Inspector and Inspection and Testing Agents of their requirements and responsibilities.

1.03 SCHEDULE OF INSPECTIONS AND TESTS

A. Required inspections and tests are described in the Schedule at the end of the Statement of Special Inspections.

1.04 QUALIFICATIONS

A. The Inspection and Testing Agents, including testing laboratories, shall be approved by the Owner's Representative and the Design Professional in Responsible Charge.

B. The following specific requirements for Inspection and Testing Agents may be waived by the Code Enforcement Officer (COE).

1. Inspectors performing inspections of soils and foundations shall have an education and background in geotechnical engineering.

2. The testing laboratories shall maintain a full time licensed Professional Engineer on staff who shall certify all test reports. This Engineer shall be responsible for the training of the testing technicians and shall be in responsible charge of the field and laboratory testing operations.

3. Technicians performing sampling and testing of concrete shall be ACI certified Concrete Field Testing Technicians - Grade 1.

4. Inspectors performing inspections of concrete work such as inspections of concrete placement, batching, reinforcing placement, curing and protection, shall be ACI certified Concrete Construction Inspectors or ICBO certified Reinforced Concrete Special Inspector in lieu of being a licensed P.E. or EIT.

5. Inspectors performing inspections of masonry shall be ICBO certified Structural Masonry Special Inspectors.

6. Inspectors performing inspections of structural steel shall be individuals who are either licensed Professional Engineers (P.E.) or Engineers-In-Training (EIT) with an education and background in structural engineering, and ICBO certified as Structural Steel Special Inspectors.

7. Technicians performing visual inspection of welding shall be AWS Certified Welding Inspectors or ICBO certified Structural Steel and Welding Special Inspectors. Technicians performing non-destructive testing such as ultrasonic testing, radiographic testing, magnetic particle testing, or dye-penetrant testing shall be certified as an ASNT-TC Level II or Level III Technician.

8. Inspectors performing inspections of spray fireproofing shall be ICBO certified Spray-Applied Fireproofing Special Inspectors.

9. Technicians performing standard tests described by specific ASTM Standards shall have training in the performance of such tests and must be able to demonstrate either by oral or written examination competence for the test to be conducted. They shall be under the supervision the Owner's Representative and shall not be permitted to independently evaluate test results.

1.05 SUBMITTALS

A. Inspection and Testing Agents shall submit to the Owner's Representative and the Design Professional in Responsible Charge for review a copy of their qualifications which shall include the names and qualifications of each of the individual inspectors and technicians who will be performing inspections or tests.

B. Inspection and Testing Agents shall disclose any past or present business relationship or potential conflict of interest with the Contractor or any of the Subcontractors whose work will be inspected or tested.

1.6 PAYMENT

A. The Owner will engage and pay for the services of the Inspection and Testing Agents.

B. If any materials which require Special Inspections are fabricated in a plant which is not located within 100 miles of the project, the Contractor shall be responsible for the travel expenses of the Special Inspector or Inspection and Testing Agents.

C. The Contractor shall be responsible for the cost of any retesting or reinspection of work which fails to comply with the requirements of the Contract Documents.

1.07 CONTRACTOR RESPONSIBILITIES

A. The Contractor shall cooperate with the Inspection and Testing Agents so that the Special Inspections and Testing may be performed without hindrance.

B. The Contractor shall provide adequate OSHA-compliant access for the Inspection and Testing Agents, for them to perform their work.

C. The Contractor shall review the Statement of Special Inspections and shall be responsible for coordinating and scheduling inspections and tests. The Contractor shall notify the Inspection and Testing Agents at least 24 hours in advance of a required test, and 3 working days in advance of a required inspection. Un-inspected work that required inspection may be rejected solely on that basis.

D. The Contractor shall provide incidental labor and facilities to provide access to the work to be inspected or tested, to obtain and handle samples at the site or at source of products to be tested, to facilitate tests and inspections, storage and curing of test samples.

E. The Contractor shall keep at the project site the latest set of construction drawings, field sketches, approved shop drawings, and specifications for use by the Special Inspector and Inspection and Testing Agents.

F. The Special Inspection program shall in no way relieve the Contractor of his obligation to perform work in accordance with the requirements of the Contract Documents or from implementing an effective Quality Control program. All work that is to be subjected to Special Inspection and Testing shall first be reviewed by the Contractor's quality control personnel.

G. The Contractor shall be solely responsible for construction site safety.

1.08 LIMITS ON AUTHORITY

A. The Inspection and Testing Agents may not release, revoke, alter, or enlarge on the requirements of the Contract Documents.

B. The Inspection and Testing Agents will not have control over the Contractor's means and methods of construction.

C. The Inspection and Testing Agents shall not be responsible for construction site safety.

D. The Inspection and Testing Agents have no authority to stop the work.

1.09 STATEMENT OF SPECIAL INSPECTIONS

A. The Statement of Special Inspections will be prepared by the Design Professional in Responsible Charge.

B. The Statement of Special Inspections shall be submitted to the Code Enforcement Officer.

1.10 RECORDS AND REPORTS

A. Inspection and Testing Agents shall prepare detailed daily reports of each inspection or test and submit these reports to the Owner's Representative and Design Professional in Responsible Charge. Reports shall include:

1. Date of test or inspection.

2. Name of inspector or technician.

3. Location of specific areas tested or inspected.

4. Description of test or inspection and results.

5. Applicable ASTM standard.

6. Weather conditions (for site inspections or testing).

7. Signature of inspector, or of the individual overseeing the testing.

B. The Inspection and Testing Agents shall report any discrepancies from the Contract Documents found during an inspection. If the discrepancies are not corrected during the inspection, the Inspection and Testing Agents shall notify the Owner's Representative and Design Professional in Responsible Charge. Reports shall document all discrepancies identified and the corrective action taken.

C. The Testing Laboratory shall promptly notify the Design Professional in Responsible Charge and the Owner's Representative by telephone, fax or email of any test results which fail to comply with the requirements of the Contract Documents.

D. The Inspection and Testing Agents shall submit reports to the Owner's Representative and Design Professional in Responsible Charge within 7 days of the inspection or test. Handwritten reports may be submitted if final typed copies are not available.

E. At the completion of the work requiring Special Inspections, each Inspection and Testing Agent, including laboratories, shall provide a statement to the Owner's Representative and Design Professional in Responsible Charge that all work was completed in substantial conformance with the Contract Documents and that all appropriate inspections and tests were performed.

2 PART 2 PRODUCTS

Not Used

3 PART 3 EXECUTION

Not Used

PART 4 - SCHEDULE

INSPECTION AND TESTING (Continuous & Periodic is as Defined by the BCNYS)	CONTINUOUS	PERIODIC	REFERENCE STANDARD	BCNYS REFERENCE	CHECK IF REQUIRED	IDENTIFY SPEC SECTION AND PROVIDE CLARIFYING NOTES IF NECESSARY
A. Steel Construction						
1. Material verification of high-strength bolts, nuts and washers.		X	Applicable ASTM material specifications. AISC ASD, Section A3.4; AISC LRFD, Section A3.3	1704.3	√	Spec 051223
2. Inspection of high-strength bolting.	X	X	AISC LRFD, Section M2.5	1704.3, 1704.3.3	√	Spec 051223
3. Material verification of structural steel.			ASTM A 6 or A 568	1704.3, 1708.4	√	Spec 051223
4. Material verification of weld filler materials.			AISC, ASD, Section A3.6; AISC LRFD, Section A3.5	1704.3	√	Spec 051223
5. Inspection of welding:						
a. Structural steel					√	Spec 051223
(1) Groove Welds	X		AWS D1.1	1704.3.1		
(2) MP Fillet Welds	X		AWS D1.1	1704.3.1		
(3) SP Fillet >5/16”	X		AWS D1.1	1704.3.1		
(4) SP Fillet <= 5/16”		X	AWS D1.1	1704.3.1		
(5) Flr & Deck Welds		X	AWS D1.3	-		
b. Reinforcing steel		X	AWS D1.4 ACI 318: 3.5.2	1903.5.2		
6. Inspection of steel frame joint details.		X		1704.3.2	√	Spec 051223
B. Concrete Construction						
1. Inspection of reinforcing steel, including prestressing tendons, and placement.		X	ACI 318: 3.5, 7.1-7.7	1704.4, 1903.5, 1907.1, 1907.7, 1914.4	√	Spec 033100
2. Inspection of reinforcing steel			AWS D1.4; ACI 318: 3.5.2	1704.4, 1903.5.2		

INSPECTION AND TESTING (Continuous & Periodic is as Defined by the BCNYS)	CONTINUOUS	PERIODIC	REFERENCE STANDARD	BCNYS REFERENCE	CHECK IF REQUIRED	IDENTIFY SPEC SECTION AND PROVIDE CLARIFYING NOTES IF NECESSARY
welding.						
3. Inspection of bolts to be installed in concrete prior to and during placement.	X			1704.4, 1912.5	√	Spec 033100
4. Verify use of required design mix.		X	ACI 318: Ch. 4, 5.2-5.4	1704.4, 1904, 1905.2-1905.4, 1914.2, 1914.3	√	Spec 033100
5. Sampling fresh concrete: slump, air content, temperature, strength test specimens.	X		ASTM C 172, C 31; ACI 318: 5.6, 5.8	1704.4, 1905.6, 1914.10	√	Spec 033100
6. Inspection of placement for proper application techniques.	X		ACI, 318: 5.9, 5.10	1704.4, 1905.9, 1905.10, 1914.6, 1914.7, 1914.8	√	Spec 033100
7. Inspection for maintenance of specified curing temperature and techniques.		X	ACI, 318: 5.11, 5.13	1704.4, 1905.11, 1905.13, 1914.9	√	Spec 033100
8. Inspection of prestressed concrete.	X		ACI 318: 18.18, 18.164	1704.4		
9. Erection of precast concrete members.		X	ACI 318: Ch. 16	1704.4		
10. Verification of in-situ concrete strength prior to stressing of tendons and prior to removal of shores and forms from beams and slabs.		X	SVI 318: 6.2	1704.4, 1906.2		

INSPECTION AND TESTING (Continuous & Periodic is as Defined by the BCNYS)	CONTINUOUS	PERIODIC	REFERENCE STANDARD		BCNYS REFERENCE	CHECK IF REQUIRED	IDENTIFY SPEC SECTION AND PROVIDE CLARIFYING NOTES IF NECESSARY
C. Masonry Construction L1 = Level 1 Inspection required for nonessential facilities. L2 = Level 2 Inspection required for essential facilities. In general, schools are not considered essential facilities unless they are a designated emergency shelter.			ACI 530/ ASCE 5/TMS 402, Ch. 35	ACI 530.1/ ASCE 6/TMS 602, Ch. 35			This project does not include structural masonry that requires special inspection and testing.
1. Verify to ensure compliance:							

a. Proportions of site prepared mortar and grout.		X L1 L2		2.6A	1704.5		
b. Placement of masonry units and construction of mortar joints.		X L1 L2		3.3B	1704.5		
c. Location and placement of reinforcement, connectors, tendons, anchorages.		X L1 L2		3.4, 3.6A	1704.5		
d. Prestressing technique and installation.		X L1 L2		3.6A, 3.6B	1704.5		
e. Grade and size of tendons and anchorages.		X L1 L2		2.4B, 2.4H	1704.5		
f. Grout specs prior to grouting.	X L2			3.2D	1704.5		
g. Placement of grout.	X L2			3.5	1704.5		
h. Grouting of tendons.	X L2			3.6C	1704.5		
2. Inspection shall verify:					1704.5		
a. Size and location of structural elements.		X L1 L2		3.3G	1704.5		
b. Type, size, and location of anchors.	X L2	X L1	1.15.4, 2.1.1		1704.5		
c. Specified size, grade, and type of reinforcement.		X L1 L2	1012	2.4, 3.4	1704.5		
d. Welding of reinforcing bars.	X L1 L2		2.1.8.6, 2.1.8.6		1704.5, 2108.9.2.1 1		
e. Cold/hot weather protection of masonry construction.		X L1 L2		108	1704.5, 2104.3, 2104.4		
f. Prestressing force measurement and application.	X L2	X L1		3.6B	1704.5		
3. Inspection prior to grouting.		X L1 L2	1.12	3.2D, 3.4, 2.6B, 3.3B	1704.5		
4. Grout placement.	X L1 L2			3.5, 3.6C	1704.5		
5. Preparation of grout specimens, mortar specimens, and/or	X L1 L2			1.4	1704.5		

prisms.							

6. Compliance with documents and submittals.		X L1 L2		1.5	1704.5	√	
D. Wood Construction: Fabrication of wood structured elements and assemblies.		X			1704.6, 1704.2		
E. Soils							
1. Site preparation.					1704.7.1	√	Spec 312210
2. During fill placement.		X			1704.7.2	√	Spec 312210
3. Evaluation of in-place density.		X			1704.7.3	√	Spec 312210
F. Pile Foundations: Installation and load tests.	X		Witness testing by contractor		1704.8		
G. Pier Foundations: Seismic Design Category C, D, E. F.					1704.9, 1616.3		
H. Wall Panels and Veneers: Seismic Design Category E, F.					1704.10, 1616.3, 1704.5		
I. Sprayed Fire-Resistant Materials							
1. Structural member surface conditions.		X			1704.11.1		
2. Application.		X			1704.11.2		
3. Thickness.		X	ASTM E 605		1704.11.3		
4. Density.		X	ASTM E 605		1704.11.4		
5. Bond strength.		X	ASTM E 736		1704.11.5		
J. Exterior Insulation and Finish Systems (EIFS)					1704.12		
K. Special Cases					1704.13		
L. Smoke Control					1704.14		
M. Special Inspections for Seismic Resistance: Applicable to specific structures, systems, and components.							
1. Structural steel.	X		AISC Seismic		1707.2		
2. Structural wood.	X				1707.3		
3. Cold-formed steel framing.		X			1707.4		

4. Storage racks and access floors.		X		1707.5		
5. Architectural components.		X		1707.6		
6. Mechanical and electrical components.		X		1707.7		
7. Seismic isolation system.		X		1707.8		
N. Structural Testing for Seismic Resistance: Applicable to specific structures, systems, and components.						
1. Testing and verification of masonry materials and assemblies.				1708.1		
2. Testing for seismic resistance.				1708.2		
3. Reinforcing and prestressing steel.			ACI 318	1708.3, 1903.5.2		
4. Structural steel.			AISC Seismic	1708.5		
5. Mechanical and electrical equipment.				1708.5		
6. Seismically isolated structures.				1708.6, 1623.8		
O. Structural Observations				1709.1		
Applicable to specific structures.						
P. Test Safe Load				1712.1		
Q. In-Situ Load Tests				1713.1		
R. Preconstruction Load Tests				1714.1		
S. Other (list)						

END OF SECTION

SECTION 014533

CODE REQUIRED SPECIAL INSPECTIONS AND PROCEDURES - ARCHITECTURE

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.02 GENERAL REQUIREMENTS

A. Special Inspections and Testing shall be in accordance with Chapter 17 of the Building Code of New York State, adopted 2002.

B. The program of Special Inspection and Testing is a Quality Assurance program intended to ensure that the work is performed in accordance with the Contract Documents.

C. This Specification Section is intended to inform the Contractor of the Owner's quality assurance program and the extent of the Contractor's responsibilities. This Specification Section also serves to inform the Special Inspector and Inspection and Testing Agents of their requirements and responsibilities.

1.03 SCHEDULE OF INSPECTIONS AND TESTS

A. Required inspections and tests are described in the Schedule at the end of the Statement of Special Inspections.

1.04 QUALIFICATIONS

A. The Inspection and Testing Agents, including testing laboratories, shall be approved by the Owner's Representative and the Design Professional in Responsible Charge.

B. The following specific requirements for Inspection and Testing Agents may be waived by the Code Enforcement Officer (COE).

1. Inspectors performing inspections of soils and foundations shall have an education and background in geotechnical engineering.

2. The testing laboratories shall maintain a full time licensed Professional Engineer on staff who shall certify all test reports. This Engineer shall be responsible for the training of the testing technicians and shall be in responsible charge of the field and laboratory testing operations.

3. Technicians performing sampling and testing of concrete shall be ACI certified Concrete Field Testing Technicians - Grade 1.

4. Inspectors performing inspections of concrete work such as inspections of concrete placement, batching, reinforcing placement, curing and protection, shall be ACI certified Concrete Construction Inspectors or

ICBO certified Reinforced Concrete Special Inspector in lieu of being a licensed P.E. or EIT.

5. Inspectors performing inspections of masonry shall be ICBO certified Structural Masonry Special Inspectors.

6. Inspectors performing inspections of structural steel shall be individuals who are either licensed Professional Engineers (P.E.) or Engineers-In-Training (EIT) with an education and background in structural engineering, and ICBO certified as Structural Steel Special Inspectors.

7. Technicians performing visual inspection of welding shall be AWS Certified Welding Inspectors or ICBO certified Structural Steel and Welding Special Inspectors. Technicians performing non-destructive testing such as ultrasonic testing, radiographic testing, magnetic particle testing, or dye-penetrant testing shall be certified as an ASNT-TC Level II or Level III Technician.

8. Inspectors performing inspections of spray fireproofing shall be ICBO certified Spray-Applied Fireproofing Special Inspectors.

9. Technicians performing standard tests described by specific ASTM Standards shall have training in the performance of such tests and must be able to demonstrate either by oral or written examination competence for the test to be conducted. They shall be under the supervision the Owner's Representative and shall not be permitted to independently evaluate test results.

1.05 SUBMITTALS

A. Inspection and Testing Agents shall submit to the Owner's Representative and the Design Professional in Responsible Charge for review a copy of their qualifications which shall include the names and qualifications of each of the individual inspectors and technicians who will be performing inspections or tests.

B. Inspection and Testing Agents shall disclose any past or present business relationship or potential conflict of interest with the Contractor or any of the Subcontractors whose work will be inspected or tested.

1.6 PAYMENT

A. The Owner will engage and pay for the services of the Inspection and Testing Agents.

B. If any materials which require Special Inspections are fabricated in a plant which is not located within 100 miles of the project, the Contractor shall be responsible for the travel expenses of the Special Inspector or Inspection and Testing Agents.

C. The Contractor shall be responsible for the cost of any retesting or reinspection of work which fails to comply with the requirements of the Contract Documents.

1.07 CONTRACTOR RESPONSIBILITIES

A. The Contractor shall cooperate with the Inspection and Testing Agents so that the Special Inspections and Testing may be performed without hindrance.

B. The Contractor shall provide adequate OSHA-compliant access for the Inspection and Testing Agents, for them to perform their work.

C. The Contractor shall review the Statement of Special Inspections and shall be responsible for coordinating and scheduling inspections and tests. The Contractor shall notify the Inspection and Testing Agents at least 24 hours in advance of a required test, and 3 working days in advance of a required inspection. Un-inspected work that required inspection may be rejected solely on that basis.

D. The Contractor shall provide incidental labor and facilities to provide access to the work to be inspected or tested, to obtain and handle samples at the site or at source of products to be tested, to facilitate tests and inspections, storage and curing of test samples.

E. The Contractor shall keep at the project site the latest set of construction drawings, field sketches, approved shop drawings, and specifications for use by the Special Inspector and Inspection and Testing Agents.

F. The Special Inspection program shall in no way relieve the Contractor of his obligation to perform work in accordance with the requirements of the Contract Documents or from implementing an effective Quality Control program. All work that is to be subjected to Special Inspection and Testing shall first be reviewed by the Contractor's quality control personnel.

G. The Contractor shall be solely responsible for construction site safety.

1.08 LIMITS ON AUTHORITY

A. The Inspection and Testing Agents may not release, revoke, alter, or enlarge on the requirements of the Contract Documents.

B. The Inspection and Testing Agents will not have control over the Contractor's means and methods of construction.

C. The Inspection and Testing Agents shall not be responsible for construction site safety.

D. The Inspection and Testing Agents have no authority to stop the work.

1.09 STATEMENT OF SPECIAL INSPECTIONS

A. The Statement of Special Inspections will be prepared by the Design Professional in Responsible Charge.

B. The Statement of Special Inspections shall be submitted to the Code Enforcement Officer.

1.10 RECORDS AND REPORTS

A. Inspection and Testing Agents shall prepare detailed daily reports of each inspection or test and submit these reports to the Owner's Representative and Design Professional in Responsible Charge. Reports shall include:

1. Date of test or inspection.

2. Name of inspector or technician.

3. Location of specific areas tested or inspected.

4. Description of test or inspection and results.

5. Applicable ASTM standard.

6. Weather conditions (for site inspections or testing).

7. Signature of inspector, or of the individual overseeing the testing.

B. The Inspection and Testing Agents shall report any discrepancies from the Contract Documents found during an inspection. If the discrepancies are not corrected during the inspection, the Inspection and Testing Agents shall notify the Owner's Representative and Design Professional in Responsible Charge. Reports shall document all discrepancies identified and the corrective action taken.

C. The Testing Laboratory shall promptly notify the Design Professional in Responsible Charge and the Owner's Representative by telephone, fax or email of any test results which fail to comply with the requirements of the Contract Documents.

D. The Inspection and Testing Agents shall submit reports to the Owner's Representative and Design Professional in Responsible Charge within 7 days of the inspection or test. Handwritten reports may be submitted if final typed copies are not available.

E. At the completion of the work requiring Special Inspections, each Inspection and Testing Agent, including laboratories, shall provide a statement to the Owner's Representative and Design Professional in Responsible Charge that all work was completed in substantial conformance with the Contract Documents and that all appropriate inspections and tests were performed.

2 PART 2 PRODUCTS

Not Used

3 PART 3 EXECUTION

Not Used

PART 4 - SCHEDULE

INSPECTION AND TESTING (Continuous & Periodic is as Defined by the BCNYS)	CONTINUOUS	PERIODIC	REFERENCE STANDARD	BCNYS REFERENCE	CHECK IF REQUIRED	IDENTIFY SPEC SECTION AND PROVIDE CLARIFYING NOTES IF NECESSARY
A. Steel Construction						
1. Material verification of high-strength bolts, nuts and washers.		X	Applicable ASTM material specifications. AISC ASD, Section A3.4; AISC LRFD, Section A3.3	1704.3	√	Spec 051223
2. Inspection of high-strength bolting.	X	X	AISC LRFD, Section M2.5	1704.3, 1704.3.3	√	Spec 051223
3. Material verification of structural steel.			ASTM A 6 or A 568	1704.3, 1708.4	√	Spec 051223
4. Material verification of weld filler materials.			AISC, ASD, Section A3.6; AISC LRFD, Section A3.5	1704.3	√	Spec 051223
5. Inspection of welding:						
a. Structural steel					√	Spec 051223
(1) Groove Welds	X		AWS D1.1	1704.3.1		
(2) MP Fillet Welds	X		AWS D1.1	1704.3.1		
(3) SP Fillet >5/16”	X		AWS D1.1	1704.3.1		
(4) SP Fillet <= 5/16”		X	AWS D1.1	1704.3.1		
(5) Flr & Deck Welds		X	AWS D1.3	-		
b. Reinforcing steel		X	AWS D1.4 ACI 318: 3.5.2	1903.5.2		
6. Inspection of steel frame joint details.		X		1704.3.2	√	Spec 051223
B. Concrete Construction						
1. Inspection of reinforcing steel, including prestressing tendons, and placement.		X	ACI 318: 3.5, 7.1-7.7	1704.4, 1903.5, 1907.1, 1907.7, 1914.4	√	Spec 033100
2. Inspection of reinforcing steel			AWS D1.4; ACI 318: 3.5.2	1704.4, 1903.5.2	☐	

INSPECTION AND TESTING (Continuous & Periodic is as Defined by the BCNYS)	CONTINUOUS	PERIODIC	REFERENCE STANDARD	BCNYS REFERENCE	CHECK IF REQUIRED	IDENTIFY SPEC SECTION AND PROVIDE CLARIFYING NOTES IF NECESSARY
welding.						
3. Inspection of bolts to be installed in concrete prior to and during placement.	X			1704.4, 1912.5	√	Spec 033100
4. Verify use of required design mix.		X	ACI 318: Ch. 4, 5.2-5.4	1704.4, 1904, 1905.2-1905.4, 1914.2, 1914.3	√	Spec 033100
5. Sampling fresh concrete: slump, air content, temperature, strength test specimens.	X		ASTM C 172, C 31; ACI 318: 5.6, 5.8	1704.4, 1905.6, 1914.10	√	Spec 033100
6. Inspection of placement for proper application techniques.	X		ACI, 318: 5.9, 5.10	1704.4, 1905.9, 1905.10, 1914.6, 1914.7, 1914.8	√	Spec 033100
7. Inspection for maintenance of specified curing temperature and techniques.		X	ACI, 318: 5.11, 5.13	1704.4, 1905.11, 1905.13, 1914.9	√	Spec 033100
8. Inspection of prestressed concrete.	X		ACI 318: 18.18, 18.164	1704.4		
9. Erection of precast concrete members.		X	ACI 318: Ch. 16	1704.4		
10. Verification of in-situ concrete strength prior to stressing of tendons and prior to removal of shores and forms from beams and slabs.		X	SVI 318: 6.2	1704.4, 1906.2		

INSPECTION AND TESTING (Continuous & Periodic is as Defined by the BCNYS)	CONTINUOUS	PERIODIC	REFERENCE STANDARD		BCNYS REFERENCE	CHECK IF REQUIRED	IDENTIFY SPEC SECTION AND PROVIDE CLARIFYING NOTES IF NECESSARY
C. Masonry Construction L1 = Level 1 Inspection required for nonessential facilities. L2 = Level 2 Inspection required for essential facilities. In general, schools are not considered essential facilities unless they are a designated emergency shelter.			ACI 530/ ASCE 5/TMS 402, Ch. 35	ACI 530.1/ ASCE 6/TMS 602, Ch. 35			This project does not include structural masonry that requires special inspection and testing.
1. Verify to ensure compliance:							

a. Proportions of site prepared mortar and grout.		X L1 L2		2.6A	1704.5		
b. Placement of masonry units and construction of mortar joints.		X L1 L2		3.3B	1704.5		
c. Location and placement of reinforcement, connectors, tendons, anchorages.		X L1 L2		3.4, 3.6A	1704.5		
d. Prestressing technique and installation.		X L1 L2		3.6A, 3.6B	1704.5		
e. Grade and size of tendons and anchorages.		X L1 L2		2.4B, 2.4H	1704.5		
f. Grout specs prior to grouting.	X L2			3.2D	1704.5		
g. Placement of grout.	X L2			3.5	1704.5		
h. Grouting of tendons.	X L2			3.6C	1704.5		
2. Inspection shall verify:					1704.5		
a. Size and location of structural elements.		X L1 L2		3.3G	1704.5		
b. Type, size, and location of anchors.	X L2	X L1	1.15.4, 2.1.1		1704.5		
c. Specified size, grade, and type of reinforcement.		X L1 L2	1012	2.4, 3.4	1704.5		
d. Welding of reinforcing bars.	X L1 L2		2.1.8.6, 2.1.8.6		1704.5, 2108.9.2.11		
e. Cold/hot weather protection of masonry construction.		X L1 L2		108	1704.5, 2104.3, 2104.4		
f. Prestressing force measurement and application.	X L2	X L1		3.6B	1704.5		
3. Inspection prior to grouting.		X L1 L2	1.12	3.2D, 3.4, 2.6B, 3.3B	1704.5		
4. Grout placement.	X L1 L2			3.5, 3.6C	1704.5		
5. Preparation of grout specimens, mortar specimens, and/or prisms.	X L1 L2			1.4	1704.5		

6. Compliance with documents and submittals.		X L1 L2		1.5	1704.5	√☐	
D. Wood Construction: Fabrication of wood structured elements and assemblies.		X			1704.6, 1704.2		
E. Soils							
1. Site preparation.					1704.7.1	√	Spec 312210
2. During fill placement.		X			1704.7.2	√	Spec 312210
3. Evaluation of in-place density.		X			1704.7.3	√	Spec 312210
F. Pile Foundations: Installation and load tests.	X		Witness testing by contractor		1704.8		
G. Pier Foundations: Seismic Design Category C, D, E. F.					1704.9, 1616.3		
H. Wall Panels and Veneers: Seismic Design Category E, F.					1704.10, 1616.3, 1704.5		
I. Sprayed Fire-Resistant Materials							
1. Structural member surface conditions.		X			1704.11.1		
2. Application.		X			1704.11.2		
3. Thickness.		X	ASTM E 605		1704.11.3		
4. Density.		X	ASTM E 605		1704.11.4		
5. Bond strength.		X	ASTM E 736		1704.11.5		
J. Exterior Insulation and Finish Systems (EIFS)					1704.12		
K. Special Cases					1704.13		
L. Smoke Control					1704.14		
M. Special Inspections for Seismic Resistance: Applicable to specific structures, systems, and components.							
1. Structural steel.	X		AISC Seismic		1707.2		
2. Structural wood.	X				1707.3		
3. Cold-formed steel framing.		X			1707.4		
4. Storage racks and access floors.		X			1707.5		

5. Architectural components.		X		1707.6		
6. Mechanical and electrical components.		X		1707.7		
7. Seismic isolation system.		X		1707.8		
N. Structural Testing for Seismic Resistance: Applicable to specific structures, systems, and components.						
1. Testing and verification of masonry materials and assemblies.				1708.1		
2. Testing for seismic resistance.				1708.2		
3. Reinforcing and prestressing steel.			ACI 318	1708.3, 1903.5.2		
4. Structural steel.			AISC Seismic	1708.5		
5. Mechanical and electrical equipment.				1708.5		
6. Seismically isolated structures.				1708.6, 1623.8		
O. Structural Observations				1709.1		
Applicable to specific structures.						
P. Test Safe Load				1712.1		
Q. In-Situ Load Tests				1713.1		
R. Preconstruction Load Tests				1714.1		
S. Other (list)						

END OF SECTION

SECTION 015639

TREE AND PLANT PROTECTION

PART 1 GENERAL

1.00 GENERAL PROVISIONS

A. Attention is directed to the PROCUREMENT AND CONTRACTING REQUIREMENTS and all Sections within DIVISION 01, GENERAL REQUIREMENTS, which are made a part of this Section of the Specifications.

1.01 WORK INCLUDED

A. Protection of existing trees and plants from damage as a result of the Contractor's operations including, but not limited to:

1. Tree protection fencing.
2. Root pruning and construction pruning.

1.02 RELATED REQUIREMENTS

A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:

1. Section 024110, SITE PREPARATION.
2. Section 312300, SITE EXCAVATING, BACKFILLING AND COMPACTING.

1.03 REFERENCED STANDARDS

A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.

1. American National Standards Institute (ANSI):

Z133.1	Safety Requirements for Pruning, Trimming, Repairing, Maintaining and Removing Trees, and for Cutting Brush.
A300 (Part One -- 2008)	Pruning (2008)

2. Council of Tree and Landscape Appraisers (CTLA)

Council of Tree And Landscape Appraisers (CTLA)	Guide for Plant Appraisal (9th edition,, 2000)

3. National Arborist Association (NAA):

Ref. 1 Pruning Standards for Shade Trees

1.04 DEFINITIONS

A. Arborist: Professional ISA Certified Arborist hired by the Contractor to perform the work of this Section.

B. Consulting Arborist: ISA Certified Arborist hired by the Owner to perform the observation of the tree related work performed by the Arborist.

1.05 SUBMITTALS

A. Prepare and submit drawings indicating the extent of tree protection fencing required.

B. Proposed methods, and schedule for effecting tree and plant protection shall be submitted for approval.

C. Proposed methods, materials, and schedule for root pruning, construction pruning, and tree fertilization by Certified Arborist shall be submitted for approval.

D. Test results assessing pH, and macro- and micronutrient levels of the soil as described in Paragraph 3.05B of this Section.

1.06 QUALITY ASSURANCE

A. Work of this section shall be completed by a professional ISA Certified Arborist with a minimum five years' experience, who has successfully completed an exam and education program equal to the International Society of Arboriculture (ISA) Certification Program, sponsored by the International Society of Arboriculture 2009, P.O. Box 3129, Champaign, IL 61826 (217) 355-9411; Email: **isa@isa-arbor.com**.

B. Owner will make arrangements and pay all costs to have a Consulting Arborist present at the beginning of tree relate work to observe and advise the Contractor of proper procedures and quality control techniques.

1.07 DAMAGE PENALTIES

A. Trees #50 and #51, the two mature yellowwoods, are to be protected and preserved. Loss of either of these trees will result in fines assessed at the condition-adjusted assessed value of the tree in question, which is currently $19,400.00 for Tree #50 and $14,400.00 for Tree # 51.

B. A fine of $1,000 will be levied against the Contractor for each incident of construction or unauthorized intrusion inside tree protection zones.

C. Damages to or loss of trees, shrubs, and other vegetation will be assessed by the Architect and Owner in accordance with the CTLA guide, using trunk formula calculations.

D. Trees or roots visibly damaged will cause the Owner to withold from the Contractor an assessed amount conforming to the requirements stipulated above for a period of two years. After that period the impact of the damage to any tree will be assessed accordingly.

E. If any trees or shrubs designated to be saved are damaged and replacement is required, a number and diameter of trees or shrubs of the same species and variety, as specified by the Owner and Architect, shall be furnished and planted by the Contractor. The total inch diameter of the replacement trees or shrubs shall equal the diameter of the tree or shrub to be replaced.

1.08 PRECONSTRUCTION TREE PREPARATION

A. Trees to remain inside or within 20 ft. of Limit of Work, shall be inspected by Consulting Arborist prior to commencement of work. Based on arborist's evaluation, pre-emptive measures shall be taken to reduce harm to trees.

B. Pre-emptive measures shall include, but not be limited to, root pruning, soil amendments, structural pruning, spraying or other horticultural treatments to improve vigor of affected plants.

C. All such measures shall be outlined and agreed upon in a pre-construction meeting with the Consulting Arborist prior to the beginning of any work in the vicinity of the protected trees.

PART 2 PRODUCTS

2.01 TREE PROTECTION FENCING

A. Trees to be preserved shall be protected with:

1. Galvanized chain link fencing, 5 or 6 feet high.
2.. Fences are to be mounted on 2-inch-diameter galvanized iron posts, driven into the ground to a depth of 2 feet at no more than 10 foot spacing.

2.02 OTHER CONSTRUCTION-IMPACT MITIGATION TREATMENTS

A. Mulch materials shall be hardwood, pine bark or cedar bark mulch. Mulch shall be derived from healthy trees. Mulch shall not be treated to give it color.

B. Soil amendments shall consist of at least 50% slow-release nitrogen. PHC for Trees 27-9-9 or equivalent shall be used.

C. Dormant oil spray shall be a dormant miscible spray equal to Sunspray Ultrafine Spray Oil or equivalent. Care must be taken to assure that the spray oil used is approved by the NYS DEC for use in New York State..

D. Trunk protection wrapping shall be Miradrain 9900 drain board, by Ten Cate Nicolson, or approved equal.

PART 3 EXECUTION

3.01 INSTALLATION OF FENCING

A. Prior to start of demolition work and clearing and grubbing operations, tree protection fencing shall be installed around the Tree Protection Zone (TPZ) as indicated on the Drawings.

B. Posts shall be set in crushed stone footings.

C. Within the tree protection zone (TPZ) thus established, the following practices are prohibited:

- Traffic entering or crossing
- Stockpiling or storage of any material or debris, including construction materials, demolition debris, soil or mulch.
- Parking vehicles or equipment. .
- Trenching for utilities installation or repair, or for irrigation system installation.
- Changing soil grade by cutting or filling.
- Damaging roots by grading, tearing, or grubbing.
- Compacting soil with equipment, vehicles, and/or materials storage
- Contaminating soil from washing out equipment (especially concrete) and vehicle maintenance

D. All fences shall be installed before any demolition; grading or construction begins, and shall remain in place until its removal is specifically approved by the consulting arborist. Although the tree protection fencing is only 5’ or 6’ tall, it is to be understood that the zones exclude work within these areas from the base to the crown of the trees. No crane work, drilling work, or other high-reaching work is to penetrate the TPZ, until ways and means have been established in a meeting that includes construction managers, equipment operators, and the consulting arborist

3.02 ROOT PRUNING

A. All roots encountered shall be preserved. If roots are inevitably torn or damaged, roots shall be pruned with bypass pruners or with hand saw to neat cross section.

B. All root pruning shall be performed by the Consulting Arborist.

C. No root shall be left exposed for greater than 30 minutes. Roots shall be re-covered with soil and/or protected with burlap fixed to the soil with landscape staples, according to the instructions of the Consulting Arborist.

D. Roots covered with burlap shall be wet every 3 hours during each day while they remain uncovered by soil.

3.03 PRE-CONSTRUCTION PRUNING

A. Dead, diseased and broken branches only shall be pruned prior to the beginning of any construction work. The work shall be performed according to ANSI A300 (Part One) standards, under the supervision of the Consulting Arborist.

3.04 OTHER CONSTRUCTION-IMPACT MITIGATION TREATMENTS

A. Root pruned and construction pruned tree shall be treated with soil amendments and with dormant oil spray, as directed by the Consulting Arborist.

B. Prior to construction, protected trees shall be fertilized, applying ¼-½ pound nitrogen per 1000 square feet. At least 50% of this nitrogen shall be in slow-release form. This application shall be made shortly before the beginning of each growing season while the work continues. According to weather conditions, this will likely be from early to mid-April of each year. If the construction schedule makes spring application not feasible, then alternatively soil amendments may be applied in late August-early September, as soon as weather begins to cool.

C. Dormant oil spray shall be applied in early spring before buds begin to swell at a rate recommended by the manufacturer.

D. A soil protection layer shall be installed above all soil within TPZ. This layer shall consist of 6 inches depth of hardwood or bark mulch. The mulch shall be kept back 12 inches from the base of each tree to be preserved. It must be noted that mulch piled directly against the base of the tree may encourage the development of root pathogens.

E. Regular tree watering shall be initiated and maintained during the growing seasons (approximately March 15-Thanksgiving) throughout the construction period. Soils must be wet to 24-36 inches depth and must be maintained at between field capacity and one-half field capacity. The Architect may periodically monitor watering; using a tensiometer to establish that sufficient water is available to trees.

F. All trees to be removed in the vicinity of protected trees must be removed carefully in pieces, lowering wood using ropes and guys. No wood greater than 2 inches in diameter should be allowed to fall out of the tree. No wood from trees to be removed is to impact either the trees to be preserved or the trees to be transplanted. Chips made from healthy wood may be re-used to create mulch layers of trees to be protected.

G. All trees to remain shall have their trunks wrapped with one layer of drain board from the soil level to the level of the first lateral branch of each tree. Secure the drainboard with twine tight enough to hold it in place, but not so tight as to impact ordinary tree growth. Care shall be taken not to scratch or gouge any tree tissue during the placement of drain board. The following practices are prohibited:

- Attaching anything to trees using nails, screws, and/or spikes.
- Wounding or breaking tree trunks or branches through contact with vehicles and heavy equipment.
- Wounding trunks with string weed trimmers and lawn mowers
- Damaging trunks, root flare or crown by proximate use of heat or fire.
- Wounding of tree trunks or crowns in the process of moving booms and lifts required for excavation or other work.

3.05 POST-CONSTRUCTION CARE

A. At the conclusion of construction, Contractor shall leave all tree protection measures in place.

B. Contractor shall perform soil tests to assess pH, and macro- and micronutrient levels of the soil. Submit soil tests to Architect for review and apply soil amendments as instructed.

END OF SECTION

SECTION 020800

ASBESTOS REMOVAL AND DISPOSAL

PART I -GENERAL

1.1 SCOPE OF WORK

A. Work of this Section shall be performed in accordance with the requirements of the Contract Documents, including but not limited to Instructions to Bidders, Agreement and General Conditions and General Requirements.

B. This Section references procedures for the removal of existing asbestos-containing materials (ACM) that will be disturbed or are disturbed during construction of this project.

C. Furnish all labor, materials, supervision, construction tools and equipment necessary to remove and dispose of all asbestos-containing materials as listed below and shown or noted on the Utility Plans.

1. The following materials are asbestos-containing materials.

a. Asbestos-containing cement pipe (ACP). Note: The ACP is a storm sewer line that must remain in service out side of normal project work hours and whenever not actively worked on.

D. Removal or disturbance of asbestos cement pipe (ACP) shall be completed in compliance with all governing regulations, including Code Rule 56. Each Contractor shall be responsible for abatement work necessary to complete the work of their contract. Any Contractor who requires the removal or disturbance of asbestos-containing material (ACM) to complete his work shall obtain the services of a certified asbestos abatement contractor to remove the ACM in compliance with this specification and all applicable rules and regulations.

E. The Engineer shall approve the asbestos abatement contractor prior to the beginning of the work. Unless otherwise noted, all costs for asbestos abatement work shall be included in the general contractor’s bid.

F. It is the intentions of the contract documents to have the General Contractor provide an approved licensed Asbestos Abatement Contractor.

1.2 SPECIAL CONDITIONS

A. Locations and quantities of all materials to be removed by the abatement contractor must be field verified. Information given on the drawings and in the specifications is for general orientation and information only.

B. The work covered by this specification section involves work with an ACP storm sewer line. Abandon or remove portions of the ACP storm sewer as required to complete the work. Phase abandonment or removal to maintain existing drainage within the project limits. The abatement contractor shall coordinate with the General Contractor to assure that the sewer line is returned to service at the end of day’s work as required to maintain site drainage.

C. The contractor shall have at least one supervisor on the job site at all times who is fluent in English while the project is in progress. The supervisor must be able to communicate fluently with all employees.

D. Contractor shall provide temporary protection, to keep the work areas enclosed, where required, during the performance of the Contract Work. The Contractor shall be responsible for any damage caused as a result of improper temporary protection.

E. The Contractor is responsible for keeping the work area in a clean and safe condition at all times.

1.3 CODES AND REGULATIONS

A. General Applicability of Codes and Regulations and Standards: Except to the extent that more explicit or more stringent requirements are written directly into the Contract Documents, all applicable codes, regulations and standards have the same force and effect (and are made a part of the Contract Documents by reference) as if copied directly into the Contract Documents, or as if published copies are bound herewith.

B. Contractor Responsibility: The Contractor shall assume full responsiblity and liability for the compliance with all applicable Federal, State and local regulations pertaining to work practices, hauling, disposal, and protection of workers, visitors to the site and persons occupying areas adjacent to the site. The Contractor is responsible for providing medical examinations and maintaining medical records of personnel as required by the applicable Federal, State and local regulations. The contractor shall hold the Owner and Owner's Representative harmless for failure to comply with any applicable work, hauling, disposal, safety, health or other regulation on the part of himself, his employees or his subcontractors.

C. Federal Requirements which govern asbestos abatement work or hauling and disposal of asbestos waste materials include but are not limited to the following:

OSHA: U.S. Department of Labor, Occupational Safety and Health Administration (OSHA), including but not limited to:

Occupational Exposure to Asbestos, Tremolite, Anthophyllite, and Actinolite; Final Rules
Title 29, Part 1926, Section 1101 of the Code of Federal Regulations

Respiratory Protection
Title 29, Part 1910, Section 134 of the Code of Federal Regulations

Access to Employee Exposure and Medical Records
Title 29, Part 1910, Section 2 of the Code of Federal Regulations

Hazard Communication
Title 29, Part 1910, Section 1200 of the Code of Federal Regulations

DOT: U.S. Department of Transportation, including but not limited to:

Hazardous Substances
Title 29, Part 171 and 172 of the Code of Federal Regulations

EPA: U.S. Environmental Protection Agency (EPA), including but not limited to:

National Emission Standard for Hazardous Air Pollutants (NESHAPS)
National Emission Standard for Asbestos
Title 40, Part 61, Subpart A, and revised Subpart M (Revised Subpart B) of the Code of Federal Regulations dated November 20, 1990

D. State Requirements which govern asbestos abatement work or hauling and disposal of asbestos waste materials include but are not limited to the following:

New York State Department of Labor (NYSDOL) Industrial Code Rule 56 (Code Rule 56): Asbestos

New York Stae Department of Environmental Conservation (DEC) Regulations regarding waste collector registration Title 6, Part 364 of the New York State Official compilation of Codes, Rules and Regulations. An annual "Industrial Waste Hauler Permit" specifically for asbestos-containing materials is required for transportation of asbestos-containing waste to the disposal site.

E. Local Requirements: Abide by all local requirements which govern asbestos abatement work or hauling and disposal of asbestos waste materials.

1.4 SUBMITTALS:

A. Prior to commencement of any work (minimum of seven days prior to starting work) involving the disturbance of ACM, the Contractor shall submit the following for review and approval:

1. Copy of current NYSDOL Asbestos Contractor's License (DOH-432)
2. Copies of current worker's Asbestos Handler's Certificates
3. Provide a statement signed by an authorized representative of the company stating that the Building Occupants/Other Trades notification required by ICR 56 will be or has been posted at least 10 days prior to the start of abatement. Provide a copy of the notification that will be posted at the job site
4. Copies of all proposed site-specific variances
5. Copy of current asbestos specific liability insurance
6. Copies of Project Notifications and proof of submittal (e.g. certified mail receipt) to NYSDOL and USEPA
7. Copy of NYSDEC permit for waste hauler
8. Name and address of landfill where asbestos-containing waste materials are to be buried. Include contact person and telephone number, and NYSDEC Part 360 permit number or other applicable permits
9. Site-specific work plan in accordance with Section 1.5 D
10. On a weekly basis, submit copies of all waste shipment records and disposal site receipts to the Owner

B. During the project, legible copies of the following items must be submitted to the Owner or Owner's Representative. If personnel records are not available at this time, workers will not be able to work on-site until copies are provided:

1. NYSDOL Asbestos Handling Certificates (DOH 442) for all persons employed on the project
2. Project Log Book entries
3. Any and all changes to the Contract, should any occur
4. Personal sampling results within 24 hours of sampling

C. Upon completion of the project, legible copies of the following items must be submitted to the Owner or the Owner's Representative:

1. Waste manifests, shipment records, and landfill receipts signed by the landfill operator submitted within 30 days after the waste leaves the site. A percentage of the final payment will be withheld until the waste shipment record is received by the Owner or Owner's Representative.

1.5 QUALITY ASSURANCE

A. Comply with the most recent edition of compilation of Codes, Rules and Regulations of the State of New York (Statutory Authority: Labor Law Section 906), including Rule 56 of Title 12 NYCRR, New York State, Department of labor, most currently amended (hereinafter referred to in this Specification as Code Rule 56). Note: Article 30 of the Labor Law sets forth procedures and standards that must be met by parties who desire to obtain variations of any of the requirements of this rule.

B. Comply with all current and appropriate Federal, State and Local rules and regulations regarding work of this section, including those of the following agencies:

- New York State Uniform Fire Prevention and Building Code
- New York State Department of Labor
- New York State Department of Environmental Conservation (DEC)
- Occupational Safety and Health Administration (OSHA)
- United States Environmental Protection Agency (EPA)

C. Pre-Work Conference: Before the work of this section is scheduled to commence, a conference will be held at the site for the purpose of reviewing the Contract Documents, discussing requirements for the work and reviewing the work procedures. The conference shall be attended by the asbestos abatement contractor.

D. Work Plan: The Contractor shall prepare a detailed work plan and submit the plan no later than one week prior to the start of the abatement project. The work plan shall include, but not be limited to:

1. A preliminary schedule for completion of the work.
2. Work procedures that will be utilized (including anticipated decon and negative air exhaust locations).
3. Types of equipment anticipated to be used for the project.
4. Estimated crew size.
5. The anticipated work hours.
6. Emergency procedures for fire and medical emergencies and for failure of containment barriers.

E. Progress Meetings: The Owner or Owner's Representative will hold general progress meetings as required. A representative of the Contractor, and the Owner is to be properly represented at each meeting.

F. Daily Log: The Contractor is to maintain within the Decontamination Unit a daily log documenting the dates and time of, but not limited to, the following items:

1. Meetings; purpose, attendees, brief discussion
2. Visitations; authorized and unauthorized
3. Special or unusual events, i.e. barrier breeching, equipment failures, accidents
4. Air monitoring tests and test results.
5. Other entries as detailed in Code Rule 56-7.3 Asbestos Contractor Daily Project Log.

Submit three (3) copies of this log at final closeout of the Project as a Project closeout submittal.

G. Project Monitor: The Project Monitor shall be a representative of the Owner during the asbestos abatement portion of the project. The Project Monitor has the following responsibilites:

1. Project Monitor: The Project Monitor shall be a City Contracted representative of the Owner during the asbestos abatement portion of the project.

2. The Project Monitor shall have at all times access to the work areas whenever it is in preparation or in progress. The Contractor shall provide the Project Monitor with keys to all locks located on the entrance(s) to the decontamination unit(s) and all other secured areas.
3. The Project Monitor, in conjunction with the Owner, will be the interpreter of the requirements of the Contract Documents and the judge of the performance thereunder.
4. The Project Monitor and/or the Owner will have the authority to reject work which is not in compliance with the requirements of the Contract Documents or Federal, State, or Local Regulations. The decision of the Owner will be final.

H. Air Sampling and Analysis

1. Area Air Sampling and Analysis

a. The Owner will be responsible for hiring an independent third party firm to perform the required area air sampling and analysis in accordance with ICR 56.
b. The Contractor is required to ensure cooperation of its personnel with the Air Sampling Technician (AST) for general air sampling, and testing of each work area after completion of asbestos work prior to removal of containment barriers.
c. All air samples shall be analyzed using Phase Contrast Microscopy (PCM) in accordance with NIOSH method 7400.

2. Personal Air Sampling:

a. As per the requirements of OSHA 1926.1101, the Contractor shall be required to perform personal air monitoring in order to determine that appropriate respiratory protection is being utilized.
b. The analysis of personal air samples shall be conducted by an ELAP approved laboratory, subject to approval of the Owner or the Owner's Representative.
c. Results of personnel air sample analyses shall be available, verbally, within twenty-four (24) hours of sampling and shall be posted at the work site within 48 hours. Results shall be submitted in accordance with the requirements of Section 1.5 F.

3. Final Clearance Air Sampling:

a. For Code Rule 56 PCM Analysis: When required, the clearance air monitoring results shall be considered satisfactory when every sample demonstrates an airborne concentration of asbestos fibers of less than 0.01 fibers per cubic centimeter, or the background level, whichever is greater.

b. The Contractor shall pay for all additional costs incurred by the Owner, including additional air monitoring, project monitoring, engineering fees, and sample analysis required if clearance air monitoring fails, or if completion of abatement work is not in accordance with approved progress schedule.

1.6 GENERAL PROCEDURES

A. General Requirements - Comply with Code Rule 56's procedures for entry, exit, logging in, showering, personal protective equipment, tools, clothing, etc., throughout the asbestos abatement. Respiratory equipment shall be as required by OSHA and air monitoring results. (Except for authorized visitors as required by Rule 56). Non-certified workers will not be allowed in the work area.

B. Equipment and Waste Container Decontamination and Removal – Code Rule 56's procedures for large projects (cleaning, recontainerization, holding areas, etc.) shall be followed.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. General Requirements: Code Rule 56's requirements for materials and equipment shall apply.

B. Miscellaneous protective materials - Provide plywood sheathing, hardboard, etc., as required to provide protective cover over surfaces of existing construction and finishes to eliminate damage resulting from work of this section, including impact and water damage. Poly shall comply with Code Rule-56 including fire retardant requirements.

C. Water and electricity shall be furnished by Owner without charge. Contractor shall provide an in-line backflow preventer at water source, and utilize non-leaking hoses.

D. The Contractor shall supply the Project Monitor and Air Monitor with sufficient electricity to operate all high volume air monitoring pumps as may be required during the course of the project.

PART 3 - EXECUTION

3.1 REMOVAL REQUIREMENTS

A. Perform work under this contract in accordance with the standards referenced in Part 1 of this Section. The provisions of any site-specific variances to Code Rule 56, or other asbestos standards, obtained for this project may not be implemented until approval is given by the Owner or Owner’s Representative.

B. Work that results in the disturbance of asbestos-containing materials shall be performed by a licensed asbestos abatement contractor who employs certified workers in accordance with all applicable standards referenced herein. If additional suspect ACM is discovered during the course of abatement, the Contractor shall notify the Owner or Owner’s Representative immediately.

C. The Contractor shall protect all items/existing construction intended to remain.

D. Should the area beyond the asbestos work area(s) become contaminated with asbestos-containing dust or debris as a consequence of the work, immediately institute emergency procedures established for asbestos removal. All costs incurred in decontaminating such non-work areas shall be borne by the Contractor at no additional cost to the Owner.

3.2 WORK AREA PROTECTION

A. General Requirements: Code Rule 56's requirements for general work area preparation shall apply, including vacating, signs, power, timing, HVAC isolation, isolation barriers, objects, exits, toilets, etc.

3.3 PERSONAL AND WASTE DECONTAMINATION ENCLOSURE SYSTEMS

A. Comply with Code Rule 56's requirements for enclosure, showers, room types and configuration, etc.

3.4 DECONTAMINATION ENCLOSURE SYSTEMS/WORK AREA BARRIERS

A. General Requirements: Comply with Code Rule 56 requirements for maintenance of work area barriers. (Setting, inspection, repairs, cleaning, etc.)

3.5 HANDLING AND REMOVAL PROCEDURES

A. General Requirements: Comply with Code Rule 56 requirements regarding handling and removal procedures.

B. Dry removal or disturbance: No dry removal or disturbance or asbestos materials shall be permitted.

C. Wetting requirements: The asbestos material shall be wetted as necessary with amended water to keep asbestos fibers from becoming airborne. If any friable material is encountered, all of its surfaces shall be saturated.

D. Cleaning of surfaces: After completion of all stripping work, surfaces where asbestos material has been removed or handled shall be HEPA vacuumed.

3.6 CLEANING PROCEDURES

A. General requirements: Code Rule 56's requirements for containerization, dust cleanup, tools and enclosure cleanup, etc., shall apply. Cleanup shall be by HEPA the vacuum.

B. Post-abatement requirements: Code Rule 56's requirements shall apply (tool/equipment cleanup, general cleanup), waste removal, clearance air monitoring, etc).

3.7 ASBESTOS WASTE TRANSPORTATION AND DISPOSAL

A. Contractor shall minimally transport and dispose of all of the Category I non-friable asbestos waste material according to correct applicable NYSDEC transportation requirements, Part 364, and solid waste requirements Part 360.

B. If any removed material is "friable", Contractor shall handle it as such and transport and dispose of as "friable" asbestos waste per regulations referenced in Part 1 of this Section.

C. All waste generated as a result of this work shall be removed from the site within 10 days of completion and clearance of abatement work.

D. Log disposal site transportation names, etc., per Code Rule 56.

E. All loading, transportation, and disposal shall also comply with NESHAPS 40 CFR 61 - 150 paragraphs C, D and E including all requirements for loading signs, shipment records, content certificate, record receipts, notifications, etc.

3.8 TEMPORARY PROTECTION OF FACILITIES

A. Contractor shall provide temporary enclosure as required to protect the existing facilities from adverse weather conditions and maintain the interior environment in its normal condition. The contractor shall maintain the building secure from intrusion at all times and exits shall be operational during construction whenever the building is occupied.

3.9 RESTORATION

A. Remove temporary decontamination facilities and restore area designated for these facilities to its original condition or better.

B. After final clearance, the Contractor shall replace all filters of the associated portions of the existing building HVAC system that were affected by the abatement operations, remove locks and restore

power. All temporary power supplies shall be disconnected, power lockouts removed and building power restored. All temporary plumbing shall be removed.

C. Finishes damaged by asbestos removal operation including, but not limited to, plaster/paint damage due to taping of polyethylene sheeting and floor tile lifted due to humid conditions, shall be restored prior to final payment. Finishes unable to be restored shall be replaced under this Contract.

3.10 PROJECT COMPLETION REQUIREMENTS

A. Submission by the Contractor to the Owner of the job log book as described in Section 1.5 paragraph F.

B. Inspection of the work sites by the Project Manager's representative and the Owner's representative for substantial completion of the Scope of Work.

C. Submission by the Contractor to the Owner of the waste disposal manifest verifying that all waste generated at the project site has been disposed of at an EPA approved waste site. A 10% payment retainage shall be withheld by the Owner until receipt of all waste manifests.

PART 4 – METHOD OF MEASUREMENT

A. The quantity paid for ACP pipe removal will be the total length removed, measured parallel with the centerline of the removed pipe.

PART 5 – BASIS OF PAYMENT

A. The unit price bid per linear foot shall include the cost of all labor, materials, and equipment necessary to complete the work. Excavation and backfill of trench is included in the unit price bid. Surface restoration, where applicable, will be paid for separately under their appropriate item.

B. Unit price bid also includes cost of removal and disposal of ACP Pipe using an approved licensed Asbestos Abatement Contractor.

Payment will be made under:

ITEM NO.	**ITEM**	**PAY UNIT**
020800.01	Remove 12" to 18" ACP Pipe (Including Excavation and Backfill)	Linear Foot

END OF SECTION

SECTION 024110

SITE PREPARATION

PART 1 GENERAL

1.00 GENERAL PROVISIONS

A. Attention is directed to the PROCUREMENT AND CONTRACTING REQUIREMENTS and all Sections within DIVISION 01, GENERAL REQUIREMENTS, which are made a part of this Section of the Specifications.

1.01 WORK INCLUDED

A. Provide all equipment and do all work necessary to demolish and remove structures and all work necessary to prepare the site, as indicated on the Drawings.

1.02 RELATED WORK

A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:

1. Section 312300, SITE EXCAVATING, BACKFILLING AND COMPACTING.
2. Section 312500, EROSION AND SEDIMENT CONTROL.

1.03 REFERENCES

A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.

1. New York State Department of Transportation (NYSDOT):

Specifications	Standard Specifications - Construction and Materials.

1.04 SUBMITTALS

A. The following shall be submitted:

1. Permits and notices authorizing site demolition.
2. Certificates of severance of utility services, if applicable.
3. Permit for transport and legal disposal off-site of demolition material and debris.
4. Demolition procedures and operational sequence for review and acceptance by Architect.

B. Predemolition photographs: Show existing conditions of below ground vaults at building faces, including waterproofing surfaces, that might be misconstrued as damage caused by demolition operations. Submit before the Work begins.

1. Photographs of these items in their present locations shall be taken and submitted to the Architect and Owner for review and documentation of the present condition prior to commencing any salvage or removal operations. If Architect determines that additional photographs are required before work begins, then Contractor shall take additional photographs until acceptable photos are submitted.

C. Demo and removal methods for site elements and paving over and adjacent to underground vaults at building face shall be submitted for Architect review and approval prior to commencing work.

1.05 QUALITY ASSURANCE

A. Predemolition Conference: Conduct conference at Project site to comply with requirements in Division 01, GENERAL REQUIREMENTS. Review methods and procedures related to selective demolition including, but not limited to, the following:

1. Inspect and discuss extent of demolition to be conducted.
2. Review and finalize demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review requirements of work performed by other trades that rely on substrates exposed by demolition operations.
4. Review areas where existing construction is to remain and requires protection.

1.06 PROTECTION

A. Do not interfere with use of adjacent buildings. Maintain free and safe passage to and from.

B. Prevent movement or settlement of adjacent structures. Provide and place bracing or shoring and be responsible for safety and support of structures. Assume liability for such movement, settlement, damage, or injury.

C. Cease operations and notify Architect immediately if safety of adjacent structures appears to be endangered. Take precautions to properly support structures. Do not resume operations until safety is restored.

D. Prevent movement, settlement or collapse of adjacent services, sidewalks, driveways and trees. Assume liability for such movement, settlement, or collapse. Promptly repair damage at no cost to the Owner.

E. Provide, erect, and maintain street boardings, sidewalk shed, barricades, lighting, and guardrails as required to protect general public, workers, and adjoining property.

1.07 EXISTING CONDITIONS

A. Arrange and pay for disconnecting, removing, capping, and plugging utility services. Disconnect and stub off. Notify the affected utility company in advance and obtain approval before starting this work.

B. Place markers to indicate location of disconnected services. Identify service lines and capping locations on Project Record Documents.

C. The Owner agrees to remove all asbestos from structures to be demolished. If asbestos is found on the site and recognized as such, all work will cease without penalty to the Contractor or Architect so that the Owner can take appropriate steps for its removal.

1.08 TREE DAMAGE PENALTIES

A. Damages to trees, shrubs, and other vegetation will be assessed by the Architect and Owner in accordance with the ISA Guide and Section 015639, TREE AND PLANT PROTECTION.

1.09 MAINTAINING TRAFFIC

A. Do not close or obstruct roadways without permits.

B. Conduct operations with minimum interference to public or private roadways.

1.10 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

B. Items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.11 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during demolition, by methods and with materials so as not to void existing warranties.

PART 2 PRODUCTS

2.01 SALVAGING

A. Materials indicated on the Drawings or designated in the field by the Owner to be salvaged shall be carefully removed and delivered to the Owner at: City of Ithaca Streets and Facilities, 245 Pier Road, Ithaca, NY 14850.

1. Salvaged materials include but are not limited to existing light poles, manhole covers and frames and storm drain grates and frames.

2.02 BACKFILL

A. Off-site material for filling holes and depressions resulting from removal and demolition operations shall be a graded, granular, non-frost susceptible, free-draining material, consisting of either durable stone and coarse sand or of blast furnace slag, practically free from loam and clay, and which can be readily compacted to form a stable foundation.

1. Material shall conform to NYSDOT Specifications Section 304.14 Subbase Course, Type 4.

PART 3 EXECUTION

3.01 DEMOLITION

A. Structures indicated to be removed shall be completely removed including foundations.

1. Backfill holes and depressions resulting from structure removals with material specified in Paragraph 2.02. Compact to minimum density of 95% of optimum density in accordance with ASTM D 698 (or 92% of optimum density in accordance with ASTM D1557).

B. Pump out buried tanks located outside building proper. Remove tanks and service piping from site or to the satisfaction of the Architect. Fill tanks with sand or fine gravel and cover with fill.

C. Remove from site, contaminated, vermin infested, or dangerous materials encountered and disposed of by safe means so as not endanger health of workers and public.

D. Backfill areas excavated as a result of demolition. Use backfill material specified.

E. Rough grade areas affected by demolition and leave areas level; paved areas shall be brought to top of sub-base so ex-grades will not be maintained.

F. Site Access and Temporary Controls: Conduct demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
2. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations. Do not use water when it may damage adjacent construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.

3.02 ABANDONED PIPES - DRAINS AND SEWERS

A. Drain and sewer pipes indicated to be abandoned shall be completely filled with an 8 in. thick mortar jointed masonry bulkhead. If a pipe indicated to be abandoned and plugged appears to be in active service, it shall not be plugged, and the Architect shall be notified.

B. Other utility pipes shall be cut and capped outside the excavation and abandoned piping removed from the site.

C. Frames, grates, covers, traps, and other castings shall be salvaged.

3.03 CLEARING AND GRUBBING

A. Trees, shrubs, and other vegetation not indicated on the Drawings or designated in the field by the Architect to remain and required for execution of the Work shall be cleared and grubbed.

B. Stumps shall be removed to their full depth. Roots 3 in. and larger shall be removed to a depth of 2 ft. below finished grade. Stumps shall be legally disposed of off-site.

1. Backfill holes and depressions resulting from stump removals with Granular Fill. Compact to minimum density of 95% of optimum density in accordance with ASTM D 698 (or 92% of optimum density in accordance with ASTM D1557).

3.04 PROTECTION OF EXISTING STRUCTURES AND UTILITIES

A. Existing structures and utilities shall be suitably protected from damage.

3.05 LOAM AND TOPSOIL

A. Loam and topsoil shall be stripped to their full depth from areas to be excavated, filled, regraded, or resurfaced. Avoid mixing with fill/subbase/non-organic material below.

B. Loam and topsoil shall be removed from the site and legally disposed of by the Contractor.

3.06 PAVEMENT REMOVAL

A. Where pavement and/or curb to be removed abuts pavement and curb to remain, a neat, straight saw cut shall be made with a concrete power saw. Sawcutting shall be by wet cutting only to reduce dust.

1. Pavement and/or curb removal shall include removal of pavement, slab or curb only, leaving the subbase in place.

B. Pavement over and adjacent to underground vaults shall be removed by methods approved by Architect prior to start of this removal work. Pavement shall be removed taking care not to damage waterproof membrane existing over the top of underground vaults at the building faces.

3.07 SITE RESTORATION

A. Below-Grade Areas: Rough grade below-grade areas ready for further excavation or new construction.

B. Site Grading: Uniformly rough grade area of demolished construction to a smooth surface, free from irregular surface changes. Provide a smooth transition between adjacent existing grades and new grades.

3.08 PROTECTION OF PROPERTY TO REMAIN

A. Contractor shall be responsible for protection of utilities to remain, and for the protection of existing trees, fences, etc.

3.09 DISPOSAL OF MATERIALS

A. Material resulting from demolition and not scheduled for salvaging shall become the property of the Contractor and shall be suitably disposed of off-site. Disposal shall be performed as promptly as possible and not left until the final clean up.

END OF SECTION

SECTION 033000

CAST-IN-PLACE CONCRETE - UTILITIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.

1.02 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

B. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
   1. ACI 301, "Specifications for Structural Concrete," Sections 1 through 5.
   2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

PART 2 - PRODUCTS

2.01 FORM-FACING MATERIALS

A. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

2.02 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

   1. Galvanized Reinforcing Bars: ASTM A 767/A 767M, Class I or Class II zinc coated after fabrication and bending.

B. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from as-drawn steel wire into flat sheets.

C. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice.

2.03 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:

   1. Portland Cement: ASTM C 150, Type I or Type II. Supplement with the following:

      a. Fly Ash: ASTM C 618, Class F or C.

b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

B. Normal-Weight Aggregates: ASTM C 33, graded.

1. Maximum Coarse-Aggregate Size: **1-1/2 inches (38 mm)** nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Water: ASTM C 94/C 94M and potable.

2.04 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.05 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

2.06 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.

2.07 CONCRETE MIXTURES

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

B. Cementitious Materials: Use fly ash, pozzolan, ground granulated blast-furnace slag, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.

C. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing dmixture in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.

D. Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4000 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.50.
3. Slump Limit: **4 inches (100 mm)** for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch (25 mm).
4. Air Content: 5.5 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch (38-mm) nominal maximum aggregate size.

2.08 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.09 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.01 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Chamfer exterior corners and edges of permanently exposed concrete.

3.02 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3.03 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

3.04 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Engineer.

3.05 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.

C. Cold-Weather Placement: Comply with ACI 306.1.

D. Hot-Weather Placement: Comply with ACI 301.

3.06 FINISHING FORMED SURFACES

A. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

3.07 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Broom Finish: Apply a broom finish to exterior concrete platforms, pads, steps, ramps, and elsewhere as indicated.

3.08 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days.
2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less

than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

3. Curing and sealing compound in subparagraph below is usually for floors and slabs and may act as a permanent surface finish.
4. Curing and Sealing Compound: Apply uniformly to floors and slabs in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.09 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Engineer/Architect. Remove and replace concrete that cannot be repaired and patched to Engineer/Architect's approval.

PART 4 – METHOD OF MEASUREMENT

4.01 DUCT BANK CONCRETE ENCASEMENT

A. The quantity to be measured for payment is the number of cubic yards of concrete encasement constructed.

PART 5 – BASIS OF PAYMENT

5.01 DUCT BANK CONCRETE ENCASEMENT

A. The unit price bid for all items shall include the cost of all labor, material, and equipment necessary to complete the work. Excavation, bedding, and backfill is included in the unit price bid. Removal of existing abandoned utilities or structures, as required to complete the work, is included in the unit price bid. Surface restoration, where applicable, will be paid for separately under their appropriate item.

B. The unit price bid per cubic yard of concrete shall also include the cost of: furnishing and placing steel reinforcement, forms, and concrete.

Payment will be made under:

ITEM NO.	**ITEM**	**PAY UNIT**
033000.01	Ductbank Concrete Encasement	Cubic Yard

END OF SECTION

SECTION 033001

CAST-IN-PLACE CONCRETE - SITEWORK

PART 1 GENERAL

1.00 GENERAL PROVISIONS

A. Attention is directed to the PROCUREMENT AND CONTRACTING REQUIREMENTS and all Sections within DIVISION 01, GENERAL REQUIREMENTS, which are made a part of this Section of the Specifications.

1.01 WORK INCLUDED

A. Provide all equipment and materials, and do all work necessary to construct the cast-in-place concrete for sitework, including but not limited to: formwork, reinforcing, and concrete for slabs, pads, bases, footings, foundations and thrust blocks, complete, as indicated on the Drawings and as specified.

1.02 RELATED WORK

A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that relate directly to work of this Section include, but are not limited to the following:

1. Section 079200, EXTERIOR SEALANTS; Backer rod and sealant for expansion joint.
2. Section 321313, PORTLAND CEMENT CONCRETE PAVEMENT.
3. Section 321413, CONCRETE UNIT PAVING.

1.03 RELATED WORK

A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirement shall govern.

1. American Concrete Institute (ACI):

325.9R	Guide for Construction of Concrete Pavements and Concrete Bases

2. American Plywood Association (APA):

Ref. 1	APA Design/Construction Guide, Residential and Commercial

3. American Society for Testing and Materials (ASTM):

A 36	Structural Steel
A 123	Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strip

A 185	Welded Steel Wire Fabric for Concrete Reinforcement
A 307	Carbon Steel Externally Threaded Standard Fasteners
A 386	Zinc Coating (Hot-Dip) on Assembled Steel Products
A510	General Requirements for Wire Rods and Course Round Wire, Carbon Steel
A 569	Steel, Carbon (0.15 Maximum, Percent), Hot-Rolled Sheet and Strip, Commercial Quality
A 615	Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
C 33	Concrete Aggregates
C 94	Ready-Mixed Concrete
C 143	Slump of Portland Cement Concrete
C 150	Portland Cement
C 171	Sheet Materials for Curing Concrete
C 494	Chemical Admixtures for Concrete
D 1752	Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.

4. New York State Department of Transportation (NYSDOT):

Specifications	Standard Specifications - Construction and Materials

1.04 SUBMITTALS

A. Shop drawings of reinforcing steel shall be submitted. Drawings shall indicate bar sizes, locations, spacings, quantity required, bending and cutting schedules, and supporting and spacing devices.

B. Samples of the following shall be submitted:

Item	Sample Size
Preformed joint filler	Two pieces, full depth and width, 12 in. length
Form	12 in. x 12 in.
Form ties	1 each, complete

C. Submit manufacturer's product data for forms and accessories.

D. Submit concrete design mix for Architect's approval.

E. Prior to start of concrete work, Contractor shall submit to the Architect for review a schedule for execution of the work of this section and a shop drawing location plan indicating sequence of concrete placement and location of proposed control joints, construction joints, and expansion joints if required.

1.05 DESIGN OF CONCRETE MIX

A. Mix design shall be certified by independent testing laboratory. Statement of materials constituting design of mixes (as required by referenced standards) shall be submitted for Architect's approval within one week following award of Contract.

B. Concrete mix design shall include the following information:

1. Proportions of cement, fine and coarse aggregates, and water.
2. Water-cement ratio, design strength, slump, and air content.
3. Type of cement and aggregates.
4. Type and dosage of all admixtures.
5. Special requirements for pumping.
6. Range of ambient temperature and humidity for which the design is valid.
7. Any special characteristics of the mix which require precautions in the mixing, placing, finishing, or curing methods to achieve the finished product specified.

C. No concrete shall be delivered to the job site until the Architect has approved the design mixes.

1.06 QUALITY ASSURANCE

A. Unless otherwise specified, cast-in-place concrete work shall conform to ACI 301. Construction of concrete walks and subbases shall conform to ACI 325.9R

B. Dimensions, locations, and details of equipment pads, anchors, supports, and similar features indicated on the Drawings are approximate. Manufacturer's approved shop drawings of equipment to be supported, anchored, or contained thereby shall be consulted for exact location, size, and details.

C. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

D. Preinstallation Conference: Conduct conference at Project site.

1.07 QUALITY CONTROL

A. Unless otherwise specified herein, or indicated on the Drawings, concrete formwork construction and materials shall conform to ACI 301, 318, and 347, and the following:

1. Variation from plumb
   a. In lines and surfaces of arrises:

In any 10 ft. of length	1/4 in.
Maximum for the entire length	1 in.

b. For exposed conspicuous lines:
In any 20 ft. length 1/4 in.
Maximum for the entire length 1/2 in.

2. Variation in sizes and location of sleeves, wall openings: 1/4 in. (+ ,-)
3. Variation in cross sectional dimensions of beams and in thickness of slabs: Minus 1/4 in.
Plus 1/2 in.
4. Variation in location of anchor bolts unless provided with sleeves or other means of adjustment: 1/4 in.

B. Maximum deflection of form facing materials at concrete surfaces exposed to view shall be 1/240 of span between structural members.

C. Reinforcing steel shall be fabricated to conform to the required shapes, dimensions, and tolerances specified in CRSI Manual.

D. Allowable Tolerances:

1. Fabricating:
a. Sheared length: Plus or minus 1 in.
b. Stirrups and ties: Plus or minus 1/2 in.
c. Members more than 8 in., but not over 2 ft. - 0 in. deep: Plus or minus 1/2 in.
d. Members more than 2 ft. - 0 in. deep: Plus or minus 1 in.
e. Crosswise of members: Space evenly within 2 in. of stated separation
f. Lengthwise of members: Plus or minus 2 in.

2. Maximum bar relocation to avoid interference with other reinforcing steel, conduits, or other embedded item: 1 bar diameter.

1.08 TESTING

A. Inspection and testing of the concrete mix will be performed by an independent testing laboratory approved by the Architect. Testing equipment shall be supplied by the laboratory, and the preparation of samples and all testing shall be performed by the laboratory personnel.

B. Concrete materials and operations will be tested and inspected as work progresses. Failure to detect any defective work or material shall not in any way prevent later rejection when such defect is discovered, nor shall it obligate the Architect to final acceptance.

C. The following testing services shall be provided by the Owner, at no cost to the Contractor:

1. Review and test of the Contractor's proposed materials for compliance with the specifications.
2. Review of the Contractor's proposed mix design.
3. Sampling and testing of materials at plants or stockpiles during the course of the work for compliance with the specifications.
4. Strength tests of concrete specimens.
5. Inspection of concrete batching, mixing, and delivery.

D. The following testing services shall be provided, at the Contractor's expenses:

1. Additional testing and inspection required because of changes in materials or proportions, requested by the Contractor.
2. Additional testing of materials or concrete occasioned by their failure by testing or inspection to meet specification requirements.

E. At least four standard compression test cylinders shall be made and tested from each day's placement of concrete. Four concrete test cylinders will be taken for every 50 cubic yards of each type and design strength of concrete placed. Two cylinders shall be tested at seven days, and two at 28 days. If job experience indicates additional cylinder tests or other tests are required for proper control or determination of concrete quality, such tests shall be made.

F. One slump test will be taken for each set of test cylinders taken.

G. Submit to the Owner, for forwarding to the testing laboratory, proposed concrete mix design for review, before beginning work.

H. Provide free access to work and full assistance and cooperation, concrete for samples, and such auxilliary personnel and equipment as needed for testing agency to take samples for required tests. Notify testing agency and Architect of intent to place concrete at least 24 hours before placement.

PART 2 PRODUCTS

2.01 FORMS

A. Recycled Content: Minimum 25 percent post-consumer recycled content, plus one-half pre-consumer recycled content.

B. Forms for Unexposed Finish: Plywood, lumber or metal, with lumber dressed on at least two edges and one side.

C. Form Ties: Provide prefabricated, adjustable length galvanized steel snap-off ties, with brackets, cones, cornerlocks and other accessories as necessary.

D. Form Coatings: Commercial formulation compounds that will not bond with, stain or adversely affect concrete.

E. Forms shall be true to line and free from warp, and shall be of sufficient strength, when staked, to resist the pressure of the concrete without springing. Formwork shall be designed so that sections may be fastened together to prevent vertical or horizontal movement of ends.

F. Concrete Column Forms: Sonotube Concrete Forms, manufactured by Sonoco, 1 North Second Street, Hartsville, South Carolina 29550. Toll Free (888) 875-8754. Website www.sonotube.com. E-mail terry.mckeon@sonoco.com..

1. Description: Multiple layers of 100 percent recycled paperboard, spirally wound, and laminated with adhesive.
2. Interior Surface: Smooth with spiral seam. Moisture barrier plastic coating.

3. Exterior Surface:
   a. Sonotube RainGuard – 100 percent recycled paper,
   b. Sonotube Commercial - Moisture Barrier outer label.
4. Forms will impart visible spiral mark on concrete columns.
5. 1-piece, 1-time-use forms.
6. Recyclable.
7. Inside Diameter: As indicated on the Drawings.

2.02 AGGREGATE BASE

A. Material for aggregate base course shall be a graded, granular, free-draining material, consisting of either durable stone and coarse sand or of blast furnace slag, practically free from loam and clay, and which can be readily compacted to form a stable foundation.

1. Material shall confom to NYSDOT Specifications Section 304, Type 2.

2.03 SOIL STABILIZATION FABRIC

A. Geotextile reinforcing fabric shall be Mirafi® HP 370, high performance geotextile, manufactured by Mirafi Construction Products, 365 South Holland Drive, Pendergrass, GA, USA 30567; 1-888-795-0808; 1-706-693-2226; 1-706-693-2083, fax; www.mirafi.com; for base course reinforcement and soil stabilization/reinforcement applications, or approved equal.

1. Geotextile fabric shall be produced from high tenacity polypropylene yarns, specifically designed to provide separation, filtration, and reinforcement for moderate to severe site condition, ensuring long-term performance in new pavement construction.

2.04 CONCRETE

A. Concrete shall be air-entrained type, conforming to ASTM C 94.

B. Unless otherwise indicated on the Drawings, minimum 28 day compressive strength shall be 4,000 psi.

C. Concrete slump shall be no less than 2 in. nor greater than 5 in., determined in accordance with ASTM C 143.

D. Cement shall be Portland cement, conforming to ASTM C 150, Type I or II.

E. Aggregates shall conform to ASTM C 33.

F. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Air-Entraining Admixture: ASTM C 260.

G. No calcium chloride or admixtures containing calcium chloride shall be added to the concrete. No admixtures other than those specified shall be used in the concrete without the specific written permission of the Architect in each case.

2.05 CONCRETE REINFORCING

A. Recycled Content: Minimum 25 percent post-consumer recycled content, plus one-half pre-consumer recycled content.

B. Steel reinforcing bars shall conform to ASTM A 615.

1. Bars employed as reinforcement shall be deformed type.
2. Bars employed as dowels shall be hot-rolled plain rounds.
3. Unless otherwise indicated on the Drawings, reinforcing bars shall be Grade 60.

C. Welded wire fabric reinforcement shall conform to the applicable requirements of ASTM A 185. Fabric reinforcement shall be furnished in flat sheets. Fabric reinforcement in rolls will not be permitted.

D. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice."

2.06 VAPOR RETARDERS

A. Plastic Vapor Retarder: ASTM E 1745, Class B. Include manufacturer's recommended adhesive or pressure-sensitive tape.

2.07 CURING MATERIALS

A. Curing shall be by moist curing or by use of curing compound.

B. Curing paper shall be a nonstaining, fiber reinforced laminated kraft bituminous product conforming to ASTM C 171. Four mil polyethylene sheeting may be substituted for curing paper.

C. Curing compound shall be a wax or resin-base, clear or white pigmented compound conforming to ASTM C 309, Type 1, Class B, dissipating.

2.08 EXPANSION JOINTS

A. Expansion joints shall be located as indicated on the submitted shop drawing location plan.

B. Where indicated, expansion joints shall be 1/2 in. wide. Expansion joint filler shall be preformed, nonbituminous type joint filler conforming to ASTM D 1752, Type II, similar to Sealtight Cork Expansion Joint Filler, manufactured by W.R. Meadows, Inc., or approved equal.

1. Premolded filler shall be one piece for the full depth and width of the joint.
2. Use of multiple pieces of lesser dimensions to make up required depth and width of joint will not be permitted.
3. Except as otherwise noted on the Drawings, joint filler shall be 1/2 in. thick.

C. Where indicated, concrete slab-on-grade shall be doweled at each expansion joint. One end of the dowel shall be greased.

2.09 CONTROL JOINTS

A. Control joints indicated on the submitted shop drawing location plan to be sawn shall be made by saw cutting concrete slab after concrete is finished and when the surface is stiff enough to support the weight of workmen without damage to the slab. Saw blade shall cut into slab at least 1 in., but in no case less than 25% of slab depth.

2.10 CONCRETE MIXTURES

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

2.11 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

2.12 BOLTS

A. Anchor bolts shall conform to ASTM A 307.

2.13 VERTICAL WEEPS IN SLAB

A. Vertical weepholes in below grade base slab for unit pavers shall be 1 in. diameter Schedule 40 PVC pipe.

PART 3 EXECUTION

3.01 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. PVC vertical weepholes in below grade base slab for unit pavers shall be arranged in 4 ft. – 0 in. o.c. staggered pattern.

3.02 SOIL STABILIZATION FABRIC

A. Place fabric in those areas that are shown on the plans or in those areas that need stabilization prior to the placement of the aggregate base course, as directed by the Architect.

B. Place fabric specified in accordance with the manufacturer’s recommendations.

C. Soil stabilization fabric shall be placed between aggregate base and compacted or undisturbed subgrade.

D. Provide minimum two foot (2') overlap for fabric used below pavement base course.

3.03 AGGREGATE BASE COURSE

A. Aggregate base course for paving and the spreading, grading, and compaction methods employed shall conform to standard requirements for usual base course of this type for first class road work, and the following:

1. NYSDOT Specifications Section 304.

B. Width of base course shall be greater than or equal to the width of pavement surface, if continuous lateral support is provided during rolling, and shall extend at least 2 x base thickness beyond edge of the course above, if not so supported.

C. Aggregate shall be applied in lifts less than or equal to 6 in. thick, compacted measure. Each lift shall be separately compacted to specified density.

1. Material shall be placed adjacent to wall, manhole, catch basin, and other structures only after they have been set to required grade and level.
2. Rolling shall begin at sides and progress to center of crowned areas, and shall begin on low side and progress toward high side of sloped areas. Rolling shall continue until material does not creep or wave ahead of roller wheels.
3. Surface irregularities which exceed 1/2 in. as measured by means of a 10 ft. long straightedge, shall be replaced and properly recompacted.

D. Base course shall be compacted at optimum moisture content to not less than 95% of maximum density as determined by ASTM D 1557.

E. Subgrade and base course shall be kept clean and uncontaminated. Less select materials shall not be permitted to become mixed with gravel. Materials spilled outside pavement lines shall be removed and area repaired.

F. Portions of subgrade or of construction above which become contaminated, softened, or dislodged by passing of traffic, or otherwise injured, shall be cleaned, replaced, or otherwise repaired to conform to the requirements of this specification before proceeding with next operation.

3.04 VAPOR RETARDERS

A. Plastic Vapor Retarders: Place, protect, and repair vapor retarders according to ASTM E 1643 and manufacturer's written instructions.

1. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.

3.05 REINFORCING

A. Before being placed in position, reinforcing shall be thoroughly cleaned of loose mill and rust scale, dirt, ice, and other foreign material which may reduce the bond between the concrete and reinforcing. Where there is delay in placing concrete after reinforcement is in place, bars shall be reinspected and cleaned when necessary.

B. Any bar showing cracks after bending shall be discarded.

C. Unless otherwise indicated on the Drawings, reinforcing shall extend within 2 in. of formwork and expansion joints. Reinforcing shall continue through control joints. Adjacent sheets of fabric reinforcing shall lap 6 in.

D. After forms have been coated with form release agent, but before concrete is placed, reinforcing steel and anchors shall be securely wired in the exact position called for, and shall be maintained in that position until concrete is placed and compacted. Chair bars and supports shall be provided in a number and arrangement satisfactory to the Architect.

3.06 FORMWORK

A. Formwork shall be so constructed, braced, and tied that the formed surfaces of the concrete will be perfectly true, smooth, and to the dimensions shown on the Drawings, within the tolerances for formed surfaces as specified in ACI 301.

B. Forms shall be sufficiently tight to prevent leakage of mortar, and where necessary shall have temporary openings as required for thorough cleaning and as required for the introduction of concrete to avoid excessive free fall.

3.07 PLACING CONCRETE

A. Before placing concrete, forms and space to be occupied by concrete shall be thoroughly cleaned, and reinforcing steel and embedded metal shall be free from dirt, oil, mill scale, loose rust, paint, and other material which might tend to reduce bond.

B. Existing concrete, earth, and other water-permeable material against which new concrete is to be placed shall be thoroughly damp when concrete is placed. There shall be no free water on surface.

C. Concrete which has set or partially set before placing shall not be employed. Retempering of concrete will not be permitted.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
2. If concrete can not be mechanically consolidated, concrete shall be thoroughly spaded and tamped to secure a solid and homogeneous mass, thoroughly worked around reinforcement and into corners of forms.

E. Cold-Weather Placement: Comply with ACI 306.1.

F. Hot-Weather Placement: Comply with ACI 301.

G. When joining fresh concrete to concrete which has attained full set, latter shall be cleaned of foreign matter, and mortar scum and laitance shall be removed by chipping and washing. Clean, roughened base surface shall be saturated with water, but shall have no free water on surface. A coat of 1:1 cement-sand grout, approximately 1/8 in. thick, shall be well scrubbed into thoroughly dampened concrete base. New concrete shall be placed immediately, before grout has dried or set.

3.08 FINISHING BELOW GRADE SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

1. Concrete slabs and pads shall be screeded off and finished true to line and grade, and free of hollows and bumps. Surface shall be dense, smooth, and at exact level and slope required.
2. Finished concrete surface for subbases shall be wood-floated to a slightly rough surface. Surface shall not deviate more than 1/4 in. in 10 ft.

B. Where finishing is performed before end of curing period, concrete shall not be permitted to dry out, and shall be kept continuously moist from time of placing until end of curing period, or until curing membrane is applied.

3.09 PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. It is essential that concrete be kept continuously damp from time of placement until end of specified curing period. It is equally essential that water not be added to surface during floating and troweling operations, and not earlier than 24 hours after concrete placement. Between finishing operations surface shall be protected from rapid drying by a covering of waterproofing paper. Surface shall be damp when the covering is placed over it, and shall be kept damp by means of a fog spray of water, applied as often as necessary to prevent drying, but not sooner than 24 hours after placing concrete. None of the water so applied shall be troweled or floated into surface.

C. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

D. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days.
2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

3.10 EXPANSION JOINTS

A. Expansion joints shall be 1/2 in. wide and shall be as located on the submitted shop drawing location plan. Expansion joint shall be formed in the concrete to required width with preformed joint filler in place. Joint filler shall extend the full depth of the slab. Joint filler shall extend the full length of the expansion joint.

1. Joint filler shall extend above concrete slab. Depth of filler shall be as required to form a 1-1/4 in. deep sealant and backer rod recess below finished grade of paved surface.
2. Depth of joint filler shall be as required to form a 1-1/4 in. deep sealant and backer rod recess below finished concrete surface.

B. Expansion joints of slab-on-grade shall be doweled. Dowel shall be centered over the joint prior to concrete placement. The end of the dowel at the side of joint which will be poured second shall be greased immediately before concrete placement.

3.11 CONTROL JOINTS

A. Control joints indicated on the submitted shop drawing location plan shall be sawn by using a diamond blade concrete power saw. Joint shall be made after concrete is finished and when the surface is stiff enough to support the weight of workmen without damage to the slab. Saw shall cut into slab at least 1 in., but in no case less than 25% of slab depth.

3.12 CONTROL JOINTS/CONTRACTION JOINTS

A. General: Joint shall be made after concrete is finished and when the surface is stiff enough to support the weight of workmen without damage to the slab, but before slab has achieved its final set. Saw cut joints shall be straight and accurate to line.

B. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least 1 in., but in no case less than one-fourth of the concrete thickness, as follows[to match jointing of existing adjacent concrete pavement]:

1. Saw cut joints shall be sawn flush to vertical surfaces.
2. Unless otherwise indicated on the Drawings, control joints in pedestrian pavements shall be located 10 ft. o.c. maximum.
3. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.
4. Doweled Contraction Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.13 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

END OF SECTION

SECTION 033100

CAST-IN-PLACE CONCRETE - ARCHITECTURE

PART 1 GENERAL

1.00 GENERAL PROVISIONS

A. Attention is directed to the PROCUREMENT AND CONTRACTING REQUIREMENTS and all Sections within DIVISION 01, GENERAL REQUIREMENTS, which are made a part of this Section of the Specifications.

1.01 SUMMARY

A. Section Includes Cast-in-place (CIP) structural concrete, including

1. Concrete Formwork and Formwork Accessories
2. Concrete Mixtures and Admixtures
3. Steel Concrete Reinforcement and Accessories
4. Curing compounds
5. Grout
6. Crack repair and epoxy adhesives
7. Handling, placing, and constructing

B. Products Installed But Not Furnished Under This Section:

1. Dovetail slot anchors, inserts and reinforcing steel required for the attachment of masonry to concrete. Refer to Unit Masonry-Section 4200.

2. Anchor rods, leveling plates, railing sleeves, brackets, and other embedded items of steel, vinyl, plastic, or other materials. Refer to Structural Steel-Section 051223 or other specification sections where the embedded item is described.

3. Sleeves for pipe, conduit and other items passing through or embedded in concrete. Refer to the specification section where the item is described.

C. Related Sections.

1. Code Required Special Inspections and Procedures – Section 014533
2. Structural Steel – Section 051223

1.02 DEFINITIONS

A. ACI 301, Section 1.2 - Definitions:

1. Add the following definitions:
   - Cementitious Material: Cementitious materials include cement, ground blast furnace slag and fly ash.
   - Corrosion Inhibitor Admixture: A liquid admixture, calcium nitrite that inhibits corrosion of concrete-embedded steel in the presence of chloride ions.

- Pumped Concrete: Concrete that is conveyed by pumping pressure through rigid pipe or flexible hose.
- Water-to-Cementitious Ratio (w/c): An equational value representing quantity in pounds of free moisture available for cement hydration divided by quantity of cementitious materials in pounds per cubic yard concrete.

1.03 REFERENCES

A. Work on this project shall conform to all requirements of ACI 301-05 published by the American Concrete Institute, Farmington Hills, Michigan, except as modified by these Contract Documents.

B. Reference publications
1. ACI 301-05: Specifications for Structural Concrete.
2. ACI 302.1R-04: Guide for Concrete Floor and Slab Construction.
3. ACI 304.2R-96: Placing Concrete by Pumping Methods.
4. ACI 305R-99: Hot Weather Concreting.
5. ACI 306R-88: Cold Weather Concreting (Re-approved 1997).
6. ACI 308.1-98: Standard Specification for Curing Concrete.
7. ACI 318-08 Building Code Requirements for Reinforced Concrete.
8. ASTM C 94/C 94M - 04: Standard Specification for Ready- Mixed Concrete.
9. ASTM C 494/C 494M - 04: Standard Specification for Chemical Admixtures for Concrete.
10. ASTM C 311-77 Standard Methods of Sampling and Testing Fly Ash or Natural Pozzolans For Use As A Mineral Admixture in Portland Cement Concrete.
11. Manual of Standard Practice, MSP-1-01 of the Concrete Reinforcing Steel Institute.

1.04 STANDARDS PRODUCING ORGANIZATIONS

A. Refer to ACI 301-05

1.05 SUBMITTALS

A. Submittals Package: Submit product data for design mix(es) and materials for concrete specified below at the same time as a package.

B. Product Data:
1. Mix Design: Submit proposed concrete design mix(es) together with name and location of batching plant at least 28 days prior to the start of concrete work.
   a. Include test results of proposed concrete proportions based on previous field experience or laboratory trial batches in accordance with ACI 301, Section 4.
   b. Pumped Concrete: Include test results of proposed design mix(es) tested under actual field conditions with the maximum horizontal run and vertical lift required for this project.
2. Portland Cement: Brand and manufacturer's name.
3. Fly Ash: Name and location of source, and DOT test numbers.
4. Air-entraining Admixture: Brand and manufacturer's name.
5. Water-reducing Admixture: Brand and manufacturer's name.
6. High Range Water-reducing Admixture (Superplasticizer): Brand and manufacturer's name.

7. Accelerating Admixture: Brand and manufacturer's name.
9. Aggregates: Name and location of source, and DOT test numbers.

C. Reinforcing Steel
1. Shop Drawings: Placing drawings for bar reinforcement.
2. Affidavit by the bar reinforcement manufacturer certifying that bar material meets the contract requirements.

1.06 QUALITY ASSURANCE

A. Refer to Section 014533-Code Required Special Inspections and Procedures, for Concrete Construction inspection and testing to be performed by the Owner's Inspection and Testing Agency.

B. Qualifications of Crew Pumping Concrete: Workers pumping concrete shall have had at least one year of experience pumping concrete.

C. Concrete batching plants shall be currently approved as concrete suppliers by the New York State Department of Transportation.

D. Truck mixers for concrete shall be currently approved by the New York State Department of Transportation.

E. Pumping equipment for pumped concrete shall be subject to the approval of the Architect.

F. Fly ash supplier shall be on the New York State Department of Transportation's current "Approved List of Suppliers of Fly Ash".

G. Source Quality Control: The Owner reserves the right to inspect and approve the following items, at his own discretion, either with his own forces or with a designated inspection agency:
1. Batching and mixing facilities and equipment.
2. Sources of materials.

H. Pre-Construction Conference: Attend a Pre-Construction Conference at the job site conducted by the Architect's Representative prior to the start of concrete placement for the purpose of reviewing the requirements and procedures of the Contract Documents.

I. Field Quality Control

1. ACI 301, Section 1.6.4.2 - Testing Services:
a. Add the following paragraph:
- 1.6.4.2.e Strength Tests for Pumped Concrete: Prepare strength test specimens and make strength tests from concrete samples obtained at the truck discharge chute and at the end of the pump delivery line in accordance with paragraph 16.3.4.4.

2. ACI 301, Section 1.6.3.3.
a. Add the following paragraph:
- 1.6.3.3.c Make available to the Owner's Inspections and Testing Agency whatever test samples are required to make tests. Furnish shipping boxes for compression test cylinders.

3. Adjustment to Concrete Mixes: Mix design adjustments may be requested by the Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, at no additional cost to the Owner and as accepted by the Architect. Laboratory test data for revised mix design and strength results must be submitted to and accepted by the Architect's Representative before using in the work.

4. Test results will be reported by the Owner's Testing Agency in writing to the Architect's Representative and Contractor within 24 hours after tests. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day tests and 28-day tests.

5. Nondestructive Testing: Impact hammer, Windsor probe, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.

6. Additional Tests: The Architect shall require additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by the Architect's Representative. The Owner's Testing Agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed. Contractor shall pay for such tests when unacceptable concrete is verified, including all inspection and Engineering fees when non-conforming work is verified.

1.07 DELIVERY

A. ASTM C 94/C 94M - 04, Article 13.1 - Batch Ticket Information: In addition to the information required by Paragraph 16.1, also include the following:
   1. Type and brand, and amount of cement.
   2. Weights of fine and coarse aggregates.
   3. Class and brand, and amount of fly ash (if any).

PART 2 PRODUCTS

2.01 MATERIALS

A. Cement: ASTM C 150, Type I or II Portland cement.

B. Water: Potable

C. Air-entraining Admixture: ASTM C 260, and on the New York State Department of Transportation's current "Approved List".

D. Water-reducing Admixture: ASTM C 494/C 494M - 04, Type A, and on the New York State Department of Transportation's current "Approved List".

E. High Range Water-reducing Admixture (Superplasticizer): ASTM C 494/C 494M - 04, Type F, and on the New York State Department of Transportation's current "Approved List".

F. Retarding Admixture: ASTM C 494, Type D, Water-reducing and retarding, for use in hot weather concreting, and on the New York State Department of Transportation's current "Approved List".

G. Accelerating Admixture: Non-corrosive admixture, containing no chloride, complying with ASTM C 494, Type C or E, and on the New York State Department of Transportation's current "Approved List".

H. Fly Ash: ASTM C 618, including Table 1 (except for footnote A), Class F except that loss on ignition shall not exceed 4.0 percent.

I. ACI 301, Section 4.2.1.2 - Aggregates:
1. Add the following paragraph:
1. Fine aggregate for pumped concrete shall meet the requirements of ASTM C 33, except 15 to 30 percent shall pass the No. 50 sieve and 5 to 10 percent shall pass the No. 100 sieve. The fineness modulus of the fine aggregate for pumped concrete shall not vary more than 0.20 from the average value used in proportioning.
2. Add the following paragraph:
2. Aggregates shall be taken from storage silos or other approved locations that have been tested and approved by the New York State Department of Transportation, unless otherwise approved in writing by the Architect.

J. Moisture-Retaining Cover: Waterproof paper, polyethylene film, or polyethylene-coated burlap complying with ASTM C 171.

K. Reinforcing Steel
1. Bar Reinforcement: ASTM A 615, Grade 60, deformed steel bars.
2. Fabric Reinforcement: ASTM A 185, welded wire fabric, fabricated into flat sheets unless otherwise indicated.
3. Bar Supports; Either of the Following Types:
a. Galvanized steel or AISI Type 430 stainless steel, and without plastic tips.
b. Insoluble plastic, with minimum 1,500 psi tensile strength and capable of retaining fabricated shape at temperatures between 5 degrees F and 170 degrees F.
c. Solid concrete brick
4. Tie Wire: Black annealed wire, 16-1/2 gage or heavier.

2.02 PROPORTIONING OF MIXES

A. Normal weight concrete for concrete foundation piers and for all other structural concrete unless otherwise specified, shall have a minimum compressive strength of 4500 psi and a water cement ratio of 0.45. Slump: Maximum 4 inches; minimum 2 inches before the addition of any water-reducing admixtures or high-range water-reducing admixtures (superplasticizers) at the Site; 8" slump with the addition of superplasticizers.

B. Normal weight concrete for footings shall have a minimum compressive strength of 3000 psi and a water cement ratio of 0.50. Slump: Maximum 3 inches;

minimum 2 inches before the addition of any water-reducing admixtures or high-range water-reducing admixtures (superplasticizers) at the Site.

C. Fly ash shall be substituted for (Portland) cement in normal weight and lightweight concrete up to a maximum of 20 percent by weight of the required minimum (Portland) cement. If fly ash is incorporated in a concrete design mix, make necessary adjustments to the design mix to compensate for the use of fly ash as a partial replacement for (Portland) cement.
1. Adjustments shall include the required increase in air-entraining admixture to provide the specified air content.
2. Lower early strength of the concrete shall be considered in deciding when to remove formwork.

D. Slump for Pumped Concrete: When a water-reducing admixture is not used, maximum slump shall be 4 inches. When a water-reducing admixture is used, maximum slump shall be 6 inches and when a high-range water-reducing admixture (superplasticizers) is used, maximum slump shall be 8 inches.

E. Design Air Content: Design air content for concrete required to be air entrained shall be 6 percent by volume, with an allowable tolerance of plus or minus 1.5 percent for total air content, except as otherwise specified. Use air-entraining admixture, not air-entrained cement. Concrete to be air-entrained shall be exterior foundation piers.

F. ACI 301, Section 4.2.2.3: Change article to read as follows:
1. 4.2.2.3 - Size of Coarse Aggregates:
   a) 4.2.2.3.a Normal Weight Concrete: Coarse aggregates shall conform to graduation requirements for various sizes as tabulated in Table No. 2 of ASTM C 33. The sizes of coarse aggregates for various classes of Work shall be as follows with all percentages being determined by weight.
   b) 4.2.2.3.c For concrete Work having a minimum cross-sectional dimension of not more than 6 inches, the coarse aggregate shall be a well graded mixture of No. 67 (3/4" to No. 4) and No. 57 (1" to No. 4), provided that not more than 50 percent nor less than 30 percent shall be Size No. 67 and not more than 70 percent nor less than 50 percent shall be Size No. 57.
   c) 4.2.2.3.d For concrete Work having a minimum cross-sectional dimension greater than 6 inches and not more than 12 inches, including concrete floors, the coarse aggregate shall consist of a mixture of No. 67, No. 57 and No. 467 (1 ½" to No. 4), providing that not more than 25 percent nor less than 10 percent shall be Size No. 67 and not more than 40 percent shall be Size No. 467.
   d) 4.2.2.3.e For concrete Work having a minimum cross-sectional dimension of more than 12 inches, the coarse aggregate shall consist of a mixture of No. 67, No. 57 and No. 357 (2" to No. 4), providing not more than 25 percent nor less than 10 percent shall be Size No. 67 and not more than 40 percent shall be Size No. 357.

G. Admixtures: Do not use admixtures in concrete unless specified or approved in writing by the Architect.

H. ACI 301, Section 4.1.2.1 - Mixture Proportions:
1. Add the following to paragraph 4.1.2.1:

- Proposed design mix(es) for pumped concrete and the pumping equipment shall have been tested under actual field conditions with the maximum horizontal run and vertical lift required for this project.

2.03 JOINTS

A. ACI 301, Section 5.3.2.6 - Construction joints and other bonded joints:
1. Delete the following subparagraphs:
- Use an acceptable surface retarder in accordance with manufacturer's recommendations;
- Roughen the surface in an acceptable manner that exposes the aggregate uniformly and does not leave laitance, loosened particles of aggregate, or damaged concrete at the surface; or

2.04 PRODUCTION OF CONCRETE

A. Provide ready-mixed concrete, either central-mixed or truck-mixed, unless otherwise approved in writing by the Architect.

B. ACI 301, Section 5.3.2.1 Weather considerations
1. Delete paragraph under 5.3.2.1.c - Hot Weather, and add the following:
- 5.3.2.1.c Provide adequate controls to insure that the temperature of the concrete when placed does not exceed 90 degrees F., and make every effort to place it at a lower temperature. The temperature of the concrete as placed shall not be so high as to cause difficulty from loss of slump, flash set or cold joints. Ingredients may be cooled before mixing by shading the aggregates, fog spraying the coarse aggregate, chilling the mixing water or other approved means. Mixing water may be chilled with flake ice or well-crushed ice of a size that will melt completely during mixing, providing the water equivalent of the ice is calculated into the total amount of mixing water.

C. Protect concrete from physical damage or reduced strength due to weather extremes during mixing, placement and curing.
1. In cold weather, comply with ACI 306R.
a. When air temperature is below 40 degrees F (4 degrees C) heat the mixing water and, if necessary, the aggregates to obtain a concrete mixture temperature of not less than 50 degrees F (10 degrees C) and not more than 80 degrees F (27 degrees C) at point of placement. If the mixing water is heated, do not exceed a temperature of 140 degrees F at the time it is added to the cement and aggregates.
2. In hot weather, comply with ACI 305R.
a. When air temperature is between 85 degrees F (30 degrees C) and 90 degrees F (32 degrees C), reduce mixing and delivery time from 1 1/2 hours to 75 minutes, and when air temperature is above 90 degrees F (32 degrees C), reduce mixing and delivery time to 60 minutes.

PART 3 EXECUTION

3.01 EXAMINATION AND PREPARATION

A. Do not use items of aluminum for mixing, chuting, conveying, forming or finishing concrete, except magnesium alloy tools may be used for finishing.

B. Check items of aluminum required to be embedded in the concrete and insure that they are coated, painted or otherwise isolated in an approved manner.

C. Install waterstops in accordance with manufacturer's printed instructions.

D. Hardened concrete, reinforcement, forms, and earth which will be in contact with fresh concrete shall be free from frost at the time of concrete placement.

E. Do not deposit concrete in water. Keep excavations free of water by pumping or by other approved methods.

F. Prior to placement of concrete, remove all hardened concrete spillage and foreign materials from the space to be occupied by the concrete.

3.02 ADMIXTURE ADDITIONS AT THE SITE

A. Site additions shall be limited to high-range water-reducers, non-chloride accelerators, and corrosion inhibitors. Comply with manufacturers' printed instructions for discharge of admixtures shall be furnished.

B. High-Range Water-Reducers:
1. Concrete shall arrive at a slump of 2 to 4 inches (50 to 100 mm). Water additions at the Site shall be limited to comply with water-to-cementitious ratio requirements.
2. Following addition of high-range water-reduced concrete, a minimum of 70 revolutions or 5 minutes of mixing shall be completed to assure a consistent mixture.

C. All concrete with other admixture additions shall mix a minimum of 70 revolutions or 5 minutes to assure a consistent mixture.

3.03 PLACING

A. ACI 301, Section 5.3.2.3 Conveying equipment:
1. Add the following paragraphs:
- 5.3.2.3.d When pumping concrete, the lubricating mortar for the delivery line shall not be discharged into an area of concrete placement.
- 5.3.2.3.e The inside diameter of the delivery lines for pumped concrete shall be the greater of either a minimum of 5 inches or 3 times the maximum size of coarse aggregate.

B. ACI 301, Section 5.3.2.2 - Conveying:
1. Add the following paragraph:
- Operation of truck mixers and agitators and discharge limitations shall conform to the requirements of ASTM C 94.

C. ACI 301, Section 5.3.2.4 - Depositing:
1. Add the following paragraph:
- Do not allow concrete to free fall more than 4 feet.

3.04 REPAIRING SURFACE DEFECTS

A. ACI 301, Section 5.3,7 – Repair of surface defects:
1. Add the following paragraph:
- 5.3.7.1.a Finish patched areas to match the texture of the surrounding surface.

B. ACI 301, Section 5.3.7.2 - Repair of tie holes:
1. Delete last paragraph in 5.3.7.2 and replace with the following:
- The patch mixture shall consist of a mixture of dry-pack mortar, consisting of one part Portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for placing and handling. For surfaces exposed to view, blend white Portland cement and standard Portland cement so that, when dry, patching mortar will match surrounding color. Provide test areas at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.

3.05 FINISHING FORMED SURFACES

A. Finish Schedule: Except where indicated otherwise on the Drawings, provide the finishes below:
1. Rough Form Finish for concrete surfaces not exposed to view.
2. Smooth Form Finish for exterior concrete surfaces exposed to view. Remove forms as soon as removal operations will not damage concrete (reference ACI 301-05.2.3.2), and perform necessary

3.06 CURING AND PROTECTION

A. Cure all exposed concrete using supervised wet cure or an approved curing compound.

B. Hot Weather Concreting: Comply with ACI 305R whenever the atmospheric temperature or the form surface temperature is at or above 90 degrees F., or climatic conditions of wind and/or low humidity will cause premature drying of the concrete.

C. Curing Temperature: Maintain the temperature of the concrete at 50 degrees F. or above during the curing period. Keep the concrete temperature as uniform as possible and protect from rapid atmospheric temperature changes. Avoid temperature changes in concrete which exceeds 5 degrees F. in any one hour and 50 degrees F. in any 24-hour period.

END OF SECTION

SECTION 044302

GRANITE

PART 1 GENERAL

1.00 GENERAL PROVISIONS

A. Attention is directed to the PROCUREMENT AND CONTRACTING REQUIREMENTS and all Sections within DIVISION 01, GENERAL REQUIREMENTS, which are made a part of this Section of the Specifications.

1.01 WORK INCLUDED

A. Provide all equipment and materials, and do all work necessary to construct the granite for bench blocks, seatwalls, stairs and planter curbs, including bronze inlays and infill painted text and graphics, as indicated on the Drawings and as specified herein.

1.02 RELATED WORK

A. Examine Contract Documents for requirements that affect the work of this Section. Other Specification Sections that relate directly to work of this Section include, but are not limited to:

1. Section 033001, CAST-IN-PLACE CONCRETE - SITEWORK.
2. Section 312300, SITE EXCAVATING, BACKFILLING AND COMPACTING; Excavation and fill; establishment of subgrade elevations.
3. Section 321440, GRANITE PAVING; Road curb.
4. Section 321640, GRANITE CURB.

1.03 REFERENCES

A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirement shall govern.

1. American Society for Testing and Materials (ASTM):

C 144	Aggregate for Masonry Mortar
C 150	Portland Cement
A 167	Stainless and Heat Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
C 207	Hydrated Lime for Masonry Purposes
C 270	Mortar for Unit Masonry
B 36	Brass Plate, Sheet, Strip, And Rolled Bar

B 43	Seamless Red Brass Pipe, Standard Sizes
B 62	Composition Bronze or Ounce Metal Castings
B 135	Seamless Brass Tube
B 455	Copper-Zinc-Lead Alloy (Leaded-Brass) Extruded Shapes
B 584	Copper Alloy Sand Castings for General Applications
C 615	Structural Granite
D 1752	Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

2. National Building Granite Quarries Association, Inc. (NBGQA):

Specifications	Specifications for Architectural Granite

1.04 SUBMITTALS

A. Samples: Samples of the following shall be submitted:

Item	Quantity and Size
Dowels	One each of each size, 4 in. length
Granite Stair Tread	One section required, full thickness x full width x 2 ft. long, specified color and finish.
Granite Planter Curb	One section required, full thickness x full height x 2 ft. long, specified color and finish.
Granite Block Bench	One section required, full thickness x full height x 2 ft. long, specified color, including etched text and graphics.
Bronze inlay	12 in. long x full dimension, specified finish
Mortar grout	Cured sample, 2 in. x 2 in. of selected color

1. Granite sample shall fully demonstrate color, shade, veining, texture, range, and finish.

B. Manufacturer's Product Data: Manufacturer's product data shall be submitted for the following items:

1. Expansion joint filler
2. Grout materials, including additives
3. Mortar coloring additive
4. Mortar materials, including additives

C. Shop Drawings: Cutting and setting drawings of granite pieces specified herein shall be submitted. Drawings shall indicate sizes, dimensions, layout, finishes, edging, radius edges, arrangement and provisions for jointing, anchoring, cut-out and holes, and other necessary details for reception of other work.

1. Drawings shall indicate locations of inserts for stone anchors and supports which are to be built into concrete, and locations and dimensions of cut-outs, holes, openings, and other provisions required for the work of other trades. The shop drawings should indicate the connections from stone to stone creating monolithic granite steps
2. Shop drawings shall indicate the setting number of each piece and each piece shall bear the corresponding number in a non-staining paint.

D. Contractor's Review: Before commencing work, submit signed statement that Contract Documents have been reviewed with a qualified representative of granite supplier, and that selected materials and construction are proper, compatible, and adequate for application shown.

E. Test Report: Submit reports from tests conforming to ASTM C 67 methods indicating:

1. Compressive strength, psi. (ASTM C 170)
2. Density, lbs./c.f. (ASTM C 97)
3. Absorption by weight, % (ASTM C 97)
4 Abrasion resistance (ASTM C 241)
5. Flexural strength psi, (MPa) (ASTM C 880)

1.05 SAMPLE INSTALLATIONS

A. Provide sample step installation as directed by Architect, conforming to typical Project construction. Sample shall show the proposed granite type, color, and finish, setting system, relationship to paving, jointing and other pertinent details of installation.

B. Provide sample planter curb installation as directed by Architect, conforming to typical Project construction. Sample shall show the proposed granite type, color, and finish, setting system, relationship to paving, jointing and other pertinent details of installation.

C. Provide sample seatwall installation as directed by Architect, conforming to typical Project construction. Sample shall show the proposed granite type, color, and finish, setting system, bronze inlay, relationship to paving, jointing and other pertinent details of installation.

D. Replace sample installation as many times as necessary until Architect's approval of the installation has been obtained. Upon Architect's approval, construct all subsequent granite work to conform to approved sample installation.

1.06 COORDINATION

A. Coordinate work with that of other sections affecting, affected by, this work, as necessary to assure the steady progress of the work under the Contract.

B. Do all cutting and drilling to accommodate work of other sections, as expressly indicated and as reasonably inferred from Contract Documents Specifications, or required for the proper completion of the Work.

1.07 DELIVERY, HANDLING, AND STORAGE

A. Granite shall be carefully packed and banded by the supplier for shipment. Following shipping granite shall be stored on wood skids or pallets, covered with non-staining, waterproof membrane and protected from the weather. Skids shall be placed and stacked in such a manner as to evenly distribute the weight of the granite materials and to prevent breakage, cracking, and damage to granite pieces. Granite materials shall be stored in such a manner as to allow air to circulate around the granite material. Granite shall not be permitted to be in direct contact with the ground any time during storage.

B. Granite shall be carefully handled to prevent chipping, breakage, soiling, or other damage. Pinch or wrecking bars shall not be used without protecting edges of granite with wood or other rigid materials. Granite units shall be lifted with wide-belt type slings wherever possible; wire rope or ropes containing tar or other substances which might cause staining or damage to granite finish shall not be used.

C. Granite damaged in any manner will be rejected and shall be replaced with new materials at no additional cost to the Owner.

1.08 PROTECTION OF FINISHED SURFACES

A. Finished surfaces adjacent to the granite work shall be adequately protected from soiling, staining, and other damage.

1.09 QUALITY ASSURANCE

A. Granite shall be supplied by a source approved by the Architect.

B. Granite shall conform to the requirements of ASTM C 615, Architectural Grade and NBGQA Specifications, except as modified herein.

C. Granite shall be standard grade, free of cracks, seams, starts, or other defects which may impair its strength, durability or appearance. Exposed surfaces shall be free from spots, spalls, chips, stains, discoloration, or other defects which would affect its appearance. Color, texture and finish shall be within the range of samples approved by the Architect.

1.10 JOB CONDITIONS

A. Cold Weather Protection:

1. Remove any ice or snow formed on granite or concrete bed by carefully applying heat until top surface is dry to touch.
2. Remove granite work determined to be damaged by freezing conditions.
3. Perform the following construction procedures while work is progressing:

Air Temperature	Procedures
40^{o} - 32^{o}F.	Heat sand to produce mortar temperatures between 40^{o} and 120^{o}F.
32^{o} - 25^{o}F.	Heat sand to produce mortar temperatures between 40^{o} and 120^{o}F. Maintain temperature of mortar on boards above freezing.

25° - 20°F.	Heat sand to produce mortar temperatures between 40° and 120°F. Maintain temperature of mortar on boards above freezing. Use wind breaks when wind is in excess of 15 mph.
20°F. - below	Heat sand to produce mortar temperatures between 40° and 120°F. Provide enclosures and auxiliary heat to maintain air temperature above 32°F. Do not lay units which have a surface temperature below 20°F.

4. Latex admixture shall be kept at 40°F. minimum.

B. Cold Weather Protection for Completed Granite Work:

Mean Daily Air Temperatures	Procedures
40° - 32°F.	Protect granite work from rain or snow for at least 24 hours by covering with weather-resistive membrane.
32° - 25°F.	Completely cover granite work with weather-resistive membrane for at least 24 hours.
25° - 20°F.	Completely cover granite work with insulating blankets or similar protection for at least 24 hours.
20°F. - below	Maintain granite work at temperature above 32°F. for 24 hours using enclosures and supplementary heat.

1. Do not use frozen materials or materials mixed or coated with ice or frost. Do not lower the freezing point of mortar by use of admixtures or antifreeze agents, and do not use calcium chloride in mortar or grout.
2. Do not build on frozen work; remove and replace granite work damaged by frost or freezing.
3. During all seasons, protect partially completed granite work against weather when work is not in progress.

PART 2 PRODUCTS

2.01 GENERAL STANDARDS

A. Quarrying Supervision

1. Quarrying shall be supervised and coordinated by the granite fabricator to insure that the as-quarried block orientations will yield finished material with characteristics as described herein.
2. All granite shall be cut from matched blocks. Matched blocks shall mean blocks extracted from a single bed of stratum in the quarry. The use of blocks chosen at random, though similar in general character and color to that of the approved granite will not be permitted, except by written permission of the Architect.

B. Examinations

1. Examination at the Quarry: Quarried blocks shall be made available for inspection by the Architect at his request.

2. Examination at the Fabrication Plant: Production units shall be made available for inspection by the Architect at his request. To this end, the Subcontractor shall, after approval of final shop drawings, advise the Architect when production has begun and of the earliest possible opportunity to inspect a representative sampling of production work.
3. Contractor shall provide lighting that is sufficient in intensity and color range to permit an adequate examination to the satisfaction of the Architect.

C. Criteria for Granite

1. Visual: All examinations, selections, and approvals shall be for the purpose of achieving a final appearance of granite with greatest possible uniformity, and will be based upon the following criteria:
2. All granite shall be of sound stock and uniform texture, and shall be free from holes, seams, shakes, clay pockets, spalls, stains, starts, and other defects which would impair the strength, durability and appearance of the work, as determined by the Architect.
3. Inherent variations characteristic of the granite and the quarry from which the granite is to be obtained shall be brought to the attention of the Architect at the time the samples are submitted for approval, and shall be subject to approval of the Architect.
4. All granite shall be selected for background color, veining, marking and matching, shall run in even shades, and shall be set accordingly.

D. Physical and Mechanical: Contractor to submit data to the Architect.

1. Absorption and Bulk Specified Gravity (ASTM C 97).
2. Flexural strength (ASTM C 880).
3. Compressive Strength (ASTM C 170).
4. Modulus of Rupture (ASTM C 99).
5. Abrasion Resistance, Hardness (ASTM C 241).

E. Any granite materials rejected for non-compliance with these standards shall be replaced at no additional cost to the Owner.

2.02 STONE FABRICATION

A. General: Fabricate stone units in sizes and shapes required to comply with requirements indicated, including details on Drawings and Shop Drawings.

1. For granite, comply with recommendations in NBGQA's "Specifications for Architectural Granite."

B. Cut and drill sinkages and holes in stone for anchors, fasteners, supports, and lifting devices as indicated or needed to set stone securely in place; shape beds to fit supports.

C. Cut stone to produce pieces of thickness, size, and shape indicated and to comply with fabrication and construction tolerances recommended by applicable stone association or, if none, by stone source, for faces, edges, beds, and backs.

1. Clean backs of stone to remove rust stains, iron particles, and stone dust.

D. Contiguous Work: Provide chases, reveals, reglets, openings, and similar features as required to accommodate contiguous work.

E. Finish exposed faces and edges of stone, except sawed reveals, to comply with requirements indicated for finish and to match approved samples and mockups.

F. Carefully inspect finished stone units at fabrication plant for compliance with requirements for appearance, material, and fabrication. Replace defective units.

1. Grade and mark stone for overall uniform appearance when assembled in place. Natural variations in appearance are acceptable if installed stone units match range of colors and other appearance characteristics represented in approved samples and mockups.

G. Flatness Tolerance: Variation from true plane, or flat surfaces, shall be determined by use of a 4 ft. long straightedge, applied in any direction on the surface. Such variations on polished, honed and fine rubbed surfaces at the bed and joint arris lines shall not exceed 3/64 in. or 1/16 of the specified joint width, whichever is greater. On surfaces having other finishes the maximum variation from true plane shall not exceed 1/4 of the specified joint width.

H. Variations from true plane on other parts of face surfaces shall not exceed the following:

1. 4-cut and sawn finishes 1/8 in.
2. Thermal a finishes 3/16 in.

I. Backs of pieces shall be sawn or roughly dressed to approximate true planes. Maximum variation in thickness from the specified shall not exceed the following:

1. 1/2 in. on pieces above 3 in. modular thick

2.03 GRANITE

A. Granite shall conform to the requirements of ASTM C 615, Architectural Grade and NBGQA Specifications.

1. Granite shall be sound and uniform in quality, texture, and strength, and shall be free of any flaws, reeds, rifts, laminations, seams, or defects which would impair its strength, durability, or appearance.
   a. Absorption by weight shall not exceed 0.4 %
   b. Compressive strength of not less than 19,000 psi.
   c. Minimum density of 160 pcf.

B. Granite shall be the following, or approved equal:

1. “Englishman’s Bay” granite supplied by JC Stone, Inc., 539 Rockland Road (Route 17) Jefferson, Maine 04348 (P) 207-549-4729 (F) 207-549-4032.

C. Sizes: Granite shall be of the sizes and dimensions indicated on the Drawings.

D. Finish:

1. Granite finish on all exposed surfaces of steps, planter curbs and seatwalls shall be “Thermal”.
2. Finish on block benches shall include:
   a. laser and/or water jet etching of text and graphics (Text and graphics will be provided by Architect.)
   b. painted infill in areas
   c, bronze inlays.

E. All faces shall be at right angles to the plane of the top.

F. Granite shall be cut accurately to required shapes and dimensions.

G. Holes, cut-outs, sinkages and openings in granite work for anchors, cramps, dowels, supports, and lifting devices, shall be accurately cut or drilled to required dimensions, as shown on the approved shop drawings, and as necessary to secure granite in place to insure correct location and accurate fit of all fixtures. Setting beds shall be shaped to fit supports.

H. Arrises shall be cut sharp and true to square, and continuous with adjoining arrises. Where exposed, arrises shall be eased.

2.04 INFILL PAINT (AT BENCH GRAPHICS AND TEXT)

A. Painted Graphics and Text Finish: Provide Lithichrome Stone Paint, manufactured by Granite City Tool 247 28th Ave. S., Waite Park, MN 56387; www.granitecitytool.com, or approved equal.

1. “Overcoat” (Clear Coat): Provide Lithco Clear, manufactured by Granite City Tool 247 28th Ave. S., Waite Park, MN 56387; www.granitecitytool.com, or approved equal.

2.05 BRONZE INLAYS (AT BENCH GRAPHICS AND TEXT)

A. Copper and Copper Alloys, General: Provide alloys indicated and temper to suit application and forming methods but with strength and stiffness not less than H01 (quarter-hard) for plate, sheet, strip, and bars and H55 (light-drawn) for tube and pipe.

1. Extruded Shapes, Bronze: ASTM B 455, alloy UNS No. C38500 (architectural bronze).
2. Seamless Pipe, Bronze: ASTM B 43, alloy UNS No. C23000 (red brass, 85 percent copper).
3. Seamless Tube, Bronze: ASTM B 135 (ASTM B 135M), alloy UNS No. C23000 (red brass, 85 percent copper).
4. Castings, Bronze: [Composition bronze castings complying with ASTM B 62, alloy UNS No. C83600 (85-5-5-5 or No. 1 composition commercial red brass)] [or] [sand castings complying with ASTM B 584, alloy UNS No. C86500 (No. 1 manganese bronze)].
5. Plate, Sheet, Strip, and Bars; Bronze: ASTM B 36/B 36M, alloy UNS No. C28000 (muntz metal, 60 percent copper).

B. Fasteners: Copper-Alloy (Bronze) Items: Silicon bronze (Alloy 651 or 655) fasteners[where concealed, muntz metal (Alloy 280) fasteners where exposed].

C. Fabrication – General: Form bronze inlays to required shapes and sizes, true to line and level with true curves and accurate angles and surfaces. Finish exposed surfaces to smooth, sharp, well-defined lines and arris. Take special care in choosing materials that are smooth and free of blemishes such as pits, roller marks, trade names, scale and roughness. Fabricate work with uniform, hairline tight joints.

1. Form simple and compound curves in bars and extruded shapes by bending members in jigs to produce uniform curvature for each configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces.

D. Finish: Finish designations for copper alloys comply with the system established for designating copper-alloy finish systems defined in NAAMM's "Metal Finishes Manual for Architectural and Metal Products".

1. Fine-Matte Finish: M42 (Mechanical Finish: nondirectional finish, fine matte).

2.06 SETTING BED MORTAR – THIN SET

A. Thin set setting bed mortar shall be equal to "Laticrete 254 Platinum", one-step, polymer fortified, thin-set mortar, manufactured by Laticrete International, Inc., One LATICRETE Park North, Bethany, CT 06524-3423 USA · 1.800.243.4788 · +1.203.393.0010, or approved equal.

2.07 MORTAR GROUT FOR POINTING

A. Sanded Grout: shall be 1500 Sanded Grout, a premium, factory prepared grout designed to be mixed with water. 1500 Sanded Grout is formulated from a blend of high strength portland cement, graded aggregates, polymers and color-fast pigments and provides a grout joint that is dense, hard and durable, manufactured by Laticrete International, Inc., One LATICRETE Park North, Bethany, CT 06524-3423 USA · 1.800.243.4788 · +1.203.393.0010, or approved equal.

1. For grout joint widths of 1/16" (1.5 mm) up to 3/8" (9 mm).
2. Color shall match color of granite.

2.08 EXPANSION JOINT FILLER

A. Preformed expansion joint filler shall be a nonextruding, resilient, nonbituminous type, conforming to ASTM D 1752, Type II.

2.09 ANCHORAGE AND SETTING MATERIALS

A. Pins, Dowels, Anchor Bolts, Nuts, Washers, and Shims: Fabricate from AISI Type 302/304 stainless steel.

B. Stone Anchors: Type and size required to securely anchor and fasten stonework in place and as indicated on the Drawings. Fabricate anchors and dowels from Type 302/304 stainless steel.

C. Epoxy adhesive for fastening stainless steel dowels into adjoining granite pieces and/or concrete foundations shall be a two-component, 100% solids, moisture-insensitive, high-modulus, high strength, structural, epoxy paste adhesive conforming to ASTM C 881, similar to “Sikadur 31, Hi-Mod Gel”, manufactured by Sika, Glendale Heights, IL 60139, or approved equal.

D. Provide lead or plastic setting buttons sized to maintain uniform joints.

PART 3 EXECUTION

3.01 ACCEPTABILITY OF CONCRETE BASE

A. Contractor shall examine the concrete foundation to determine its adequacy to receive granite unit and mortar setting bed. Evidence of inadequate condition shall be brought to the immediate attention of the Architect.

B. Start of work of this Section shall constitute acceptance of the concrete foundation.

3.02 SETTING

A. The grades need to be staked, elevations confirmed and approved by the Architect before granite is to be set.

B. All setting shall be done by competent granite setters under adequate supervision and in accordance with the approved shop drawings.

C. Granite units with chips, cracks, stains, or other defects which might be visible in the finished work shall not be used.

D. Before setting, granite shall be clean and free of dirt, and foreign matter on all sides. Granite shall be dry before setting.

E. Granite shall be set true to the required lines and grades. Joints shall be uniform in thickness. Expansion joints shall be 1/2 in. wide. Unless otherwise indicated on the Drawings all other joints shall be 1/4 in. wide. Direct bearing contact between granite pieces shall be prohibited.

F. Before setting, the back of each granite piece shall be dampened and shall receive a slurry of mortar to ensure maximum contact with mortar bed. Each piece shall be carefully bedded in a full bed of mortar and tapped home with a rawhide mallet to a full and solid bearing. Particular care shall be exercised to equalize bed and joint openings and eliminate the need for redressing of exposed surfaces.

G. Exposed surfaces shall be kept free from mortar at all times. Any mortar smears shall be immediately removed with a clean sponge and clean water before latex modified mortar can set.

H. Holes, slots, and other sinkages for anchors, and dowels, shall be completely filled with mortar during setting of granite.

I. All joints except expansion joints shall be completely filled with mortar, then raked out to a depth of not less than 3/4 in. Raked joints shall be brushed clean and pointed with colored mortar to a flat cut joint. Mortar grout between granite pieces shall be uniform in appearance, texture, and color. After initial set of mortar, joints shall be finished by tooling with a rounded, nonstaining jointer to produce a glassy-hard, polished, slightly, concave joint, free of drying cracks.

J. Granite shall be set according to the details and locations indicated on the Drawings.

K. Expansion joints shall be located as indicated on the Drawings. Expansion joint shall be 1/2 in. wide. Preformed joint filler shall be installed between granite units at expansion joint locations.

3.03 INFILL PAINT

A. Apply a thinned (thinned about half with Lithco Solvent) color and then a regular coat of color. If applying by brush, do a minimum of brush “stroking” as excessive brushing results in poor adhesion.

B. Follow with an “overcoat” of Lithco Clear for added stone color durability.

3.04 BRONZE INLAYS

A. Perform cutting and fitting required to install inlays as indicated on the Drawings. Set inlays accurately in location, alignment, and elevation; measured from established lines and levels. Unless otherwise indicated, set inlays flush with granite surface.

3.05 CLEANING

A. After pointing granite work shall be carefully cleaned, removing all dirt, excess mortar, stains, and other defacements.

1. Mild abrasive cleaners that contain no harsh or caustic ingredients may be used, with fiber brooms or brushes and clear water. Wire brushes, steel wool, and acids or other solutions which may cause discoloration are expressly prohibited.
2. Expansion joints and other joints to receive sealant shall be cleaned of all mortar and left ready for sealing of joints under Section 079200, EXTERIOR SEALANTS.

B. Upon completion of granite work, surfaces shall be left in a clean, unsoiled condition, acceptable to the Architect.

3.06 PROTECTION

A. Granite work shall be properly and adequately protected under the responsibility of the Contractor until final acceptance of the Project by Owner.

B. After the granite work has been installed, it shall be properly and adequately protected from damage. Boxing or other suitable protection shall be provided by Contractor wherever required. However, no lumber which may stain or deface the granite shall be used. Nails shall be high-quality galvanized or non-rusting.

END OF SECTION

SECTION 051200

STRUCTURAL STEEL – CATENARY POLES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes

The structural steel as shown on the drawings and specified herein, including, but not limited to, the following:

2. Columns at catenary lighting.

3. Miscellaneous steel shown on the drawings.

4. Grouting of base plates, leveling and bearing plates.

5. Bolts and other steel accessories.

B. Related Sections

1. 033000 Cast-in-Place Concrete.

1.02 REFERENCES

A. American Institute of Steel Construction (AISC).

1. AISC 360-05 - “Specification for Structural Steel for Buildings”.

2. AISC “Code of Standard Practice for Steel Buildings and Bridges”.

B. Research Council on Structural Connections (RCSC).

1. RCSC “Specification for Structural Joints Using ASTM A 325 or A 490 Bolts".

C. American Society for Testing and Materials (ASTM)

1. ASTM A 36 "Specification for Carbon Structural Steel".

2. ASTM A 53 "Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless".

3. ASTM A 153 "Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware".

4. ASTM A 307 "Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength".

5. ASTM A 325 "Specification for Structural Bolts, Steel, heat Treated, 120/105 ksi Minimum Tensile Strength ".

6. ASTM A 490 "Specification for Heat-Treated, Steel Structural Bolts, 150 ksi Minimum Tensile Strength".

7. ASTM A 563 "Specification for Carbon and Alloy Steel Nuts".

8. ASTM B 695 “Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel”.

9. ASTM F 436 "Specification for Hardened Steel Washers".

10. ASTM F 1554 “Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength”.

D. American Welding Society (AWS).

1. AWS D1.1 “Structural Welding Code - Steel".

E. Structural Steel Painting Council (SSPC).

1. SSPC "Steel Structures Painting Manual, Volume 2, Systems and Specifications".

1.03 SUBMITTALS

A. Shop Drawings:

1. Prepare complete shop drawings showing anchor rod setting plans, details of layout, fabrication, and erection.

a. Indicate the materials used and member marks.

b. Reference shop drawings to specific location and detail number on the Drawings.

c. Show extent of painting .

d. Indicate location and type of special finish requirements.

e. Copies of the Contract Documents will not be considered as meeting these requirements.

2. Provisions of AISC Code of Standard Practice for Steel Buildings and Bridges related to shop and erection drawings are applicable.

3. Submit shop drawings to Architect for review and obtain acceptance prior to start of fabrication.

B. Mill Reports

1. Submit copies of certified mill test reports for each heat of steel and for all fasteners, including nuts and washers prior to start of fabrication.

2. Mill test reports shall include ladle analysis and tensile elongation and bend tests. Perform mechanical and chemical tests for all material regardless of thickness or use.

3. Mill reports shall be traceable to individual pieces of steel used.

4. In addition to other requirements mill reports shall address the following elements: copper, columbium, chromium, nickel, molybdenum, silicone, and vanadium.

5. Provide mill reports for all welding consumables used on this project.

C. Submit certificates of compliance for:

1. Welding electrodes.

2. Welders have passed qualification tests.

D. Welding Procedure Submittals:

1. Submit written Welding Procedures Specifications (WPSs) in accordance with AWS D1.1 requirements for each different welded joint proposed for use whether prequalified or qualified by testing. The manufacturer and specific electrode shall be stated in the WPS. Manufacturer and specific electrode shall be considered essential variables for the WPS.

2. In addition to the Welding Procedure Specifications submit fabrication and erection procedures where needed to control shrinkage, fabrication tolerances, or to insure proper inspection.

3. Procedure Qualification Record (PQR) in accordance with AWS D1.1 for all procedures qualified by testing.

4. Electrode manufacturers data.

5. When larger effective throat thicknesses of flare groove welds than allowed by Table J2.2 of AISC “Specification for Structural Steel for Buildings Allowable Stress Design and Plastic Design”, submit data establishing by qualification the consistent production of of such larger effective throat thicknesses. Qualification of effective throat thicknesses shall be as prequired by the AISC specification.

6. The WPS and PQR will be reviewed by the Testing Laboratory for conformance with the requirements of AWS D1.1.

E. Connection Design

1. The Contractor is responsible for the design of connections when they are not fully defined on the contract documents.

2. At the commencement of the project submit a letter signed and sealed by the Engineer that will supervise the steel connection design attesting to this responsibility.

3. At the end of the steel shop drawing submission phase submit a letter, signed and sealed by the Engineer supervising the steel connection design, attesting to the completion of the work.

4. Submit calculations of all connections. Calculations and details shall be clearly keyed to the appropriate members on the construction documents. Calculations shall bear the seal of the Engineer supervising design of the steel connections.

5. Contractor shall not proceed with steel erection until these requirements are fulfilled.

1.04 QUALITY ASSURANCE

A. Qualifications: Design of structural steel connections to be under the direct supervision of a Professional Engineer experienced in the design of such components and registered in the State of New York, and shall conform to the applicable national, state and city standards.

B. Owner's Testing Laboratory: Shop and field testing and inspection of steelwork specified in this document or requested by the Owner will be performed by an independent laboratory engaged by the Owner ("Inspector").

C. All work shall be performed by qualified operators experienced in their field of work and as otherwise required by these specifications.

D. Qualifications of Welders:

1. Qualify welders in accordance with AWS D1.1 for each process, position, and joint configuration. Each operator shall have been qualified as prescribed by AWS.

2. Require welders to retake the qualification test if, as determined by the Architect, there is a reasonable doubt as to the proficiency of the welder. If the welder does not requalify, he shall not perform any welding on the project.

3. Pay all costs associated with welder qualification.

1.05 DELIVERY, STORAGE AND HANDLING

A. Store materials to permit easy access for inspection and identification. Support steel members off ground. Protect steel members and packaged materials from corrosion and deterioration. Materials showing evidence of damage will be rejected and shall be immediately removed from the site.

B. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.

C. Do not handle structural steelwork until paint has thoroughly dried. Care shall be exercised to avoid abrasions and other damage.

D. All fasteners and washers shall be delivered to the site, where they will be installed, in unopened containers.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Steel Plates: ASTM A 36.

B. Pipe: ASTM A 53, Type E or S, Gr. B

C. Welding Electrodes:

1. Conform to AWS D1.1. Base selection of electrodes on the actual properties of the metal connected.

2. Electrodes shall have a specified minimum tensile strength of at least 70 ksi.

3. Use low hydrogen electrodes.

2.02 FASTENERS

A. Unfinished Bolts and Nuts (Machine Bolts) and Threaded Rods:

1. Bolts and Nuts: ASTM A 307, Grade A.
2. Washers: ASTM F 436.

B. High Strength Bolts Nuts and Washers: ASTM A 325 Type 1 and/or ASTM A490 Type 1.

C. Anchor Rods: ASTM F 1554 Grade 36 unless otherwise noted.

D. Where fasteners are indicated as galvanized, provide units that are zinc coated in accordance with ASTM B 695, Class 50

E. Expansion Bolts: Kwik-Bolt III as manufactured by Hilti Inc. or approved alternate.

F. Clevises and Turnbuckles: Dimensions and minimum capacities to conform to the values listed in Tables 8-27 and 8-29 of the “Manual of Steel Construction, Load & Resistance Factor Design Volume II” Second Edition.

G. Sleeve Nuts: Strength of sleeve nut shall be such that when loaded axially the sleeve nut shall be stronger than the ultimate capacity of the connected parts.

H. Recessed-Pin Nuts: Dimensions and minimum capacities to conform to the values listed in the “Manual of Steel Construction, Load & Resistance Factor Design Volume II” Second Edition.

J. Cotter Pins: Dimensions and minimum capacities to conform to the values listed in the “Manual of Steel Construction, Load & Resistance Factor Design Volume II” Second Edition.

2.03 PRODUCTS

A. Paint

1. Shop Paint: SSPC, Paint 20, Type I, Inorganic, or Type II, Organic. Paint shall comply with the requirements of SSPC-PS 12.01.

2. Primer paints shall be compatible with finishes specified by the architect.

B. Grout

1. Nonmetallic Shrinkage-resistant Grout: Premixed, nonmetallic, non-corrosive, nonstaining product containing selected silica sands, Portland Cement, shrinkage compensating agents, plasticizing and water-reducing agents. Subject to compliance with requirements, provide: Master Builders "Masterflow 713" or US Grout Corp "Five Star Grout".

2. Non-Shrink Grout: Premixed non-shrink, non corrosive compound consisting of non-metallic aggregate, cement; water reducing and plasticizing agents capable of developing minimum compressive strength of 2,400 psi in 48 hours and 6,000 psi in 28 days; "Five-Star Grout" manufactured by US Grout Corporation.

3. Drypack: Master Builders' "Embeco 636 Grout"; Euclid Chemical Companys' "Euco Dry Pack Grout", Master Builders' "Masterflow Dry Pack", or equal. Mix to a plastic consistency.

2.04 CONNECTION DESIGN

A. Contractor shall design all steel connections not fully defined.

B. Type of Connections

1. All connections shall be one of the following:

a. High-strength bolts.

b. Unfinished bolts.

c. Welds.

2. When the type of connection is shown on the drawings use that type of connection.

3. Use a connection other than unfinished bolts where required by code and at all connections indicated as such.

C. Design Criteria.

1. Design connections for the loads and according to the requirements in the Contract Documents and the applicable building regulations.

2. Bolts shall be at least 3/4 inches in diameter.

2.05 FABRICATION

A. General:

1. Fabrication to be performed in accordance with Chapter M of AISC "Specification for Structural Steel Buildings", the AISC "Code of Standard Practice for Buildings and Bridges" sections 3.2, 5, 6, 8 and the Drawings and Specifications.

a. Assume all thermally cut edges are subject to substantial stresses.

b. Paragraph M4.6 shall be considered deleted from Chapter M.

c. The last sentence of paragraph M5.1 shall be deleted from Chapter M..

2. Provide holes and accessories required for securing other work to the work specified here.

3. Splice members only where indicated on Drawings or where accepted by the Architect.

4. Remove burrs that would prevent solid seating of the connected parts.

5. When bending steel plate:

a. Bend plates perpendicular to the rolling direction.

b. Grind flame cut plate edges transverse to the bend line.

c. Grind out nicks in plate edges transverse to the bend line.

d. Round sharp corners on plate edges transverse to the bend line.

6. Weld sizes where shown shall be assumed to be the effective weld sizes.

B. Architecturally Exposed Steel

1. All members exposed to view shall be classified as "Architecturally Exposed Structural Steel".

2. Comply with the provisions of the AISC Code of Standard Practice for Steel Buildings and Bridges regarding architecturally exposed structural steel.

a. Abutting cross sectional configurations shall match.

b. Remove backing bars.

c. Remove weld runoff tabs and grind smooth.

d. All surfaces and welds exposed to view shall be treated as finished surfaces.

3. Exposed Welds:

a. All exposed fillet welds shall be made smooth of uniform convex contour, radius and dimension for their full length; grind smooth, if welds were not made to this criteria.

b. All other exposed welds shall be milled or ground smooth and flush with the surfaces of the adjoining materials welded.

4. Weld show-through shall not be permitted.

5. Remove weld splatter on architecturally exposed steel.

6. All exposed corners shall be square and sharp, eased to a radius of 1/4 in.

C. Bolting, General:

1 Bolts shall be of a length that will extend not more than 1/4 in beyond the nuts unless noted otherwise.

2. Washers shall be used on Bolts. Use beveled washers where bolts bear on sloping surface.

3. Bolts shall be installed such that no threads occur in the shear plane when joining pieces 3/8” thick and thicker.

4. Manufacturers symbol and grade markings shall appear on all bolts and nuts.

5. Product containers must be marked so that correspondence with mill reports can be established.

6. Holes in column baseplates shall be oversized per Section 14 of AISC Manual of Steel Construction, latest edition.

7. Circular and slotted holes shall be as per Specification for Structural Joints Using ASTM A325 or A490 Bolts. For purposes of hole fabrication assume dynamically loaded connections.

8. When bolt holes are subject to welding shrinkage stresses the holes shall be drilled.

D. Unfinished Bolts (Machine Bolts) and Anchor Rods:

1. Install and tighten unfinished bolts in accordance with requirements for snug tightened bolts as defined in “Specification for Structural Joints Using ASTM A325 or A490 Bolts”.

2. Mutilate bolt threads for unfinished bolts to prevent the nuts from backing off.

E. High-Strength Bolts: Install high-strength threaded fasteners in accordance with RCSC "Specifications for Structural Joints using ASTM A 325 or A 490 Bolts". Contact surfaces of bolted parts shall as a minimum comply with the class A requirements.

F. Welding

1. Welding shall be in accordance with AWS D1.1 "Structural Welding Code".

a. Contractor is responsible for selection of specific materials and procedures except as specifically noted in contract documents.

b. Connections have varying levels of restraint and thus necessary steps shall be taken by Contractor to control or accommodate the restraint.

c. Welding and fabrication procedures shall incorporate measures necessary to eliminate cracking. These measures shall include but are not limited to additional preheat, postheat, or retarded cooling.

d. When selecting materials and procedures, consideration shall be given to the need for materials and procedures in excess of code requirements.

e. The need for pre-heat and other procedures are to be based on the actual chemistry and mechanical properties of the steel and not solely on the specified properties of the steel.

f. Limit maximum interpass temperatures so as not to decrease toughness and strength of the weld metal.

g. Weld variables shall be consistent with the recommendations of the electrode manufacturer.

h. Welding Procedure Specifications shall be readily available to all welders, inspectors, and supervisors during the production process.

i. Weld only in accordance with the WPSs.

j. Do not mix different electrodes in the same weld joint unless the interactions have been shown not to cause problems.

k. Welding procedures shall incorporate low hydrogen practices.

l. Use stringer beads only (no weaving).

2. No tack welds not incorporated into a weld will be allowed on the finished structure with the exception of backing plates that are not removed.

3. All groove or butt welds shall be full penetration unless noted otherwise on the Drawings.

4. Sequence the work as necessary to accommodate testing.

5. Remove run-off tabs and backup plates and grind surfaces smooth as required for inspection or testing.

6. Where tubes, pipes or other closed sections are exposed to the weather, provide seal welds where other specified welds do not provide a complete seal of the enclosed space.

G. Finishes of Architecturally Exposed Steel

1. All surfaces of architecturally exposed structural steel members shall be uniform in appearance, including smoothness and texture, when viewed in direct sunlight at a distance of 10 feet, at angles of incidence 0 degree to 90 degree at completion of surface preparation and shop prime painting.

2. Surface Appearance: The initial condition of steel to be exposed in use shall conform to SSPC-Vis 1 Rust Grade A. The exposed surfaces, edges and ends of all plates and other components shall be free of any surface defects including weld splatter, burrs, dents, gouges, occlusions, streak, ridges and recesses. Such defects may be repaired and surface restored with weld or other approved filler material and machining (milling, grinding or sanding) to match appearance, including smoothness and texture, of parent surface.

H. Shop Painting

1. All structural steel exposed to the weather or classified as Architecturally Exposed Steel shall receive a shop coat of primer except as follows:

   a. Steel in contact with concrete.

   b. Contact surfaces of welded connections and areas within 4 in on each side of field welds.

   c. Machined surfaces.

   d. Contact surfaces of high-strength bolted connections.

2. The following surfaces shall be temporarily protected by a thin coating of varnish or lacquer:

   a. Unpainted area around field welds.

   b. Steel around high strength bolts.

   c. Machined surfaces.

3. Surface preparation and application shall be in accordance with SSPC-PS 12.01 “One-Coat Zinc-Rich Painting System”.

2.06 SOURCE QUALITY CONTROL

A. Testing and inspection of structural steelwork will be performed by the Testing Laboratory. Provide the Inspector with the following:

1. A complete set of accepted "Submittals"

2. Cutting lists, order sheets, material bills, and shipping bills.

3. Representative sample pieces as requested by the testing agency.

4. Full and ample means and assistance for testing all material.

5. Access and facilities for testing and inspection at all places where materials or components are stored or fabricated, and also in their erected position.

B. Scheduling of Tests and Inspections

1. The Contractor shall notify the Inspector in sufficient time prior to fabrication or erection work to allow testing and inspection without delaying the work.

2. Shop welds will be inspected in the shop before the work is painted or shipped.

C. Non-destructive Testing and Inspections

1. As a minimum the inspector will make all tests and inspections as required by the New York State Building Code. The Inspector will make all the tests and inspections indicated in the Construction Documents.

2. The Inspector will make all verification tests and inspections as required by AWS D1.1 "Structural Welding Code".

3. Do not reduce testing frequency unless permission is obtained from Architect.

4 Inspector shall be present during all welding operations.

5 Verify that welders are certified.

6. Check materials, equipment and procedures. Verify meters on welding equipment are functioning and are accurate.

7. Visual Inspection:

   a. Visually inspect all welds.

   b. Visual inspection of multi-pass welds to be continuous.

   c. Verify the effective throat thickness of flare groove welds is consistently obtained when flush to bar or section. This verification shall be based on test sections where necessary.

8. Test Methods:

   a. Butt welds will be tested using magnetic partical test methods and either ultrasonic or radiographic test methods.

   b. Butt welds to pipes and tubes to be tested using magnetic particle tests.

c. Use magnetic partical test methods for filet welds and to supplement the testing requirements for butt welds.

d. For radiographic a double film technique will be used. One copy of each film will be sent to the Architect, the other will be retained by the Inspector.

e. In addition to the non-destructive testing specified other non-destructive test methods recognized by AWS D1.1 may be used at the Architects discretion and the results can be used to reject work under this contract.

9. Frequency of non-destructive examination is to be as follows:

a. Full Penetration Butt Welds: 100 percent ultrasonic.

b. Partial Penetration Butt Welds: 50 percent min. ultrasonic or radiographic inspection..

c. Fillet and other welds not otherwise inspected - a minimum of 20 percent.

d. Selection of welds to be examined: Where there is a requirement for less than 100% examination the method of selection of welds to be examined is to be agreed with the Architect before commencement of the work. If the Architect does not provide more specific criteria inspectors will select the welds to be tested. The inspectors will chose specific weld so as to obtain results that are representative of the conditions in the structure. In addition inspectors will emphasize those locations that experience has shown are more likely to have problems.

e. On five percent of the full penetration butt welds (as chosen by inspector) at connections denoted as being a "special moment connection" as noted on the drawings, after removing, run-off tabs, grind the end of the weld sufficiently to allow determination of number and sizes of weld passes.

10. Where inspection reveals unacceptable defects:

a. The extent of inspection will be increased to provide confidence that the defects in a joint has been found and to assure that the problem is not systematic.

b. As a minimum, examine two additional joints in the group represented by the joint. If the non-destructive examination of the two additional joints reveals unacceptable defects, examine each joint in the group.

D. Take samples of all welding consumables and store in sealed containers.

E. Tests of High Strength Bolts, Nuts and Washers:

1. The Inspector will make all tests and inspections of high strength bolt connections as required by RCSC "Specifications for Structural Joints Using High Strength Bolts".

F. Inspection Records

1. Make systematic record of all welds, including:

a. Location and type of weld.

b. Identification marks of welders.

c. List of defective welds.

d. Manner of correction of defects.

2. The Inspector will maintain a daily record of the work that has been inspected and its disposition. One copy of each of the report will be submitted to the Owner on a weekly basis. Test reports will be made on the form suggested in the AWS D1.1 "Structural Welding Code."

G. Mill Reports: Testing laboratory will review mill reports for conformance to referenced standard.

PART 3 - EXECUTION

3.01 CONDITION OF SURFACES

A. Prior to commencing with the erection of structural steel inspect the job site and verify that the structural steel may be erected in accordance with the Drawings and Specifications.

B. Discrepancies:

1. In the event of discrepancy, immediately notify the Architect in writing.

2. Do not proceed with construction in the region of the discrepancy until all such discrepancies have been resolved.

3.02 PREPARATION

A. Secure field measurements required for proper and adequate fabrication and installation of the work covered in this Section. Assume responsibility for exact measurements.

B. Furnish templates for exact locations of items to be embedded in concrete and any setting instructions required for installation.

C. Contractor to employ an engineer or surveyor to check elevations of concrete bearing surfaces, anchor rod locations, and similar devices before erection proceeds. Report discrepancies to the Architect. Do not proceed with erection until corrections have been made or until compensating adjustments to structural steel work have been agreed upon with the Architect.

3.03 ERECTION

A. General:

1. Structural steel shall be erected in accordance with Chapter M of AISC Specifications and the Drawings and Specifications and with the AISC Code of Standard Practice.

2. Erection of architecturally exposed structural steel shall be in accordance with Section 10.5.1 and 10.5.2 of AISC Code of Standard Practice for Steel Buildings and Bridges.

3 Dimensions shown on drawings are based on an assumed design temperature of 70 degree F. Fabrication and erection procedures shall take into account the ambient temperature range at the time of the respective operations.

4. Care shall be taken to protect work already installed from damages resulting from structural steel erection.

5. Steel erection may be allowed prior to supporting concrete reaching specified strengths if the contractor provides technical justification and the Architect concurs.

B. Temporary Shoring and Bracing:

1. Provide temporary bracing and shoring adequate to protect the structure against damage due to construction loads and other loads such as wind and seismic forces.

2. Provide temporary works as necessary to erect the structure.

3. Contractor is responsible for identifying need for temporary construction.

C. Field Assembly:

1. Set structural members to the lines and elevations indicated. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

2. Before assembly clean bearing surfaces and other surfaces which will be in permanent contact after assembly.

3. Do not enlarge unfair holes in members by burning or by the use of drift pins. Ream holes that need to be enlarged to admit bolts. Where a hole is required to be enlarged by more than 3/32-inch ream to and use next larger bolt size.

4. Do not use gas cutting torches in the field for correcting fabricating errors in the structural framing unless accepted by the Architect. Finish gas cut sections equal to a sheared appearance when permitted.

5. The quality of field welds or bolting shall be the same as that performed in the shop.

6. Erection bolts for welded connection shall be tightened securely and left in place.

7. Erection Bolts: On architecturally exposed steel construction, remove erection bolts, fill holes with plug welds, and grind exposed surfaces smooth.

D. Setting Base Plates:

1. Prepare surface of existing concrete as if for a concrete construction joint. Clean the bottom surface of base plates.

2. Grout shall be non-shrink grout mixed and applied in strict accordance with the manufacturer’s directions.

3. Leave no voids between the base plate and the concrete.

4. Tighten anchor rods after the supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with the edge of the base plate prior to installing grout.

E. Expansion Bolts:

1. Install in accordance with the manufacturer's recommendations.

2. Use washers on all bolts.

3. Use care to avoid cutting or damaging reinforcing bars.

4. When exposed to view in the final structure, bolts shall be of a length that will extend entirely through but not more than 1/4-inch beyond the nuts unless otherwise shown on the Drawings.

3.04 BASE PLATE GROUTING

A. Base plate grout shall be mixed and applied in strict accord with manufacturer's directions.

B. Leave no voids between the base plates and the concrete.

3.05 TOUCH-UP PAINTING

A. Immediately after erection, clean field welds, bolted connections, and abraded areas of the shop paint, and paint all surfaces exposed to the elements with the exception of those surfaces in direct contact with concrete.

B. Use same materials and standards as for shop painting.

3.06 FIELD QUALITY CONTROL

A. All field welding shall be inspected by a full time inspector.

B. Field quality control shall, as a minimum, conform to the requirements specified under Source Quality Control.

C. Expansion bolts to be proof tested after installation by loading 25 percent of them to 150 percent of the manufacturers recommended tensile design loads.

PART 4 - METHOD OF MEASUREMENT (None)

PART 5 - BASIS OF PAYMENT

A. Cost of work for this section shall be included in the price bid for Exterior Lighting System. No separate payment.

END OF SECTION

SECTION 051223

STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.01 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Anchor Bolts: Installed under Section 033100.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Code Required Special Inspections and Procedures: Section 014533
B. Cast-In-Place Concrete: Section 033100
C. High Performance Coatings: Section 099600.

1.03 REFERENCES

A. Except as shown or specified otherwise, the Work of this Section shall meet the requirements of the following:
   1. Design, Fabrication, and Erection: "Specification for Structural Steel Buildings, Allowable Stress Design and Plastic Design", June 1, 1989, by the American Institute of Steel Construction (AISC Specification).
   2. Standard Practice: Fabrication and erection practices shall comply with the "Code of Standard Practice for Steel Buildings and Bridges", June 10, 1992, by the American Institute of Steel Construction (AISC Code).
   3. Welding: "Structural Welding Code - Steel, AWS D1.1", by the American Welding Society (AWS Code).
   4. High-Strength Bolting: "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts", November 13, 1985, by the Engineering Foundation's Research Council on Structural Connections (Specification for Structural Joints).
   5. Cleaning Steel: Comply with the appropriate specifications (SSPC SP-X) by the Steel Structures Painting Council.

1.04 DEFINITIONS

A. AISC Manual: Where reference is made to the AISC Manual, it shall mean the Manual of Steel Construction, Ninth Edition, of the American Institute of Steel Construction.

1.05 REQUIREMENTS FOR CONNECTIONS

A. General:
   1. Size connections for the loads indicated on the Drawings. If the loads are not indicated, use a connection whose capacity is half the total uniform load capacity shown in the "Allowable uniform loads in kips for beams laterally supported" tables in the AISC Manual for the given shape, span, and steel specification of the beam in question, unless otherwise indicated.
   2. All bolted connections shall have a minimum of two bolts except where indicated otherwise.

B. Shop Connections: Welded unless otherwise indicated. Field connections required to be welded or fully-tensioned high-strength bolted shall meet the same requirements when fabricated in the shop.

C. Field Connections:
1. All field connections are welded unless detailed otherwise.
2. Field bolted connections shall be ¾" diameter A325 High Strength bolted or welded. Field bolted connections shall be shear/bearing connections, unless otherwise noted in drawings or this specification. Shear/bearing connections shall be installed to the snug tight condition (reference AISC Specification for Structural Joints Using ASTM A325 or A490 Bolts, section 8.c).

D. High-Strength Bolted Connections: Amend the Specification for Structural Joints as follows:
1. In Item 3(b) of the specification, change the second sentence to read "Burrs shall be removed."
2. In Item 3(c) of the specification, delete the last two sentences, and add the following sentence: "Flame cut surfaces shall be ground smooth."
3. In Item 7(b)(1) of the specification, add the following to the last sentence: ", except that oversize holes shall not be used in connections with galvanized faying surfaces."
4. In Item 7(b)(2) of the specification, add the following to the last sentence: ", except that short slotted holes shall not be used in connections with galvanized faying surfaces when the force on the joint is in a direction other than normal to the axis of the slot."
5. In Item 7(b)(3) of the specification, add the following to the last sentence: ", except that long slotted holes shall not be used in connections with galvanized faying surfaces when the force on the joint is in a direction other than normal to the axis of the slot."
6. Change Item 7(c)(3) of the specification to read as follows: "All fully-tensioned high-strength bolts shall have a hardened washer under the element (nut or bolt head) turned in tightening, regardless of the method of tightening."
7. In Item 8(b) of the specification, change the first sentence to read: "A tension measuring device shall be required at all work sites where high-strength bolts are being installed."
8. In Item 8(c) of the specification, delete the second and third sentences and add the following sentence: " The snug-tight condition is defined as the tightness attained by either a few impacts of an impact wrench or the full effort of a worker with an ordinary spud wrench that brings the connected plies into firm contact."
9. Change the last sentence in Item 8(c) to read "Unless otherwise required in the Specifications, bolts required to be fully-tensioned shall be identified on the Drawings. All other bolts need only be tightened to the snug tight condition.".
10. In Item 9(b) of the specification, delete "Arbitration" from the heading. Also change the first paragraph to read: "When high-strength bolts have been installed by any of the tightening methods in Item 8(d), the following inspection procedure shall be used."
11. In Item 9(c) of the specification, delete "arbitration" from the last sentence.
12. In Item 9 of the specification, the inspection of bolt tightening shall be as specified under Item 9(b). Furnish the calibration device and the inspection torque wrench, and make them available, upon request, to

representatives of the State or designated inspection laboratory during the entire period when steel is being fabricated and erected. The inspection torque wrench shall be capable of indicating that the job inspecting torque has been reached by a second method in addition to direct observation of the wrench dial. The inspection wrench calibration and the bolt tightening inspection shall be performed by the Contractor, and shall be witnessed by a representative of the Architect or the designated inspection laboratory.

F. Design, Fabrication and Erection (Amendments to the AISC Specification):
1. In Item A6. of the specification, change "American Welding Society" to "American Welding Society (Latest Adoption Date)". Delete the date from all referenced AWS Codes.
2. In Item J1.8. of the specification, change the last sentence to read: "Weld access holes and beam copes in other shapes shall be ground smooth, but need not be inspected by dye penetrant or magnetic particle methods.".
3. In Item J1.8. of the specification, delete "or with A307 bolts" from the second
paragraph.
4. In Item J2. of the specification, change the introductory sentence to read: "All provisions of the American Welding Society Structural Welding Code-Steel, AWS D1.1, except Sections 2.3.2.4, 2.5, 8.13.1 and 9, apply to work performed under this Specification.".
5. In Item J3.2.c of the specification, change the first sentence to two sentences as follows: "Oversized holes are permitted in any or all plys of slip-critical connections, except those with galvanized faying surfaces. Oversized holes shall not be used in slip-critical connections with galvanized faying surfaces, or in bearing-type connections.".
6. In Item J3.2.d. of the specification, change the second sentence to two sentences as follows: "Short-slotted holes are permitted without regard to direction of loading in slip-critical connections, except those with galvanized faying surfaces. The length of the slot shall be normal to the direction of the load in slip-critical connections with galvanized faying surfaces and in bearing-type connections.".
7. In Item J3.2.e of the specification, change the second sentence to two sentences as follows: "Long-slotted holes are permitted without regard to direction of loading in slip-critical connections, except those with galvanized faying surfaces. The length of the slot shall be normal to the direction of the load in slip-critical connections with galvanized faying surfaces and in bearing-type connections.".
8. In Item M2.2. of the specification, delete the first two paragraphs.
9. In Item M2.5. of the specification, change the second sentence of the fifth paragraph to read: "Burrs shall be removed.".
10. Delete Item M4.5. of the specification in its entirety.
11. In Item M5.4. of the specification, delete "Slip-critical" from the heading and delete "slip-critical" from the first sentence.

G. Fabrication and Erection (Amendments to the AISC Code):
1. In Item 4.1. of the code, delete the last sentence of the first paragraph.
2. In Item 5.1. of the code, change the first paragraph to read: "Contract Drawings are not considered released for construction. Orders for materials may be placed only after approval of erection drawings or written approval of the Architect.".

1.06 SUBMITTALS

A. Shop Drawings: Submit shop drawings for all structural steel. Machine duplicated copies of Contract Drawings will not be accepted as shop drawings. Shop drawings shall be standard 22 by 36 inch size sheets. The fabricator's name, address, and telephone number shall be indicated in the title block on each drawing.
   1. Include anchor bolt and base plate plans, erection drawings, and detail drawings for all members.
   2. Indicate shop and field welds by standard AWS welding symbols in accordance with AWS A2.4.
   3. When shop drawings are marked "Approved as Noted", promptly resubmit copies of corrected shop drawings for formal approval and record.
   4. Contract Drawings are not considered released for construction. Orders for materials may be placed only after approval of erection drawings or written approval of the Architect.

B. Product Data:
   1. Paint including Powder Coating: Manufacturer's name and printed product literature, including storage and application instructions.

C. Quality Control Submittals:
   1. Certificates: Submit evidence, in triplicate, of steel material compliance with this Specification. Evidence shall consist of certification of source of material or mill test reports. For stock material, submit copies of latest mill or purchase orders for material replacement.
   2. Fabricator's and Erector's Qualifications Data: Name and experience of fabricator and erector.
   3. Galvanizing and Powder Coating: Subcontractors qualications and experience. Note that galvanizing and powder coating are to be procured from a subcontractor capable of performing both processes.

1.07 QUALITY ASSURANCE

A. Refer to Section 014533, Code Required Special Inspections and Procedures, for Structural Steel Inspection and Testing to be performed by the Owner’s Inspection and Testing Agency. Quality assurance inspection made by the Owner shall not relieve the fabricator and erector of responsibility for their own quality control programs.

B. Fabricator's and Erector's Qualifications: At least 5 years experience with projects of similar size and scope.

C. Welding Procedures and Welder’s certification. Current certification in compliance with AWS D1.1.

D. Galvanizing and Powder Coating: Subcontractors qualications and experience. Stamp galvanized items with galvanizer's name, weight of coating, and applicable ASTM number. Note that galvanizing and powder coating are to be procured from a subcontractor capable of performing both processes.

1.08 WELDING PROCESS

A. Use only shielded metal arc welding.

B. Shielded metal arc welding procedures that comply with the provisions of the AWS Code shall be considered to be prequalified.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Coordinate delivery of anchor bolts and other anchorage devices to be built into other construction to avoid delay.

B. Upon delivery to the site, promptly cover and protect steel items (which are not required to receive shop paint) from rusting.

C. Store shop paint in accordance with paint manufacturer's printed instructions.

PART 2 PRODUCTS

2.01 MATERIALS

A. Anchor Bolts. ASTM A325 hot dipped galvanized threaded rod.

C. High-Strength Bolts: ASTM A 325 or A 490.

D. Steel Pipe: ASTM A 53, Type E or S, Grade B or ASTM or Round HSS A500 Gr B (42 ksi).

E. Steel Structural Tubing (square and rectangular): ASTM A 500, Grade B; or ASTM A 501.

F. Other structural shapes not otherwise specified: ASTM A 36.

G. Weld Filler Metal: Weld filler metal for shielded metal arc welding complying with AWS Specifications A5.1 or A5.5.

H. Cold Galvanizing Compound: Single component compound giving 93 percent pure zinc in the dried film, and meeting the requirements of DOD-P-21035A (NAVY).

I. Paint (General): All structural steel shall receive powder coating. Non-galvanized steel shall be blast cleaned to an SSPC-6 commercial blast clean and shall receive powder coating. Powder for coating shall be polyester based thermal setting resin. Color shall be as selected by Owner. The powder coat system shall meet or exceed the following test requirements:

1. Direct Impact Resistance: ASTM D2794, up to 160 inch-pounds.
2. Flexibility: ASTM D522, Method B, equal to or less than a ¼" mandrel.
3. Pencil Hardness: ASTM D3363, HB-2H.
4. Crosshatch Adhesion: ASTM D3359, Method B, 5B
5. Salt Spray Resistance: ASTM B117, plus 1000 hours.
6. Humidity Resistance: ASTM D2247, plus 1000 hours.

J. Bedding Mortar:
1. Cement Grout: Portland cement complying with ASTM C 150, Type I or III, and clean uniformly graded natural sand complying with ASTM C 404,

size No. 2; mixed at a ratio (by volume) of 1.0 part cement to 3.0 parts sand, with only the minimum amount of water required for placement and hydration.

2. Shrink-Resistant Grout (Non-Staining): Factory-packaged, non-ferrous mortar grouting compound selected from the following:
   a. Masterflow 713 by Master Builders, 23700 Chagrin Blvd., Cleveland, OH 44122 (800) 227-3350.
   b. Sonogrout by Sonneborn, Chemrex, Inc., 57-46 Flushing Ave., Maspeth, NY 11378, (800) 433-9517.
   c. Five Star Grout by Five Star Products, Inc., 425 Stillson Rd., Fairfield, CT 06430, (800) 243-2206.
   d. Crystex by L&M Construction Chemicals, 14851 Calhoun Rd., Omaha, NB 68152, (800) 362-3331.
   e. Non-Corrosive, Non-Shrink Grout by A.C. Horn, Inc., Tamm Industries, 7405 Production Dr., Mentor, OH 44060, (800) 862-2667.

2.02 FABRICATION

A. Do not commence fabrication until the fabricator has been approved and the fabrication schedule has been coordinated with the designated Quality Assurance inspection agency (reference Specification Section 014533).

B. Progress shop fabrication from "Approved" or "Approved as Noted" detail drawings only.
   1. When detail drawings are "Approved as Noted", progress fabrication in strict accordance with notes thereon.
   2. Fabrication progressed from "DISAPPROVED" or "RETURNED FOR CORRECTION" detail drawings will be rejected. The contractor shall have no claim for any costs or delays due to rejection of items fabricated from "DISAPPROVED" or "RETURNED FOR CORRECTION" detail drawings.

C. Finish column ends at base plates and at load carrying cap plates to a true plane square to the column, with a maximum American National Standards Institute surface roughness value of 500 microinches.

D. Pipe and Tube Columns: Shop weld a closure plate to top of columns to form a watertight closure.

E. Make provisions for connections of other Work, including all cutting and punching of structural members where required by the Drawings, or for which information is furnished prior to approval of the shop drawings.

F. Prepare material in accordance with Section 3 of the AWS Code. Do not use gas or air carbon-arc cutting to cut or enlarge bolt holes.

G. Galvanizing: Unless otherwise specified or noted, items indicated to be galvanized shall receive a zinc coating by the hot-dip process, after fabrication, complying with the following:
   1. ASTM A 123 for plain and fabricated material.
   2. ASTM A 153 for iron and steel hardware.

H. Cleaning Steel: Thoroughly clean all structural steel. Remove oil, grease, and similar contaminants in accordance with SSPC SP-1 "Solvent Cleaning".

Remove loose mill scale, loose rust, weld slag and spatter, and other detrimental material in accordance with SSPC SP-2 "Hand Tool Cleaning", SSPC SP-3 "Power Tool Cleaning", or SSPC SP-7 "Brush-Off Blast Cleaning". Clean all bolts used in shop connections with SSPC SP-2.

I. Shop Painting:
1. Galvanized Items:
a. Galvanized items which are to be finish painted under Section 099600 shall be rinsed in hot alkali or in an acid solution and then in clear water.
b. Welded and abraded galvanized surfaces shall be wire brushed and repaired with a coating of cold galvanizing compound.

2. All steel, including galvanized steel, is to be powder coated after fabrication:
a. Do not shop paint steel surfaces to be field welded. Protect steel from coating at weld ends. Welded connections are to be cleaned and painted with a matching paint provided to be furnished by the powder coating subcontractor.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine conditions under which structural steel is to be installed and notify Engineer in writing of any conditions detrimental to proper and timely installation. Do not proceed with installation until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

3.02 ERECTION

A. Erect steel in accordance with the AISC Specification, the AISC Code, the AWS Code and the Specification for Structural Joints, except as otherwise specified.

B. Prepare and place shrink-resistant grout in accordance with grout manufacturer's printed instructions.
1. Comply with manufacturer's instructions for preparation of surfaces in contact with grout, and for curing and protection of grout.

C. Do not use gas or air carbon-arc cutting to cut or enlarge bolt holes.

D. Do not make corrections or alterations to fabricated steel without prior written approval by the Engineer.

E. Do not commence field erection until the erector has been approved and the erection schedule has been coordinated with the designated Quality Assurance inspection agency (reference Specification Section 014533).

END OF SECTION

SECTION 051400

STRUCTURAL ALUMINUM FRAMING

PART 1 - GENERAL

1.01 Section Includes Structural Framing for the Gateway Structures:

A. Aluminum truss framing members, bracing members and connection components.
B. Aluminum plates.

1.02 Related Sections:

A. Code Required Special Inspections and Procedures: Section 014533

1.03 REFERENCES

A. Federal Specifications: TT-P-645 – Paint, Aluminum, Heat Resisting

B. Aluminum Association:

1. Aluminum Design Manual

C. ASTM International:

1. ASTM B308 / B308M Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles

2. ASTM B221 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

3. ASTM B429 Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube

D. American Welding Society:

1. AWS D1.2 - Structural Welding Code, Aluminum.

1.04 SUBMITTALS

A. Submit under provisions of Division 01 Section "General Requirements."

B. Shop Drawings: For aluminum fabrications as follows:

1. Complete fabrication and erection plans and procedures giving full information on all aspects of the erection that will affect alignment, plumb and dimensional accuracy of the structure.

2. Connections, including size and spacing of bolts and welds.

3. Indicate profiles, sizes, spacing, and locations of structural members, openings, camber and attachments.

4. Indicate welded connections with AWS welding symbols. Indicate net weld lengths. Include details of welding materials, equipment, sequence and technique to be used.

C. Manufacturer's Certificate: Submit certification that manufactured products (including bolts, nuts and washers) meet or exceed specified requirements.

D. Deliver manufactured products to the site in unopened containers. Certification numbers must appear on product containers for bolts, nuts and washers and the numbers shall correspond to the identification numbers on the Manufacturer's Certificate. The Manufacturer's symbol and grade markings must appear on bolts, nuts and washers.

E. Mill Test Reports: Submit mill test reports indicating structural strength, destructive and nondestructive test analysis and chemical analyses from the aluminum used in the Work.

F. Welders' Certificates: Documentation certifying welders employed by the Subcontractor meet AWS qualifications.

G. Submit the following as specified elsewhere in this Section:

1. Written welding procedures in accordance with AWS D1.2 for each proposed joint.

2. Procedure qualification records in accordance with AWS D.1.2 for procedures qualified by testing.

1.05 QUALITY ASSURANCE

A. Fabricate aluminum members in accordance with CBC and Aluminum Design Manual “Specification for Aluminum Structures - Building Load and Resistance Factor Design”.

B. Welders shall be qualified in accordance with AWS D1.2 for each process, position and joint configuration.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Rolled and Extruded Members: Alloy and temper 6016-T6 unless otherwise indicated on the Drawings.

B. Aluminum Tubing: Alloy and temper 6061-T6.

2.01 Bolts, Nuts, and Washers:

A. Bolts and Nuts in Structural Connections: ASTM F593D 304 Stainless Steel

B. Threaded Rod Studs – 6061 T6 Aluminum

C. Bolts and Nuts in Plate Hanger Connections: 6061 T6 Aluminum

2.02 Welding Materials:

A. Filler Metals: AWS D1.2.

B. Electrodes and Equipment Settings: As recommended by the filler metal manufacturer for the position, thickness and conditions of use.

C. Furnish written verification that filler metal is appropriate to the materials and welding process

2.03 CONNECTIONS

All truss connections are shop welded. Truss connections to the columns are field bolted and truss to truss connections are field bolted. Weld in accordance with approved welding procedures.

2.04 FABRICATION

A. Fabricate aluminum members in accordance with the approved Shop Drawings. Fabricate and assemble in the shop except for connections indicted as field connections.

B. Obtain field measurements necessary for fabrication.

C. Where structural joints are welded, the detail of the joints, welding technique, weld quality and appearance, and methods for correcting defective welds shall conform to the AWS D1.2.

1. Welding Process: Inert shielded gas or resistance welding process.

D. Structural members are selected from generally available rolled sections; however, if the specified sections are not available, provide sections with equivalent physical properties at no additional cost after approval by the Engineer.

2.05 FINISHES

A. Fabricated Aluminum assemblies are to be powder coated after fabrication. Powder for coating shall be polyester based thermal setting resin. Color shall be as selected by Owner. The powder coat system shall meet or exceed the following test requirements:

1. Direct Impact Resistance: ASTM D2794, up to 160 inch-pounds.
2. Flexibility: ASTM D522, Method B, equal to or less than a ¼" mandrel.
3. Pencil Hardness: ASTM D3363, HB-2H.
4. Crosshatch Adhesion: ASTM D3359, Method B, 5B
5. Salt Spray Resistance: ASTM B117, plus 1000 hours.
6. Humidity Resistance: ASTM D2247, plus 1000 hours.

PART 3 - EXECUTION

3.01 PREPARATION

A. Provide temporary supports and internal braces necessary to support structure during erection. Temporary supports and braces shall be adequate for anticipated wind, seismic, equipment and erection loads. Remove temporary shoring after the erection is complete.

B. Before erection, paint contact surfaces between dissimilar materials.

3.02 EXAMINATION

A. Verify that field conditions are acceptable and are ready for erection.

B. Beginning of installation means Subcontractor accepts that existing conditions meet the requirements for installation.

3.03 ERECTION

A. Where members can not be properly assembled due to misfabrication or deformation due to handling or transportation, report the condition to the Engineer with a proposed method of correction for approval. Erect structure to the lines and grades indicated on the Drawings and in accordance with the Shop Drawings.

B. Do not field cut or alter structural members without approval of the Engineer.

3.04 INSPECTION AND TESTING

A. Inspection and testing will be performed under provisions of Section 014533; Code Required Special Inspections and Procedures. The Subcontractor shall be responsible for in-house visual inspection and implementing a quality control program.

B. Notify the Engineer of the fabrication and erection schedules and permit the Engineer's representative to observe shop assembly, make visual inspections, nondestructive tests of welds, observe erection and perform field testing. Correct defective work, rejected by the Engineer at no additional cost to the Owner.

C. A certified welding inspector employed by the Owner's Independent Testing Laboratory will verify that welds are made in accordance with approved welding procedures and visually inspect shop and welding operations as directed by the Engineer.

END OF SECTION 051400

SECTION 051500

WIRE ROPE AND ROD ASSEMBLIES – CATENARY LIGHTING

PART 1 GENERAL

1.00 GENERAL PROVISIONS

A. Attention is directed to the PROCUREMENT AND CONTRACTING REQUIREMENTS and all Sections within DIVISION 01, GENERAL REQUIREMENTS, which are made a part of this Section of the Specifications.

1.01 WORK INCLUDED

A. Provide all materials and equipment, and do all work necessary to furnish and install the stainless steel cable members for the following applications:
1. Catenary lighting system.

1.02 RELATED REQUIREMENTS

A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:

1. Section 051200 - Structural Steel – Catenary Poles
2. Section 265613 – Exterior Lighting Fixtures

1.03 REFERENCED STANDARDS

A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.

1. American Society for Testing and Materials:
    1. ASTM A276 - Standard Specification for Stainless Steel Bars and Shapes
    2. ASTM A368 - Standard Specification for Stainless Steel Wire Strand
    3. ASTM A380 - Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment and Systems
    4. ASTM A492 - Standard Specification for Stainless Steel Rope Wire
    5. ASTM A555 - Standard Specification for General Requirements for Stainless Steel Wire and Wire Rods
    6. ASTM A581 - Standard Specification for Free-Machining Stainless Steel Wire and Wire Rods
    7. ASTM A582 - Standard Specification for Free-Machining Stainless Steel Bars

2. BSMA29 – Standard Specification for Stainless Steel Wire Strand.

3. DIN 3053 – For Galvanized Strand

4. DIN 17 440 – Technical Delivery Conditions for Drawn Wire

5. DIN 18 800 – Rating and Tension

6. DIN EN 10264-3 – Galfan Coating

1.04 DEFINITIONS

A. Maximum Working Load (MWL) is the maximum static and/or dynamic load at which the product will still function without excessive friction, distortion, wear or permanent deformation of components. Above this load, bearing systems may fail, moving parts may seize and stainless steel or plastic components may begin to bend, stretch or otherwise deform. Maximum working loads shall not exceed half of the breaking load, and shall not be exceeded by maximum design loading.

B. Breaking Load (BL) is the published approximate load at which a major failure can be expected to occur to some part of the structure when new. Plastic components may split, rivets may give way, shackles may break, and other metallic components may fracture. Products shall not be used at more than half of the breaking load, to provide a minimum safety factor of two. The consulting engineer shall confirm that an appropriate safety factor is employed for the purpose of the intended application and consistent with all regulations and standards.

C. The Maximum Working Loads, Breaking Loads, Minimum Yield Loads and Ultimate Loads detailed in this specification should only be considered in the context of the project application. The consulting engineer shall confirm that an appropriate safety factor is employed for the purpose of the intended application and consistent with all regulations and standards.

1.05 SYSTEM DESCRIPTION

A. General
1. Contractor shall furnish proof of insurance certifying Fabricator-Installer is specifically insured in the fabrication and installation of tension member materials.
2. Contractor shall perform installation by component supplier, or under supplier's direct supervision.

B. Design Requirements
1. Components shall be free from defects impairing strength, durability and appearance. Exposed surface throughout system shall have same inherent texture and color for similar locations.
2. Exposed fasteners shall be of same materials, colors and finish as materials to which applied.
3. Design and fabricate assemblies and systems to resist loads required by applicable building codes.
4. Design supports and hardware to withstand loads encountered without excessive deflection or distortion when cables are tensioned to the required loading to conform to building codes.
5. Structural calculations shall be prepared by a registered structural engineer. The engineer shall be licensed in the state in which the project is located.

1.06 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, including:
1. Indicate material and grade, fabrication and finishes, if applicable.
2. Installation instructions and recommendations.
3. Storage and handling requirements and recommendations.

B. Shop Drawings: Submit shop drawings prepared by a structural engineer licensed in the jurisdiction of the project. Include structural calculations, details of construction and relationship with adjacent materials. Indicate materials and finishes.

C. Contractor to verify all cable and rod part or system numbers with manufacturer and submit shop drawings to architect for approval prior to fabrication.

D. Verification Samples: Submit sample indicating profiles and finishes specified if practical.

1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications: Minimum of 10 years' experience in manufacturing similar load-rated products.

B. Professional Structural Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind required. Engineering services are defined as those performed for installations that are similar to those required for this Project in material, design, and extent.

C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
   1. Finish areas designated by Architect.
   2. Do not proceed with remaining work until workmanship and performance are approved by Architect.
   3. Reconstruct mock-up area as required to produce acceptable work.

D. Pre-installation conference: Prior to beginning work of this Section, hold a conference to review work to be accomplished.
   A. Contractor, Architect, fabricator, installer and other subcontractors whose work involves system shall attend conference.
   B. Contractor shall notify all parties at least seven days prior to time for conference.
   C. Contractor shall record minutes of meeting and distribute to attending parties.
   D. Meeting shall include review of the following:
      a. Method of attachment of components to supporting surfaces.
      b. Installation, adjusting, cleaning, and protection of system components.
      c. Coordination with other work.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Transport, deliver, inventory and store components to prevent damage.

B. Store materials in accordance with manufacturer's instructions.

C. Protect components during handling and installation to prevent damage.

1.09 PROJECT CONDITIONS

A. Field measurements: Take field measurements after permanent end termination connection points are in place and prior to fabrication to confirm final pin to pin system lengths.

B. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.10 WARRANTY

A. Manufacturer shall warrant the goods manufactured or sold by it to be free of defects in materials or workmanship for three years from the date of purchase by the original purchaser except that: This warranty shall not apply to any product which has been improperly fitted, improperly maintained, or used in any application for which it was not intended.

B. This warranty shall not apply to normal wear which can reasonably be expected in normal use of the product.

C. Manufacturer makes no warranties that its products are fit for a particular purpose.

D. Manufacturer's liability shall be limited to the repair or replacement, at its discretion, of the defective goods.

E. This warranty shall not apply to products installed in severe chlorine or high humidity environments such as covered swimming pools, due to potential stress corrosion and reliance on appropriate cleaning methods.

F. Manufacturer accepts no liability for components or assemblies used in aeronautical applications.

G. The useful life of any product shall be assessed in each application, and thus no guarantee will be provided for product life, load capacity or any other factor due to the variability in usage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Wire rope and all cable assembly components shall be manufactured by Ronstan International, Inc; 45 High Point Avenue, Suite 2, Portsmouth, RI 02871. ASD. Tel: (401) 293-0539. Fax: (401) 293-0538. Email: arch@ronstan.us. Web: http://www.ronstan.com/arch, or approved equal.

2.02 HORIZONTAL CABLE ASSEMBLIES – ADJUSTABLE LENGTH – STRUCTURAL, STAINLESS STEEL

A. Compact Adjuster Structural Cable System:
1. Assembly: ACS1-SS-12 stainless steel swaged compact adjuster x swaged compact adjuster cable system. Tension provided by rotating compact adjuster located at the end of the cable assembly mounted to the connection plate on the Catenary Light Poles.
2. Cable Diameter:12 = 3/8 inch wire, minimum cable break load 14,430 pounds.
3. Number of wires/strands: 1 X 19.

4. Fork and Pins: Strain hardened Grade 316 stainless steel. Nylon Coated Pins and Washers
5. Threads: Fully concealed threads, adjustable.
6. Length: per drawings.

B. Fittings:
1. Cable: Swaged stainless steel.
2. Tensioner: Stainless steel compact adjuster.

C. Finish: Clean and de-scale and fittings.

2.03 VERTICAL ASSEMBLIES - ADJUSTABLE LENGTH – STRUCTURAL – Greater than 42” in length.

A. Adjustable Length Cable System
1. Assembly ACS2-SS-12 Type 1: Stainless steel toggle/swage turnbuckle and swage toggle. Turnbuckles shall provide adjustment from one point and shall be (Type 1) style and offer articulating coupler for easy installation and to reduce stress and prolong the life of wire used. Swage toggles shall have same toggle ends as turnbuckles.
2. Cable Diameter:12 = 3/8 inch wire, minimum cable break load 14,430 pounds.
3. Number of wires/strands: 1 X 19.
4. Fork and Pins: Strain hardened Grade 316 stainless steel.
5. Threads: Fully concealed threads, adjustable
6. 2-Piece Collar SS Construction – two required per assembly
7. Length: per drawings.

B. Fittings: Cable, swaged stainless steel. Crimping is not acceptable.

C. Finish: Clean and de-scale rods and fittings.

2.04 VERTICAL ASSEMBLIES - ADJUSTABLE LENGTH – STRUCTURAL – Greater than 21” and less than 42” in length.

A. Adjustable Length Rod System
1. Assembly ARS3-SS-10: Stainless steel toggle/swage turnbuckle x LH Fork Clevis. Turnbuckles shall provide adjustment from one point and shall be (Type 1) style and offer articulating coupler for easy installation and to reduce stress and prolong the life of wire used. Fork Clevis is non-articulating.
2. Rod Diameter: 10 = 5/8 inch, minimum rod break load 19,110 pounds.
3. 316 SS Rod
4. Fork and Pins: Strain hardened Grade 316 stainless steel.
5. Threads: Fully concealed threads, adjustable
6. 2-Piece Collar SS Construction – two required per assembly
7. Length: per structural drawings.

B. Fittings: 5/8 UNF Thread stainless steel.

C. Finish: Clean and de-scale rods and fittings.

2.05 VERTICAL ASSEMBLIES - ADJUSTABLE LENGTH – STRUCTURAL – Less than 21” in length.

A. Adjustable Length Rod System
   1. Assembly RF1588 Type 1: Stainless steel toggle/ toggle turnbuckle x toggle. Turnbuckles shall provide adjustment from one point and shall be (Type 1) style and offer articulating coupler for easy installation and to reduce stress and prolong the life of wire used. Swage toggles shall have same toggle ends as turnbuckles.
   2. Minimum break load 19,184 pounds.
   3. Toggles and Pins: Strain hardened Grade 316 stainless steel.
   4. Threads: Fully concealed threads, adjustable
   5. 2-Piece Collar SS Construction – two required per assembly
   6. Length: per structural drawings.

B. Finish: Clean and de-scale rods and fittings.

2.06 FABRICATION

A. Fabricate systems in accordance with approved shop drawings.

B. Shop assembly: Preassemble and hydraulic swage items in shop to greatest extent practicable to minimize assembly at project site. Disassemble units only to extent necessary for shipping and handling limitations. Mark units for reassembly.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Inserts and Anchorages: Furnish inserts and anchoring devices which must be set in concrete for installation of work.

D. Coordinate setting drawings, diagrams, templates, instructions and directions for installation of anchorages, such as concrete inserts, anchor bolts and miscellaneous items having integral anchors, which are to be embedded in concrete construction or welded to metalwork during fabrication.

E. Layout: Set out wire runs in equal and symmetrical configuration in accordance with code requirements.

3.02 INSTALLATION

A. Install and tension in accordance with manufacturer's instructions. Install in accordance with approved submittals.

B. Fastening to in-place construction: Provide anchorage devices and fittings to secure to in-place construction; including threaded fittings for concrete inserts, toggle bolts and through-bolts. Separate dissimilar materials with bushings, grommets or washers to prevent electrolytic corrosion.

C. Cutting, fitting and placement: Perform cutting, drilling and fitting to install work. Set work in location, alignment and elevation, plumb and level, true and free of rack, measured from established lines and levels.

3.04 PROTECTION

A. Protect system from damage until Date of Substantial Completion.

B. Touch-up, repair or replace damaged products before Substantial Completion.

C. Replace damaged components including cables with kinks and sags.

PART 4 METHOD OF MEASUREMENT (None)

PART 5 BASIS OF PAYMENT

A. Cost of work for this section shall be included in the price bid for Exterior Lighting System. No separate payment.

END OF SECTION

SECTION 055213

METAL HANDRAILS AND RAILINGS

PART 1 GENERAL

1.00 GENERAL PROVISIONS

A. Attention is directed to the PROCUREMENT AND CONTRACTING REQUIREMENTS and all Sections within DIVISION 01, GENERAL REQUIREMENTS, which are made a part of this Section of the Specifications.

1.01 WORK INCLUDED

A. The work of this Section consists of providing all exterior metal handrails and railings, and related items, as indicated on the Drawings and as specified herein.

1.02 RELATED WORK

A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:

1. Section 033001, CAST-IN-PLACE CONCRETE - SITEWORK; Installation of inserts and sleeves.

1.03 REFERENCES

A. Comply with applicable requirements of following standards. Where these standards conflict with other specified requirements, the most restrictive requirement shall govern.

1. American Society for Testing and Materials (ASTM):

A 36	Structural Steel
A 53	Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
A 123	Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed and Forged Steel Shapes, Plates, Bars, and Strip
A 153	Zinc Coating (Hot-Dip) on Iron and Steel Hardware
A 385	High-Quality Zinc Coatings (Hot-Dip)
A 386	Zinc Coating (Hot-Dip) on Assembled Steel Products
A 501	Hot-Formed Welded and Seamless Carbon Steel Structural Tubing

2. American Welding Society (AWS):

D1.1 Structural Welding Code - Steel

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's printed product data, specifications, standard details, installation instructions, use limitations and recommendations for each material used. Provide certifications that materials and systems comply with specified requirements.

B. Shop Drawings: Provide large scale shop drawings for fabrication, installation and erection of all parts of the work. Provide plans, elevations, and details of anchorages, connections and accessory items. Provide installation templates for work installed by others. Show all interfaces and relationships to work of other trades.

C. Field Measurements: Take all necessary field measurements before preparation of shop drawings and fabrication. Do not delay progress of the job. If field measurements are not possible prior to fabrication, allow for field cutting and fitting.

D. Initial Selection Samples: Submit samples showing complete range of colors, textures, and finishes available for each material used.

E. Verification Samples: Submit representative samples of each material that is to be exposed in the completed work. Show full color ranges and finish variations expected. Provide samples having minimum size of 144 sq. in.

F. Calculations: Provide professionally prepared calculations and certification of the performance of this work. Indicate how design requirements for loading and other performance criteria have been satisfied.

1.05 MOCKUP

A. Handrails:

1. Construct a 6 ft. long mockup section with specified finish and color on indicated concrete support structure before start of any handrail work.
2. Sample section shall be inspected by the Architect. If the sample is not acceptable, construct additional sections at no additional cost to the Owner, until an acceptable section is constructed. Accepted section shall become the standard for the entire job and shall remain undisturbed until Substantial Completion.

B. Planter Rail:

1. Construct a mockup section before start of any planter rail work. Sample section shall exhibit specified finish and color, and an exposed proposed connection of post to base plate at concrete footing. Rail shall be minimum 36 in. long and include at least one post.
2. Sample section shall be inspected by the Architect. If the sample is not acceptable, construct additional sections, at no additional cost to the Owner, until an acceptable section is constructed. Accepted section shall become the standard for the entire job and shall remain undisturbed until Substantial Completion.

1.06 GENERAL REQUIREMENTS

A. The Contractor shall verify all measurements and shall take all field measurements necessary before fabrication. Welding to or on structural steel shall be in accordance with AWS D1.1/D1.1M. Items specified to be galvanized, when practicable and not indicated otherwise, shall be hot-dip galvanized after fabrication. Galvanizing shall be in accordance with ASTM A 123/A 123M, ASTM A 653/A 653M, or ASTM A 924/A 924M, as applicable. Exposed fastenings shall be compatible materials, shall generally match in color and finish, and shall harmonize with the material to which fastenings are applied. Materials and parts necessary to complete each item, even though such work is not definitely shown or specified, shall be included. Poor matching of holes for fasteners shall be cause for rejection. Fastenings shall be concealed where practicable. Thickness of metal and details of assembly and supports shall provide strength and stiffness. Joints exposed to the weather shall be formed to exclude water.

1.07 WORKMANSHIP

A. Handrail and railing work shall be well formed to shape and size, with sharp lines and angles and true curves. Drilling and punching shall produce clean true lines and surfaces. Welding shall be continuous along the entire area of contact except where tack welding is permitted. Exposed connections of work in place shall not be tack welded. Exposed welds shall be ground smooth. Exposed surfaces of work in place shall have a smooth finish, and unless otherwise approved, exposed riveting shall be flush. Where tight fits are required, joints shall be milled. Corner joints shall be coped or mitered, well formed, and in true alignment. Work shall be accurately set to established lines and elevations and securely fastened in place. Installation shall be in accordance with manufacturer's installation instructions and approved drawings, cuts, and details.

1.08 ANCHORAGE

A. Anchorage shall be provided where necessary for fastening handrails and railings securely in place. Anchorage not otherwise specified or indicated shall include slotted inserts made to engage with the anchors, expansion shields, and power-driven fasteners when approved for concrete; toggle bolts and through bolts for masonry; machine and carriage bolts for steel; and lag bolts and screws for wood.

1.09 DISSIMILAR MATERIALS

A. Where dissimilar metals are in contact, or in contact with concrete, mortar, masonry, wet or pressure-treated wood, or absorptive materials subject to wetting, the surfaces shall be protected with a coat of bituminous paint or asphalt varnish.

1.10 QUALITY ASSURANCE:

A. Source: For each material type required for the work of this section, provide primary materials which are the product of one manufacturer. Provide secondary or accessory materials which are acceptable to the manufacturers of the primary materials.

B. Engineering: Provide services of Professional Engineer, registered in the State of New York, to design and certify that work of this Section meets or exceeds performance requirements specified.

1.11 PERFORMANCE REQUIREMENTS

A. Structural Performances: Provide installed handrail and railing and guardrail assemblies complying with following structural performances, unless otherwise indicated:

1. Handrails and Railings:
   a. Uniform load of 50 lbf/ ft. (0.73 kN/m) applied in any direction.
   b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
   c. Uniform and concentrated loads need not be assumed to act concurrently.

PART 2 PRODUCTS

2.01 STEEL HANDRAILS AND RAILINGS

A. Materials shall be new stock, free from defects impairing strength, durability or appearance, and of best commercial quality for each intended purpose.

1. Steel pipe shall be seamless steel pipe conforming to ASTM A 53, Schedule 40. Galvanized steel pipe shall be used at exterior uses.
2. Steel tubing shall be structural steel square tubing conforming to ASTM A 501.
3. All other steel shall conform to ASTM A 36.
4. Construction specialties such as slotted inserts, wedge inserts, etc., shall be as manufactured by Hohmann and Barnard; Gateway Erectors Inc.; Richmond Screw Anchor Co.; or equal approved by the Architect.

2.02 FASTENERS AND ANCHORS

A. Provide all anchors, bolts, sockets, sleeves, and other parts required for securing each item of work of this Section to the construction. Furnish required inserts and sleeves for installation in concrete under Section 033001, CAST-IN-PLACE CONCRETE - SITEWORK.

B. Exposed fastenings shall be of the same material and finish as the metal to which applied, unless otherwise noted.

C. Welding rods shall conform to AWS Standards and the recommendation of the welding rod manufacturer. Welding of steel shall conform to AWS D1.1. At stainless steel work, welding rods shall be such as to produce absolute color and finish match between welds and the surrounding stainless steel.

2.03 GROUT

A. Epoxy Grout: Provide non-shrink, non-metallic, non-corrosive epoxy grout conforming to the
following requirements:

1. Grout shall be manufactured specifically for use in supporting heavy loads.
2. Shrinkage at 28 days: None (0.00 shrinkage when tested in accordance with ASTMC827modified procedure) with a minimum effective bearing area (EBA) of 95 percent coverage of the tested base plate.
3. Compressive strength, minimum: 10,000 psi at seven days, when tested in accordance with ASTM C579.
4. Initial setting time: Approximately one hour at 70 degrees F.
5. Provide flowable consistency as necessary for the particular application.
6. Epoxy grouts which are volatile and which give off noxious fumes are not acceptable.

2.04 ELECTROLYTIC SEPARATION

A. Coating for electrolytic separation between steel and concrete and grout shall be a high-build coal tar epoxy providing one coat protection for steel and concrete in a variety of chemical, immersion and underground conditions, manufactured by Tnemec Company, Inc., 6800 Corporate drive, Kansas City, MO 64120-1372; Tel. 816-483-3400; Kop-Coat Inc, 436 Seventh Avenue, Pittsburgh, PA 15219-1818; 1/412/227-2700, parent company RPM, International 2628 Pearl Road - P.O. Box 777 - Medina, Ohio 44258; Phone: 330.273.5090 - Fax: 330.225.8743; Carboline Company, 2150 Schuetz Road, St. Louis, MO 63146; Phone: 800-848-4645 or 314-644-1000; FAX: 314-644-4617, or approved equal.

2.05 FINISH

A. Finish: Unless other wise indicated, all parts shall be hot-dip galvanized after fabrication with minimum layer of 80 microns (1.8 oz./sq. ft. zinc). Surface shall then be mechanically cleaned and roughened with stainless steel sandblast for optimal coating adhesion and polyester powdercoated per German Industry Norm 50976 in non-lead, UV-stable, thermally-set polyester powder paints. This process shall afford maximum durability with minimal compromising of surface smoothness. Matching liquid paint shall be provided for field touch-up. Bolts and nuts shall be hot-dip galvanized or stainless steel only, for field painting.

B. Galvanizing: Hot-dip galvanize products made from rolled, pressed, and forged steel shapes, castings, plates, bars, and strips indicated to be galvanized to comply with ASTM A 123/A 123M.

1. Hot-dip galvanize steel and iron hardware indicated to be galvanized to comply with ASTM A 153/A 153M.
2. Fill vent and drain holes that will be exposed in finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

C. Powder-Coat Finish: Prepare, treat, and coat galvanized metal to comply with resin manufacturer's written instructions and as follows:

1. Prepare galvanized metal by thoroughly removing grease, dirt, oil, flux, and other foreign matter.
2. Treat prepared metal with zinc-phosphate pretreatment, rinse, and seal surfaces.
3. Apply thermosetting polyester or acrylic urethane powder coating with cured-film thickness not less than 1.5 mils (0.04 mm).
4. Color: RAL 8019.

PART 3 EXECUTION

3.1 FABRICATION AND WORKMANSHIP

A. Metal surfaces shall be clean and free from mill scale, flake, rust and rust pitting; well formed and finished to shape and size, true to details with straight, sharp lines and angles and smooth surfaces. Curved work shall be to true radii. Exposed sheared edges shall be eased.

B. Weld all permanent connections. Weld shall be continuous on all exposed surfaces and where required for strength on concealed surfaces. Exposed welds shall be ground flush and smooth, with voids filled with metallic filling compound (metallic filling compound not permitted on surfaces to receive hot-dip galvanizing). Tack-welding will not be permitted unless specifically called for. Do not use screws or bolts where they can be avoided. Where used, fastener heads shall be countersunk, screwed up tight, and threads nicked to prevent loosening.

C. Fastenings shall be concealed where practicable. Thickness of metal and details of assembly and supports shall give ample strength and stiffness. Joints exposed to weather shall be formed to exclude water.

D. Do all cutting, punching, drilling, and tapping required for attachment of hardware and of work by other trades where so indicated or where directions for same are given prior to, or with approval of, shop drawings.

E. Live loads shall be not less than the minimum required by law. In addition, the top railing shall be capable of resisting a force of 200 lbs. applied at any point in any direction. Design and construction shall be such as to assure that under these design live loads there shall be no failure of any member or connection, deflection of not more than L/360 of length of any member, and without permanent deformation of any member or fastener. Factor of safety shall not be less than 2-1/2 to 1.

3.02 SHOP COATINGS

A. Galvanizing:

1. Ferrous metal under this Section for exterior use shall be hot-dip galvanized, including all bolts, nuts, washers, and other related ferrous metal items used therewith.
2. Hot-dip galvanizing process shall comply with ASTM A 123, A 153, A 385, and A 386, as applicable. After galvanizing, processed items shall be straightened to remove all warpage and distortion caused by the process.
3. Furnish to the Contractor, with copy to Architect, a certified statement that galvanizing complies fully with this Specification.

B. Shop Finish:

1. Apply polyester powdercoat per German Industry Norm 50976 in non-lead, UV-stable, thermally-set polyester powder paints in strict accordance with manufacturer's printed instructions to uniform thickness(es) recommended by manufacturer.
2. Do not powdercoat surfaces to be embedded in concrete, or to be welded in the field. After field welds are complete, grind smooth and flush, thoroughly clean and then apply specified finish in accordance with powdercoat manufacturer’s printed instructions.
3. After erection, sand smooth and retouch all portions of the shop coats chipped or damaged during erection, and coat all field welds and connections with specified finish in accordance with powdercoat manufacturer’s printed instructions.

3.03 INSTALLATION - GENERAL

A. Materials shall be carefully handled and stored under cover in manner to prevent deformation and damage to the materials and to shop finishes, and to prevent rusting and the accumulation of foreign matter on the metal work. All such work shall be repaired and cleaned prior to erection.

B. Work shall be erected square, plumb, and true, accurately fitted, and with tight joints and intersections. All anchors, inserts and other members to be set into concrete or masonry shall be furnished loose by this trade to be built-into concrete and masonry by those trades as the work progresses. Later cutting or drilling shall be avoided wherever possible.

C. Metal work shall be rigidly braced and secured to surrounding construction, and shall be tight and free of rattle, vibration, or noticeable deflection after installation.

D. Where members, other than expansion bolts or inserts, are fastened into concrete, set such members in proprietary-type expanding grout manufactured specifically for such purpose, used strictly in accordance with manufacturer's directions. Holes to receive members shall be formed with galvanized sheet metal sleeves, expanded polystyrene foam, or other approved method to provide at least 1/2 in. clearance around entire perimeter. At exposed applications, hold expanding grout back 1/2 in. from finish surface and fill voids with Portland cement grout to match color and texture of surrounding concrete surface.

E. Electrolytic Isolation: Where dissimilar metals are to come into contact with one another, isolate by application of a heavy coating of bituminous paint on contact surfaces in addition to shop coat specified above. Do not permit the bituminous paint in any way to remain on surfaces to be exposed or to receive sealant.

3.04 STEEL HANDRAILS AND RAILINGS

A. Fabricate and install exterior steel handrails and railings at stairs, planter curb and other locations as called for on the Drawings.

B. Handrails and railings, at all but mechanical and service areas, throughout, shall be of Architectural Quality. Exceptional care shall be taken in welding and grinding, filling and surface sanding to provide truly smooth, clean, neat and flush construction throughout, free of all surface defects and defacements.

C. Steel handrails shall be fabricated in accordance with designs and configurations as called for on the Drawings. Sizes and shapes of all members shall be as indicated. Joints shall be full-welded and ground flush and smooth.

D. Include as part of this work all posts, balusters, pipe handrails, intermediate rails, proprietary wall brackets, proprietary weld-on fittings (escutcheons, flanges, and returns, 90 degree corners, bends, crossovers, tees, etc.) anchors, and other items required for complete installations.

E. Installation of Steel Handrails: Unless otherwise indicated on the Drawings, installation shall be in pipe sleeves embedded in concrete and filled with epoxy grout with anchorage covered with standard pipe collar pinned to post.

END OF SECTION

SECTION 079200

EXTERIOR SEALANTS

PART 1 GENERAL

1.00 GENERAL PROVISIONS

A. Attention is directed to the PROCUREMENT AND CONTRACTING REQUIREMENTS and all Sections within DIVISION 01, GENERAL REQUIREMENTS, which are made a part of this Section of the Specifications.

1.01 WORK INCLUDED

A. Caulk and seal exterior joints as indicated on the Drawings and as specified. Include, but do not limit to:

1. Sealing of joints in exterior construction.
2. All other exterior sealing called for, or reasonably inferred from the Drawings, and as required to provide weathertight conditions in exterior assemblies.

1.02 RELATED WORK

A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:

1. Section 321313, PORTLAND CEMENT CONCRETE PAVEMENT
2. Section 033001, CAST-IN-PLACE CONCRETE - SITEWORK.
3. Section 044302, GRANITE.

1.03 REFERENCES

A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.

1. American Association of State Highway and Transportation Officials (AASHTO):

M 220	Preformed Elastomeric Compression Joint Seals for Concrete

2. American Society for Testing and Materials (ASTM):

C 920	Elastomeric Joint Sealants
C 962	Use of Elastomeric Joint Sealants
D 412	Test Methods for Rubber Properties in Tension
D 624	Test Method for Rubber Property - Tear Resistance

D 2628	Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements

3. Federal Specifications (Fed. Spec.):

TT-S-00227	Sealing Compound: Elastomeric Type, Multi-Component (For Calking, Sealing, and Glazing in Buildings and Other Structures)

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's printed product data, specifications, standard details, installation instructions, use limitations and recommendations for each sealant material used. Provide certifications that sealant materials comply with specified requirements.

B. Initial Selection Samples: Submit samples manufacturer's color charts showing complete range of colors, textures, and finishes available for each material used.

C. Test Reports: Provide certified reports for all specified tests.

1.05 COMPATIBILITY

A. Provide sealant and sealant joint backing materials suitable for the use intended and compatible with the materials with which they will be in contact. Compatibility of sealant and accessories shall be verified by the sealant manufacturer.

1.06 QUALITY ASSURANCE:

A. Source: For each sealant material type required for the work of this section, provide primary materials which are the product of one manufacturer. Provide secondary or accessory materials which are acceptable to the manufacturers of the primary materials.

B. Installer: A firm with a minimum of five years experience in type of work required by this Section and which is acceptable to the manufacturers of the primary materials.

C. Mock-Ups: Prior to commencing the primary work of this Section, provide mock-ups at locations acceptable to Landscape Architect and Construction Manager. Obtain Landscape Architect's acceptance of visual qualities. Protect and maintain accepted mock-ups throughout the remainder of the work of this section to serve as criteria for acceptance of the work.

1.07 PROJECT CONDITIONS

A. Weather: Perform work of this Section only when existing or forecasted weather conditions are within the limits established by manufacturers of the materials and products used.

B. Substrates: Proceed with work only when substrate construction and penetration work is complete.

1.08 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Materials under this Section shall be delivered to, and stored at, the job site in unbroken factory sealed containers with labels intact.

1.09 WARRANTY

A. Furnish joint sealant manufacturer's written single-source performance warranty that joint sealant work will be free of defects related to workmanship or material deficiency for five years from date of Substantial Completion of the Project.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Before installation check each sealant for compatibility with adjacent materials and surfaces and with indicated exposures. Select sealers which are recommended by manufacturer for each application indicated. Where exposed to pedestrian or vehicular traffic, provide sealants which are non-tracking and are strong enough to withstand the traffic without damage.

B. Provide colors as selected by Landscape Architect and Construction Manager from manufacturer's standard and special (Tremco Fastpak) colors. Where specifically requested, provide custom color matches.

2.02 SELF-LEVELING POLYURETHANE SEALANT

A. Provide two or more part, self-leveling, polyurethane based elastomeric sealant, complying with ASTM C 920, Fed. Spec. TT-S-00227E Type 1 Class A, having Shore A hardness of not less than 30 when tested according to ASTM C 920, cured modulus of elasticity at 100% elongation of not more than 150 psi when tested according to ASTM D 412, and tear resistance of not less than 50 lbs./inch when tested according to ASTM D 624.

B. Where joint surfaces contain bituminous materials, provide modified sealants which are compatible with bituminous materials encountered.

C. Provide one of the following products, or approved equal, that meet or exceed specified requirements:

1. Pecora Urexpan NR-200.
2. Mameco Vulkem 245 or 255.
3. Sika 2C, SL.
4. Sonneborn Sonolastic PvJtSt.
5. Tremco THC 900.

D. Extent: Provide self-leveling polyurethane sealant for paving joints not indicated to be sealed with another type of sealant.

2.03 NON-SAG POLYURETHANE SEALANT

A. Provide multi-part, non-sag, polyurethane based elastomeric sealant, complying with ASTM C 920 Type M, Grade NS, Class 25, Fed. Spec. TT-S-00227E Class A, having Shore A hardness of 20 to 30, cured modulus of elasticity at 100% elongation of not more than 75 psi, and tear resistance of not less than 50 lbs./inch when tested according to ASTM D 624.

B. Provide one of the following products, or approved equal, that meet or exceed specified requirements:

1. Mameco International Vulkem 227
2. Harry S. Peterson Co. Iso-Flex 2000
3. Sika Sikaflex 2c NS.
4. Sonneborn Sonolastic NP 2.
5. Tremco Dymeric

C. Where joint requires 50% movement capabilities, provide Tremco Dymeric Plus, or equal product approved by Landscape Architect and Construction Manager..

D. Extent: Provide non-sag polyurethane sealant for all other joints not indicated to be sealed with another type of sealant.

2.04 SEALANT FOR WATER IMMERSION (Fountain Granite)

A. Provide pourable, two-component, cold-applied, non-sag, polysulfide based joint sealant with a history of field experience in sealing joints immersed intermittently or continuously in water of same composition as that to which sealant will be exposed after installation, similar to DECK-O-SEAL GUN GRADE Two-Part, Elastomeric, Polysulfide Based Joint Sealant manufactured by W. R. MEADOWS®, INC., PO Box 338, Hampshire, Illinois 60140-0338. (800) 342-5976. (847) 683-4500. Fax (847) 683-4544. Web Site www.wrmeadows.com, or approved equal.

1. Performance Characteristics: Joint sealant shall have the following characteristics:
   a. Consistency: Thixotropic paste.
   b. Application time (77° F - 50% RH): 1 hour.
   c. Tack-Free Time: 4 hours.
   d. Linear Shrinkage: Negligible.
   e. Volume Shrinkage: Negligible.
   f. Shore Hardness: Shore A 20 ± 5.
   g. Tensile Strength: 125 - 250 psi. (862.5 to 1723 KPa)
   h. Elongation: 400%.
   i. Peel Adhesion (ASTM C794): 20 lb./in. min. (357 g/mm).

B. Accessories:

1. Backer Rod: KOOL-ROD™ or CERA-ROD™ manufactured by W. R. MEADOWS.
2. Joint Filler: CERAMAR® manufactured by W.R. MEADOWS.
3. Primer System P/G PRIMER is required for all joints subjected to hydrostatic pressure, submerged underwater, and/or joints over 1" in width.

2.05 METAL SEAM SEALANT

A. Provide metal seam sealant, specifically compounded to seal very thin joints in metal to metal joints and to match adjacent metal colors and finishes.

B. Provide one of the following products:

1. Protective Treatments, Inc. PTI 200.
2. Tremco Seam Sealer

C. Extent: Provide seam sealant for metal to metal joints in aluminum storage shed system.

2.06 PREFORMED JOINT SEALER

A. Preformed Resilient Joint Sealer: Preformed Resilient Joint Sealer for use at expansion joints in exterior concrete and masonry walls where specifically called for on Drawings shall be preformed, resilient, extruded polychlorophrene elastomeric joint sealer, conforming to ASTM D 2628 and AASHTO M 220 of indicated configuration(s), in continuous lengths, set in manufacturer's recommended primer-lubricating-adhesive consisting of moisture curing polyurethane and aromatic hydrocarbon solvent mixture (73% solid by weight) concrete gray color, equal to one of the following:

1. D.S. Brown Co.
2. Watson-Bowman & Acme Corp.

2.07 PREFORMED, PRECOMPRESSED, IMPREGNATED FOAM SEALANT

A. Provide manufacturer's standard preformed, precompressed, impregnated open-cell foam sealant manufactured from high-density urethane foam impregnated with a nondrying, water-repellant agent; factory-produced in precompressed sizes in roll or stick form to fit joint widths indicated. Provide foam sealant permanently elastic, mildew-resistant, nonmigratory, nonstaining, compatible with substrates, and complying with the following requirements:

1. Impregnating Agent: Manufacturer's standard.
2. Density: 8 - 10 lb./cu. ft.
3. Backing: Manufacturer's standard pressure sensitive adhesive, factory applied to one side, with protective wrapping.

B. Provide one of the following products, or Landscape Architect approved equal:

1. Emseal Greyflex; Emseal Corp.
2. Will-Seal 150; Wil-Seal Construction Foams Div., Illbruck.
3. York-Seal 100; York Manufacturing, Inc.

2.08 MISCELLANEOUS MATERIALS

A. Primer: Provide primer recommended by sealant manufacturer for surfaces to be adhered to.

B. Bond Breaker Tape: Provide polyethylene or other plastic tape recommended by sealant manufacturer to prevent three-sided adhesion.

C. Backer Rod: Provide compressible rod of durable nonabsorptive material recommended by sealant manufacturer for compatibility with sealant. Provide products of one of the following manufacturers, or approved equal:

1. Backer Rod Manufacturing and Supply Co.
2. Dow Chemical Co.
3. W. R. Meadows, Inc.
4. Williams Products, Inc.
5. Woodmont Products, Inc.

D. Joint backing for general use at joints in horizontal surfaces shall consist of two rows of butyl rubber or neoprene foam rod in contact with one another, and each compressed to approximately 2/3 original width when in place.

E. Provide miscellaneous materials of type that will not bleed through sealant, discolor surface, or produce other deleterious effects. Select size to provide compression to approximately 2/3 original width when in place. Provide backing material profile concave to the rear of the sealant, and equipped with a bond-breaking film.

PART 3 EXECUTION

3.01 INSPECTION

A. The Installer shall examine substrates and conditions under which this work is to be performed and notify Contractor, in writing, of conditions detrimental to proper completion of work. Do not proceed with work until unsatisfactory conditions are corrected. Beginning of sealant work means Installer's acceptance of joint surfaces and conditions.

3.02 PREPARATION

A. Strictly comply with manufacturers' instructions and recommendations, except where more restrictive requirements are specified in this Section.

B. Clean joint surfaces immediately before installation of sealants, primers, tapes and fillers. Remove substances which could interfere with bond. Etch or roughen joint surfaces to improve bond. Surfaces which have been given protective coatings and those that contain oil or grease shall be thoroughly cleaned with xylol or MEK solvent, with due precautions taken to minimize hazards.

C. Unless otherwise indicated, use of sealants shall conform to the following: ASTM C 790 for latex sealants and ASTM C 962 for other sealants.

D. Tape or mask adjoining surfaces to prevent spillage and migration problems.

E. Prime surfaces as recommended by sealant manufacturer.

3.03 INSTALLATION

A. Schedule work as long as possible after completion of concrete work and finished masonry work.

B. Provide backer rods for liquid sealants except where specifically recommended against by sealant manufacturers.

C. Prevent three sided adhesion by use of bond breaker tapes or backer rods.

D. Force sealant into joints to provide uniform, dense, continuous ribbons free from gaps and air pockets. Completely wet both joint surfaces equally on opposite sides.

E. Except in hot weather, make sealant surface slightly concave. Install sealants so that compressed sealants do not protrude from joints. Dry tool sealants to form a smooth dense surface. At horizontal joints form a slight cove to prevent trapping water.

F. Provide sealants to depths indicated, or if not indicated, follow manufacturer's recommendations. For joints up to 3/8 in. width, depth of joint shall not exceed 1/2 in.; for joints larger than 1/2 in. width, depth of joint shall not exceed 5/8 in.

3.04 EXTENT OF SEALANT WORK

A. General Extent: Seal joints indicated, and all exterior joints, seams, and intersections between dissimilar materials. Provide elastomeric sealant installation with backer rod in all exterior control joints.

B. Exterior Sealing: Without limitation, the work of this Section includes sealing the following:

1. Concrete to concrete joints.
2. Joints and cracks in paving and walks.
3. Joints in stone masonry.
4. Metal to metal joints.
5. Joint fillers for all joints.

3.05 INSTALLATION AT FOUNTAIN

A. Priming:

1. Mix all material in both containers.
2. Pour part A into part B and mix thoroughly with a clean wooden or metal paddle for approximately 3 - 4 minutes.
3. Scrape container sides and bottom for complete integration.
4. Apply primer system to properly prepared joint surfaces by brush, depositing a light, continuous film.
5. Apply an additional coat to very soft, porous surfaces.
6. Allow primer to become tacky to the touch prior to application of the joint sealant.

B. Application:

1. Mix the setting agent and base components separately using a wooden paddle or slow speed drill and flat blade paddle in accordance with manufacturer's instructions.
2. Pour setting agent into base and mix slowly.
3. Scrape material from sides and bottom until joint sealant is a uniform color.
4. Continue mixing for a minimum of 10 minutes.
5. Apply thoroughly blended material with a hand- or air-operated caulking gun, putty knife, or trowel.
6. Tool sealant beads with tools wetted with clean water.
7. Joint sealant will become tack free after approximately four hours and will fully cure after 24 hours at air and surface temperatures above 77^{o} F (25^{o} C).

3.06 CURING

A. Cure sealants in strict compliance with manufacturers' instructions and recommendations to obtain highest quality surface and maximum adhesion. Make every effort to minimize accelerated aging effects and increase in modulus of elasticity.

3.07 CLEANING AND PROTECTION

A. Remove smears from adjacent surfaces immediately, as the work progresses. Exercise particular care to prevent smearing or staining of surrounding surfaces which will be exposed in the finished work, and repair any damage done to same as result of this work without additional cost to Owner.

B. Remove and replace work that is damaged or deteriorated.

C. Clean adjacent surfaces using materials and methods recommended by sealant manufacturer. Remove and replace work that cannot be successfully cleaned.

D. Provide temporary protection to ensure work being without damage or deterioration at time of final acceptance. Remove protection immediately before final acceptance.

END OF SECTION

SECTION 083100

ACCESS DOORS

PART 1 GENERAL

1.00 GENERAL PROVISIONS

A. Attention is directed to the PROCUREMENT AND CONTRACTING REQUIREMENTS and all Sections within DIVISION 01, GENERAL REQUIREMENTS, which are made a part of this Section of the Specifications.

1.01 WORK INCLUDED

A. Furnish access door for vault access in granite pavers, as indicated on Drawings and as specified.

1.02 RELATED WORK

A. Examine Contract Documents for requirements that affect the work of this Section. Other Specification Sections that relate directly to work of this Section include, but are not limited to:

1. Section 033001, CAST-IN-PLACE CONCRETE – SITEWORK.
2. Section 321440, GRANITE PAVING.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's printed product data, specifications, standard details, installation instructions, use limitations and recommendations for each material used. Provide certifications that materials and systems comply with specified requirements.

B. Shop Drawings: Provide large scale shop drawings for fabrication, installation and erection of all parts of the work. Provide plans, elevations, and details of anchorages, connections and accessory items. Provide installation templates for work installed by others. Show all interfaces and relationships to work of other trades.

1. Where pavers must fit and coordinate with finished surfaces and/or constructed spaces, take measurements from site and not from drawings.
2. Furnish accepted shop drawings to the trades responsible for installing the connectors or inserts.

1.04 QUALITY ASSURANCE:

A. Source: For each material type required for the work of this section, furnish primary materials which are the product of one manufacturer. Furnish secondary or accessory materials which are acceptable to the manufacturers of the primary materials.

PART 2 PRODUCTS

2.01 FRAMES

A. All frames shall be custom fabricated by hatch manufacturer in accordance with Drawings and approved shop drawings.

2.02 METAL ACCESS DOORS

A. Refer to Custom Access Hatch Schedule on Drawings for hatch types, quantities, infill material, dimensions, loading requirements and other information.

B. Performance

1. For H20 Covers: live load deflection on the manhole and vault covers shall not exceed 1/720 of the span when the covers consist of stone pavers inset in a steel tray.

C. Pavement Access Doors for Vault: shall be Bilco JD-2H20 for double door access, engineered with lift assistance for smooth, easy one-hand door operation, regardless of size; Automatic hold-open arm locks the cover in the open position to ensure safe egress; heavy-duty construction and positive latching mechanism to help prevent unauthorized access; Available in a number of standard and special sizes to satisfy any requirement, manufactured by The Bilco Company, P.O. Box 1203, New Haven, CT 06505; Tel. 203-934-6363; Fax: 203-933-8478, or approved equal.

1. Material: Cover and frame are 1/4" (6 mm) steel
2. Cover: Diamond-pattern tread plate reinforced for 300 psf (1464 kg/m^2) live load.
3. Frame: Formed channel frame with full anchor angle welded around the perimeter. A 1-1/2" (38mm) drain coupling is welded under the frame for a pipe connection to a dry well or disposal system
4. Hinges: Heavy forged brass hinges with 3/8" (9 mm) type 316 stainless steel hinge pins.
5. Latch: Type 316 stainless steel slam lock with fixed interior handle and removable exterior turn/lift handle. Latch release is protected by a flush, gasketed, removable screw plug
6. Lift Assistance: Compression spring operators enclosed in telescopic tubes. Automatic hold-open arm with grip handle release.
7. Finish: Alkyd base red oxide primer
8. Hardware: Engineered composite compression spring tubes and steel compression springs packed in grease. Slam lock and all fasteners are type 316 stainless steel. All other hardware is zinc plated/chromate sealed

D. Furnish metal access doors to the proper trades for building into the work, except that any access panels specifically specified under the Mechanical or Electrical Sections of the Specifications to be furnished by those trades are excluded from the work of this Section.

PART 3 EXECUTION

3.01 INSTALLATION

A. All items furnished under this Section shall be delivered to site and turned over to the Contractor for installation by other appropriate trades at locations indicated on the Drawings and as described in the Custom Access Hatch Schedule on Drawings.

3.02 FRAMES

A. Frames shall be anchored (by threaded rod) to paving substructure as indicated on the Drawings.

B. Adjust threaded anchors to sit flush with adjacent paving; grout to fill any gaps between frame and substructure as indicated on the Drawings.

C. Maximum clearance/ gap between frame and cover shall be 1/8” as indicated on the Drawings.

END OF SECTION

SECTION 084429

GLASS CANOPIES

PART 1 GENERAL

1.00 GENERAL PROVISIONS

A. Attention is directed to the PROCUREMENT AND CONTRACTING REQUIREMENTS and all Sections within DIVISION 01, GENERAL REQUIREMENTS, which are made a part of this Section of the Specifications.

1.01 WORK INCLUDED

A. Functional design, structural engineering, custom fabrication, and site erection of glass canopies.

1.02 RELATED REQUIREMENTS

A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:

1. Section 033100, CAST-IN-PLACE CONCRETE
2. Section 051223, STRUCTURAL STEEL FRAMING

1.03 REFERENCED STANDARDS

A. American National Standards Institute (ANSI): ANSI Z97.1 - Safety Performance Specifications and Methods of Test for Safety Glazing Material Used in Buildings.

B. American Society of Civil Engineers (ASCE): ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

C. American Society for Testing and Materials (ASTM):

1. ASTM A276 - Stainless and Heat-Resisting Steel Bars and Shapes.
2. ASTM C920 - Elastomeric Joint Sealants.
3. ASTM C1048 - Heat Treated Flat Glass, Kind HS, Kind FT, Coated and Uncoated.
4. ASTM C1172 - Laminated Architectural Flat Glass.
5. ASTM E331 - Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
6. ASTM E1300 - Determining Load Resistance of Glass in Buildings.

D. Consumer Product Safety Commission (CPSC): CPSC 16 CFR 1201 - Safety Standard for Architectural Glazing Materials.

E. Glass Association of North America (GANA): GANA - Glazing Manual.

1.04 DESIGN AND PERFORMANCE CRITERIA

A. Design Requirements:

1. Design Wind Loads: As indicated on the structural drawings.
2. Snow Loads: As indicated on the structural drawings.
3. Seismic Loads: As indicated on the structural drawings.
4. Live load deflection of supporting structure as indicated on the structural drawings.

B. Design, size components, and install glass canopy in accordance with ASTM E1300 to withstand these loads without breakage, loss, failure of seals, product deterioration, and other defects.

1. Dead and Live loads: Determined by ASCE 7 and calculated in accordance with applicable codes.
2. Seismic loads: System shall be designed and installed to comply with applicable seismic requirements for Project location and Seismic Zone.
3. Movement and deflection of structural support framing.
4. Effects of applicable wind load acting inward and outward normal to plane of canopy in accordance with ASTM E330.
5. Thermal Loads and Movement:
   a. Ambient Temperature Range: 120 degrees F (67 degrees C).
   b. Material Surfaces Range: 180 degrees F (100 degrees C.

1.05 SUBMITTALS

A. Submit in accordance with Section 013300 - Submittal Procedures:

1. Product data for all proposed components, materials, products, and accessories.
   a. For each type glass, provide maximum allowable stress in both horizontal and vertical directions.
2. Shop drawings:
   a. Plans, elevations, and sections illustrating shape, configuration, and dimensions. For complex canopies provide perspectives, renderings, or models.
   b. Illustrate method of assembly, installation, and glazing.
   c. Provide details for support framing, reinforcement, connections, joints, anchors, and other fabrication and installation conditions.
   d. Indicate required tolerances and coordination with adjacent elements and work of other trades.
3. Calculations: Show compliance with performance criteria and applicable loads with stamp of Licensed Professional Engineer registered in the State of New York.
4. Samples:
   a. [12 by 12 inches] [152 by 152 mm] minimum size for each type glass.
   b. [6 inches] [152 mm] minimum length of metal support framing.
   c. [6 inches] [152 mm] minimum length of structural silicone sealant installed between two pieces of glass simulating a typical joint in the finished canopy.
   d. Metal finishes.
   e. Sealant colors.
5. Manufacturer's installation and maintenance instructions.
6. Certificates or test reports demonstrating components and methods have been successfully tested by an independent laboratory in the United States certifying that the proposed system has been tested.
7. Data showing compliance with manufacturer's and installer's. Provide descriptions, locations, photographs, references, and completion dates for previous projects.

8. Warranties: Samples of warranties as required below.. Included with warranty, shall be a letter certifying the proposed system will be manufactured from one source. Glass cannot be supplied by one manufacturer and hardware from another manufacturer to comply with this warranty. Letters signed by the subcontractors or installers for this section are not acceptable.

B. Proposed methods, and schedule for effecting tree and plant protection shall be submitted for approval.

C. Proposed methods, materials, and schedule for root pruning, construction pruning, and tree fertilization by Certified Arborist shall be submitted for approval.

1.06 QUALITY ASSURANCE

A. Single source responsibility: Design, structural engineering, and custom fabrication for glass canopy and supply of all components, materials, and products shall be sole responsibility of single manufacturer. Provision of products from numerous sources for site assembly without complete single source design and supply responsibility is not acceptable. Components to be fabricated or supplied by single source are:

1. Support framing.
2. Glass
3. Connectors, fittings, anchors, and installation accessories.
4. Gaskets, glazing tape, and sealants.
6. All other components, products, and materials required for complete, functional glass canopy.

B. Single installation responsibility: All components specified herein shall be installed by a single installer with undivided responsibility for the completed assembly.

C. Manufacturer qualifications: Company specializing in designing, engineering, and fabricating unique, custom designed, glass canopies, facades, entrances, storefronts, and other glazed structures. Glass cannot be supplied by one manufacturer and hardware from another manufacturer to comply with this warranty. Letters signed by the subcontractors or installers for this section are not acceptable.

D. Installer qualifications: Company experienced in erecting custom designed, glass canopies, facades, entrances, storefronts, and other glazed structures and acceptable to manufacturer for installing proposed structure.

1. Experience: 3 years minimum successful experience erecting glass structures.
2. Previous projects: Successfully completed 3 minimum glass structures of scope, type, and size as proposed Project.
3. Design structural components and develop shop drawings under direct supervision of professional structural engineer experienced in design of glass structures. Calculations and shop drawings shall bear engineer's seal.
4. Safety glazing: Comply with Consumer Product Safety Commission 16 CFR 1201, ANSI Z97.1, and other applicable safety requirements. Each piece of safety glazing shall be permanently labeled with appropriate marking.

A. Design structural components and develop shop drawings under direct supervision of professional structural engineer experienced in design of glass structures. Calculations and shop drawings shall bear engineer's seal.

F. Safety glazing: Comply with Consumer Product Safety Commission 16 CFR 1201, ANSI Z97.1, and other applicable safety requirements. Each piece of safety glazing shall be permanently labeled with appropriate marking.

G. Manufacturer's Field Representative:

1. During installation, provide services of manufacturer's field representative knowledgeable of erection process for proposed glass canopy.
2. Manufacturer's representative shall observe installation, quality control, and certify work meets specified requirements.
3. Manufacturer's representative shall submit report covering observations, procedures, noted deficiencies, corrective measures, and certification of proper installation.

1.07 MOCK-UP

A. In accordance with Section 014000 - Quality Control, prepare separate mock-up illustrating construction method for glass canopy. Mock-up shall demonstrate performance and establish workmanship quality standard.

B. Provide posts and other framing to support canopy mock-up to allow inspection from above and below canopy.

C. Mock-up shall be portion of canopy with glass panels, support framing, curb, flashing, and fittings. Construct with all anchors, fasteners, sealants, and other components proposed for actual installation.

D. Approximate size: 6 feet by 6 feet (2m by 2 m).

E. Test mock-up with water hose to verify weathertightness.

F. Submit report describing tests, results, and any modifications made to correct deficiencies or to improve performance.

G. Do not proceed with installation until mock-up has been inspected and accepted by Architect.

H. Retain approved mock-up during construction as quality standard. Completely remove when work is accepted.

1.08 PREINSTALLATION CONFERENCE

A. Preinstallation Conference: Conduct conference at the Project site prior to commencing work of this Section

1. Require attendance of entities directly concerned with canopy, including manufacturer's field representative.
2. Review at the conference:
   a. Coordination with supports, wall system, and preparation for attachment of canopy.
   b. Schedule, sequence, and method for installing glass canopy and coordination with other work.
   c. Safety procedures.
   d. Protection of adjacent items and finishes.
   e. Other items related to successful execution of work.

1.09 PRODUCT HANDLING

A. Protect glass and other components during delivery, storage, and handling in accordance with manufacturer's instructions. Prevent edging chipping and other damage.

B. Do not store glass panels on site for extended time.

1.10 ENVIRONMENTAL REQUIREMENTS

A. During glazing, maintain [40 degrees F] [4 degrees C] minimum temperature.

1.11 WARRANTIES

A. Provide under provisions of Section 017700 - Closeout Procedures:

1. Manufacturer's 2 years warranty to cover design, fabrication, and materials against defects and failure to perform and remain watertight. Warranty to provide for replacement of defective components.
2. Glass Warranties: 5 years warranty to cover replacement of laminated glass units in event of delamination, edge separation, and blemishes.
3. Installer's 5 years warranty to cover installation against defects and failure to perform and remain watertight. Warranty to provide for required repairs.

PART 2 PRODUCTS

2.01 GENERAL

A. Exterior glass canopy to be custom designed, engineered, detailed, factory fabricated, and site assembled and erected.

B. Basic Configuration: Pitched shape to provide architectural appearance shown on Drawings.

C. Dimensions: Glass canopy shall be nominal dimensions shown on Drawings. Minor variations to accommodate manufacturer's design and components are acceptable provided overall concept is maintained.

D. Type of Glass Canopy: Mechanically fastened glass panels supported by metal connector fittings.

2.02 MANUFACTURERS

A. Basis of Design Product: Subject to compliance with requirements, provide **Innovative Structural Glass, Inc.** *Series 100 Articulated Post Support Spider Fitting Glass Canopy System* or comparable product to one of the following:

1. Sentech Architectural Systems, Austin, TX 78732; telephone 512-266-7045.
2. W&W Glass Systems, Inc. (Pilkington); Nanuet, NY 10954; telephone 800-452-7925.

2.03 GLASS

A. Glass Type: Laminated glass fabricated by bonding two glass panes with transparent, flexible interlayment material in accordance with ASTM C1172. Laminated glass shall meet requirements of ANSI Z97.1 and CPSC 16 CFR to qualify as safety glass.

B. Fabricate laminated glass for canopy components from ASTM C1048 Kind FT fully tempered glass as determined by manufacturer to accommodate Project design and performance requirements.

C. Color: Clear.

D. Screen-Printed Ceramic Frit Coating: Custom ceramic screen graphic as indicated on the drawings.

1. Color: White

D. Glass thickness: Determined by glass canopy manufacturer to accommodate Project design and performance requirements.

E. For glass panels to be installed with mechanical connectors and fittings, provide holes to receive bolts and fitting pins. Holes shall be drilled prior to tempering glass.

2.04 FITTINGS

A. Provide structurally engineered and independently tested fittings for connecting glass panels together and for attachment to supporting substrates.

B. Material: Stainless steel complying with ASTM A276, Type 316 with No. 4 (brushed satin finish).

C. Types: Configuration, number of points, size, and spacing shall be determined by manufacturer and scheduled on shop drawings to accommodate project design and meet performance criteria. Ensure that fitting-induced stresses do not exceed glass strength.

D. Providing fittings with countersunk stainless steel bolts, Delrin bushings, and resilient gaskets.

2.05 ACCESSORIES

A. Provide glazing accessories, anchors, and fasteners of type recommended by canopy manufacturer and as required for complete, functional, weather-tight installation.

B. Anchorage Devices: Clips, anchors, fasteners, and shims required for secure installation of glass canopy. Type, size, and spacing as recommended by canopy manufacturer.

C. Cleaners and Primers: Recommended by manufacturer to be compatible with substrate and glazing materials.

D. Contact Structural Sealant: High performance, two component, non-sag, neutral cure, ultraviolet resistant, silicone sealant designed for structural glazing and complying with ASTM C920.

2.06 CANOPY FABRICATION

A. Insofar as possible, fit and assemble canopy in shop.

B. Fabricate free of visual distortion and defects. Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof.

C. Prepare components to receive anchor devices. Fabricate anchors.

D. Arrange fasteners and attachments to ensure concealment from view.

E. Fabricate to drain water entering joints, condensation, and migrating moisture occurring within unit.

PART 3 EXECUTION

3.01 COORDINATION

A. Coordinate provision of glass canopy with construction of support framing specified in Section 051223 - Structural Steel. Ensure that provision is made for attachments and transfer of calculated loads.

B. Field verify dimensions prior to fabricating glass canopy components.

3.02 INSPECTION

A. Prior to delivery of glass panels to site, verify that support framing and substrates are ready to receive glass canopy. Verify alignment, dimensions, and tolerances are correct.

B. Report unacceptable conditions and deficiencies. Do not proceed with installation until corrective action has been performed.

3.03 GENERAL INSTALLATION

A. Site assemble and erect glass canopy in accordance with approved shop drawings, manufacturer's installation instructions, and GANA Glazing Manual.

B. Damaged glass: Do not install glass with edge damage or other imperfections. Remove from site and replace.

C. Allow for settling, expanding, and contracting to occur without breaking glass.

D. Do not field cut or alter structural framing without written approval from manufacturer and Architect

3.04 GLAZING

A. Protect adjacent surfaces sealants and glazing materials with masking tape or other means.

B. Glazing Method: Use the following methods for applications indicated on the drawings:

1. Structural silicone glazing: Use for butt glass joints.

a. Cleaning: Thoroughly clean all joints and glazing areas immediately prior to sealant application. Remove oil, dust, grease, water, surface dirt, contaminants, and other foreign matter. Vacuum or blow out dust and loose particles from joints. Do not use water cleaning treatments.
b. Use primers only as recommended by sealant manufacturer. Field test with and without primer before actual application.
c. Mask areas adjacent to joints to insure neat sealant line. Do not allow tape to touch surfaces to which sealant will be applied.
d. Install sealant back-up spacers as indicated on Drawings and approved shop drawings.
e. Apply silicone structural sealant in continuous operation. Tool sealant immediate before skin forms. Tool concave to ensure complete contact.
f. Post application test: After structural sealant has cured 14 to 21 days, conduct field test as prescribed by manufacturer to test sealant adhesion. Replace sealant not passing test.

3.05 MECHANICAL ASSEMBLED GLASS UNITS

A. Mechanically install glass canopy panels with stainless steel fittings as designed by manufacturer and indicated on approved shop drawings.

B. Glass panels shall be mechanically attached directly to supporting substrate with fittings and anchors.

C. Secure glass panels to fittings with bolts. Torque bolt to amount specified on approved shop drawings using calibrated tool. Lock torqued bolt into position to prevent backoff. Reset calibrations regularly to ensure accurate torquing.

3.06 CLEANING

A. Clean excess sealant from glass and other surfaces immediately after application. Use solvents or other cleaners recommended by manufacturer.

B. Remove protective material from prefinished surfaces.

C. Wash exposed surfaces using a solution of mild detergent in warm water, applied with soft, clean cloths. Do not use abrasives. Take care to remove dirt from corners. Wipe surfaces clean.

END OF SECTION

SECTION 099600

HIGH-PERFORMANCE COATINGS

PART 1 GENERAL

1.00 GENERAL PROVISIONS

A. Attention is directed to the PROCUREMENT AND CONTRACTING REQUIREMENTS and all Sections within DIVISION 01, GENERAL REQUIREMENTS, which are made a part of this Section of the Specifications.

1.01 WORK INCLUDED

A. Section includes surface preparation and application of high-performance coating systems on the following substrates:

1. Exterior Substrates:
   a. Steel.
   b. Galvanized metal.

1.02 RELATED REQUIREMENTS

A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:

1. Section 051223 "STRUCTURAL STEEL for shop priming of metal substrates with primers specified in this Section.

1.03 DEFINITIONS

A. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.

1.04 SUBMITTALS

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

B. Samples for Initial Selection: For each type of finish-coat product indicated.

C. Product List: For each product indicated. Cross-reference products to coating system and locations of application areas. Use same designations indicated on Drawings and in schedules.

1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.
3. VOC content.

D. Maintenance Materials: Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Coatings: 5 gal. (3.8 L) of each material and color applied.

1.05 QUALITY ASSURANCE

A. Master Painters Institute (MPI) Standards:

1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."

B. Mockups: Apply mockups of each coating system indicated to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each coating system specified in Part 3.
2. Final approval of color selections will be based on mockups.
   a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.07 FIELD CONDITIONS

A. Apply coatings only when temperature of surfaces to be coated and surrounding air temperatures are between 50 and 95 deg F (10 and 35 deg C) or as otherwise directed by paint manufacturer.

B. Do not apply coatings when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces or as otherwise directed by paint manufacturer.

C. Do not apply exterior coatings in snow, rain, fog, or mist.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements listed in other Part 2 articles for the paint category indicated.

B. Products: Subject to compliance with requirements listed in other Part 2 articles for the paint category indicated.

2.02 HIGH-PERFORMANCE COATINGS, GENERAL

A. MPI Standards: Provide products that comply with MPI standards indicated and are listed in "MPI Approved Products List."

B. Material Compatibility:

1. Provide materials for use within each coating system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a coating system, provide products recommended in writing by manufacturers of topcoat for use in coating system and on substrate indicated.
3. Provide products of same manufacturer for each coat in a coating system.

C. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction.

1. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: 250 g/L.

D. Colors: Match Architect's samples.

2.03 METAL PRIMERS

A. Primer, Epoxy, Anti-Corrosive, for Metal: MPI #101.

1. Subject to compliance with requirements, provide **Pittsburgh Paints** *Amercoat Amerlock 400*, or comparable product by one of the following:

a. Benjamin Moore
b. Sherwin Williams Company
c. Tnemec Company, Inc.

2.04 EPOXY COATINGS

A. Epoxy, Gloss: MPI #77.

1. Subject to compliance with requirements, provide **Pittsburgh Paints** *Aquapon35 Polyamide Epoxy Gloss*, or comparable product by one of the following:

a. Benjamin Moore
b. Sherwin Williams Company
c. Tnemec Company, Inc.

2.05 POLYURETHANE COATINGS

A. Polyurethane, Two-Component, Pigmented, Gloss (Gloss Level 6): MPI #72.

1. Subject to compliance with requirements, provide **Pittsburgh Paints** *Pitthane Ultra Gloss Urethane Enamel*, or comparable product by one of the following:

a. Benjamin Moore
b. Sherwin Williams Company
c. Tnemec Company, Inc.

2.06 SOURCE QUALITY CONTROL

A. Testing of Coating Materials: Owner reserves the right to invoke the following procedure:

1. Owner will engage the services of a qualified testing agency to sample coating materials. Contractor will be notified in advance and may be present when samples are taken. If coating materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying coating materials from Project site, pay for testing, and recoat surfaces coated with rejected materials. Contractor will be required to remove rejected materials from previously coated surfaces if, on recoating with complying materials, the two coatings are incompatible.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

C. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.02 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

B. Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce coating systems indicated.

C. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer.

D. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

E. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied coatings.

3.03 APPLICATION

A. Apply high-performance coatings according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."

1. Use applicators and techniques suited for coating and substrate indicated.
2. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Coat back sides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not apply coatings over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of the same material are to be applied. Tint undercoats to match color of finish coat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.

D. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

3.04 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner will engage the services of a qualified testing and inspecting agency to inspect and test coatings for dry film thickness.

1. Contractor shall touch up and restore coated surfaces damaged by testing.
2. If test results show that dry film thickness of applied coating does not comply with coating manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with coating manufacturer's written recommendations.

3.05 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from coating operation. Correct damage by cleaning, repairing, replacing, and recoating, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

3.06 EXTERIOR HIGH-PERFORMANCE COATING SCHEDULE

A. Steel Substrates:

1. Pigmented Polyurethane over Epoxy System:

a. Prime Coat: Primer, epoxy, anti-corrosive, for metal, MPI #101.
b. Intermediate Coat: Epoxy, gloss, MPI #77.
c. First Topcoat: Polyurethane, two-component, pigmented, gloss (Gloss Level 6), MPI #72.
d. Second Topcoat: Polyurethane, two-component, pigmented, gloss (Gloss Level 6), MPI #72.

B. Galvanized-Metal Substrates:

1. Epoxy System:

a. Prime Coat: Primer, epoxy, anti-corrosive, for metal, MPI #101.
b. Intermediate Coat: Epoxy, gloss, MPI #77.
c. Topcoat: Epoxy, gloss, MPI #77.

END OF SECTION

SECTION 107450

DIGITAL KIOSK

PART 1 GENERAL

1.00 GENERAL PROVISIONS

A. Attention is directed to the PROCUREMENT AND CONTRACTING REQUIREMENTS and all Sections within DIVISION 01, GENERAL REQUIREMENTS, which are made a part of this Section of the Specifications.

1.01 WORK INCLUDED

A. The work of this Section consists of furnishing and installing an outdoor digital kiosk, as indicated on the Drawings and as specified.

1.02 SUBMITTALS

A. Shop Drawings: Submit complete shop drawings of all work of this Section to Architect for approval, showing all pertinent details of construction and installation.

B. Product Data: Submit complete manufacturer's product data of all work of this Section to Architect for approval, consisting of complete product description and specifications, catalog cuts, and other descriptive data required for complete product and product use information.

C. Do not order materials or begin fabrication or installation work until Architect's approval of submittals has been obtained.

1.03 RELATED WORK

A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:

1. Section 033001, CAST-IN-PLACE CONCRETE – SITEWORK.
2. Section 260010, BASIC ELECTRICAL WORK; Electrical power and wiring of directory.
3. Section 312300, SITE EXCAVATING, BACKFILLING AND COMPACTING.

1.04 REFERENCES

A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirement shall govern.

1. American Association of State Highway and Transportation Officials (AASHTO):

Specifications	Standard Specifications for Highway Bridges

2. American Society for Testing and Materials (ASTM):

F 512	Smooth-Wall Poly (Vinyl Chloride)(PVC) Conduit and Fittings for Underground Installation.

1.05 QUALITY ASSURANCE

A. Products provided under work of this Section shall be the most current version of the product available at the time the product is ordered.

B. Materials and workmanship shall comply with all applicable state and national codes, specifications, and specified industry standards.

1.06 CONSTRUCTION REQUIREMENTS

A. Contractor shall carefully lay out his work at the site to conform to the structural and Architectural conditions, to provide proper grading of lines, and to avoid all obstructions, whether indicated on the Drawings or not. The Drawings do not give exact details as to elevation of utilities nor do they show exact locations of utilities to scale. Before installation of utilities the Contractor shall refer to the in-place construction as it is then in progress and determine the exact required locations of these systems in conjunction with advice from the Architect.

B. Drawings showing the extent and arrangement of the work of particular trade shall be used together with Drawings showing extent and arrangement of work of other trades to insure that the Contractor in laying out and installing his work shall do so in a manner such that the work of the several trades may progress in the most direct, workmanlike, and harmonious manner.

1.07 TESTS

A. Before completion of the Project, the Contractor shall test all materials and equipment which normally require testing.

PART 2 PRODUCTS

2.01 MATERIALS

A. Manufacturer's names are listed herein and on the Drawings to establish a standard for quality and design. Where one manufacturer's name is mentioned, products of other manufacturers will be acceptable if, in the opinion of the Architect, the substitute material is of quality equal to or better than that of the material specified. Where three or more manufacturer's names are specified, material shall be by one of these manufacturers.

B. Material furnished under this Contract shall be new, free from defects of any character, of the quality and design hereinafter specified, and shall conform with the standards of Underwriters' Laboratories, Inc., except for equipment which U.L. does not list or provide with label service. Materials shall be free from defects at the time of installation. Materials or equipment damaged in shipment or otherwise damaged shall not be repaired at the jobsite, but shall be replaced with new materials.

2.02 CONDUIT

A. Underground conduit and fittings shall be Schedule 40, heavy wall PVC conduit. Conduit and fittings shall be free from all substances that injuriously affect wire or cable insulation. The conduit and fitting shall be corrosive-resistant and not adversely affected by insects, rodents, acids, alkalies, salts, bacteria, or other organic matter that would be encountered in the ground. Water absorption at 24 hours shall not be more than 0.02 percent based on the initial weight of 6 in. sample at 73.4^{o}C. Conduits shall be jointed together with a fitting by solvent welding or other method recommended by the conduit manufacturer.

B. Conduit and fittings for underground duct construction shall be smooth-wall PVC conduit conforming to ASTM F 512. Conduit shall be nominal 20 ft. lengths with bell end or coupling on one end.

1. Conduit for direct burial shall be Type DB-120.
2. Conduit shall be joined together with a fitting by solvent cement or other method approved by the conduit manufacturer.

C. Fittings, couplings, adaptors, and spacers shall be compatible with and equal in quality to conduit and conform to utility company standards.

1. Spacers shall provide a minimum of 1-1/2 in. separation between ducts and 3 in. beneath ducts. Spacers shall lock vertically and horizontally.

D. Detector tape for identification of underground conduit locations shall be manufactured by Reef Industries, Inc., Houston, TX 77275-0218, or approved equal. Detector tape shall be high visibility, color coded inert polyethylene plastic tape. Detector tape shall conform to the following:

1. Plastic jacket shall be impervious to alkalis, acids, and other chemicals in the soil.
2. Overall thickness of the tape shall be 4.0 mils, minimum.
3. Tensile strength shall be 2,800 psi, minimum.
4. Tape width shall be 3 in., minimum.
5. Color of tape shall be "Safety Red" for electric, and "Safety Alert Orange" for telephone and communications.
6. Tape shall be imprinted with the legend: "Caution Buried Electric Line Below" for electric, and "Caution Buried Telephone/Communication Line Below" for telephone and communications.

2.03 DIGITAL KIOSK

A. General: Contractor shall provide the most current version of the product available at the time the product is ordered.

B. Digital Kiosk: shall be the K-Phlat 42" Outdoor Kiosk with display mounted in the Portrait "vertical" position. Unit shall have anti-glare/SRF Vandal Resistant Glass, IR touch screen, all-around heat shields, self-contained heat/cool system, 3-point compression latch-locking system, amplified weatherproof sound system, mobile base plate, manufactured by FITHco, Inc. (MDKS) -109 Becky Drive Cleveland , GA 30528; T.706-865-0511; F.706-865-0519; info@mdks.com; www.mdks.com, or approved equal.

1. Finish: Unit shall receive manufacturer’s standard powder coat finish.
2. Color: Custom color RAL 8019.
3. Base Plate: Provide rectangular base plate in lieu of standard curved plate.

PART 3 EXECUTION

3.01 CONDUIT INSTALLATION

A. Conduit shall be installed as indicated on the Drawings. Where exact locating dimensions of conduit are not indicated on the Drawings, the Architect's approval shall be obtained for proposed locations before installation.

B. Conduit installation shall conform to the utility company standards.

1. Excavation and backfill, and bedding materials shall conform to Section 312300, SITE EXCAVATING, BACKFILLING AND COMPACTING.
2. Bottom of trench excavation shall be kept dry and free of water during pipe installation. Adequate measures shall be taken to prevent flotation of conduit in the trench.
3. Conduits shall be installed with a minimum of 24 in. of cover below the finished grade, unless otherwise indicated.
4. Detector tape shall be installed in the utility trench and shall be located directly over the conduit at a maximum depth of 6 in. below finished grade.

3.02 INSTALLATION

A. All items furnished under this Section shall be installed in strict accordance with the approved shop drawings and the manufacturer's printed instructions and recommendations, required to be submitted hereinbefore.

PART 4 METHOD OF MEASUREMENT

4.01 DIGITAL KIOSK

A. The quantity to be measured for payment is a single lump sum.

PART 5 BASIS OF PAYMENT

5.01 DIGITAL KIOSK

A. The lump sum price bid shall include the cost of all labor, material, and equipment necessary to furnish and install the digital kiosk, including excavation and backfill, conduit, fiber optic wiring, foundation, adjustment to finish grade, field testing and warranty, complete, as indicated on the Drawings and specified.

B. Payment will be made under:

ITEM NO.	ITEM	PAY UNIT
107450.01	Digital Kiosk	Lump Sum

END OF SECTION

SECTION 116816

PLAY STRUCTURES

PART 1 GENERAL

1.00 GENERAL PROVISIONS

A. Attention is directed to the PROCUREMENT AND CONTRACTING REQUIREMENTS and all Sections within DIVISION 01, GENERAL REQUIREMENTS, which are made a part of this Section of the Specifications.

1.01 WORK INCLUDED

A. Provide all labor, materials, and equipment necessary to furnish and install the play equipment, as indicated on the Drawings, and as specified herein.

1.02 RELATED SECTIONS

A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:

1. Section 312300, SITE EXCAVATING, BACKFILLING AND COMPACTING; Excavation and backfill; establishment of subgrade elevations, and gravel base material; sand material.
2. Section 321816.12, PLAYGROUND SAFETY SURFACING.
3. Section 033001, CAST-IN-PLACE CONCRETE - SITEWORK; Concrete footings and bases.

1.03 REFERENCES

A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirement shall govern.

1. American Society for Testing and Materials (ASTM):

C 90	Hollow Load-Bearing Concrete Masonry Units
A 36	Structural Steel
A 123	Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strip
A 325	High-Strength Bolts for Structural Steel Joints.
C 136	Sieve Analysis of Fine and Coarse Aggregates
F 355	Test Method for Shock Absorbing Properties of Playing Surface Systems and Materials

F1292	Standard Specification for Impact Attenuation of Surface Systems Under and Around Playground Equipment.
F 1487	Standard Consumer Safety Performance Specifications for Playground Equipment for Public Use

2. Americans with Disabilities Act (ADA)

   Accessibility Guidelines for Buildings and Facilities; Play Areas, amended November 20, 2000.

3. U.S. Consumer Product Safety Commission (CPSC):

   Technical Guidelines for Play Equipment

1.04 SUBMITTALS

A. Submit to the Architect manufacturer's literature on all equipment to be provided.

B. Shop drawings of play structures, including all panels and fastening hardware shall be submitted. Show assembly and installation details.

C. Manufacturer's written guarantee for minimum period of one year from date of installation. Guarantee shall cover replacement of any damaged components, not including vandalism or improper use.

D. Product Data: Include physical characteristics such as materials, dimensions and finish.

1.05 QUALITY ASSURANCE

A. Installer Qualifications - An experienced installer familiar with local building codes and with the latest safety guidelines, who has completed installation of playground structures similar in material, design, and extent to that indicated for this project, and whose work has resulted in construction with a record of successful in-service performance.

B. Product Options - Drawing indicates size, components and dimensional requirements of playground structure and is based on the specific system indicated.

1.06 DELIVERY, STORAGE AND HANDLING

A. Inspect all components on delivery to ensure that no damage occurred during shipping or handling. Materials shall be stored in original undamaged packaging in such a manner to ensure proper ventilation and drainage, and to protect against damage, weather, vandalism, and theft until ready for installation. Inspect components prior to installation.

PART 2 PRODUCTS

2.01 PLAY SYSTEMS

A. Play Equipment shall be products of Landscape Structures, Inc. 601 7th Street South Delano, MN 55328 USA; Tel. 888.4FUNLSI or 888.438.6574 (toll-free, United States and Canada); 763.972.5200 (everywhere else); 763.972.3185 (fax), or approved equal.

B. Provide all components from a single manufacturer.

C. Colors:

1. Arches: RAL 8019
2. Clamps: Blue ProShield
3. Components: RAL 8019
4. Plastic Components: Blue Polyethylene

2.02 COMPONENTS”

A. 2 Arch Main Structure

B. RingTangle Climber

C. Rush Slide

D. Belt-Zone Climber

PART 3 EXECUTION

3.01 INSTALLATION INSTRUCTIONS AND AIDS

A. To guide installation, each structure shall be accompanied by bills of materials, written instructions, an erection plan view drawing, and a footing plan location drawing to be furnished prior to or with the delivery of the play structure. To facilitate assembly, each part shall be indelibly stenciled with an easily-read identification number keyed to the bills of materials and erection drawings. All components shall be shipped unitized, protectively wrapped, banded for mechanical handling and ready for assembly.

3.02 INSTALLATION

A. Playground equipment shall be assembled and installed in strict accordance with manufacturer's printed instructions, true to the dimensions, layout, and details shown on the Drawings.

1. Install play structure in compliance with manufacturer’s written instructions.
2. Install components in sequence as recommended by manufacturer.
3. Install play structure as indicated on the drawings provided.
4. Variations from the installation indicated must be approved.
5. Variations from the installation indicated and all costs for removal and replacement will be the responsibility of the contractor.
6. Installation Contractor will warranty the replacement of any warranty item for the entire manufactor’s warranty period at no cost to the Owner.

B. Locate positions of all play equipment support posts with proper clearances as dimensioned on the Drawings, and as called for on manufacturer's shop drawings.

C. Coordinate equipment installation with playground safety surface installation under work of Section 321816.12, PLAYGROUND SAFETY SURFACING.

C. Concrete footings shall be to depth and dimension indicated on the Drawings.

D. Install all members at proper heights, levels, in plumb or horizontal relationships as required. Assemble all structures in conformance with approved shop drawings. Final installations shall be stable, secure and free from any hazardous projections.

E. Touch up finishes damaged during installation with finish kits provided by manufacturer.

3.3 MANUFACTURER'S CERTIFICATION

A. Manufacturer's representative shall provide written certification that all play equipment has been installed in strict accordance with manufacturer's guidelines and standards.

3.4 CLEANING

A. The contractor shall clean the jobsite of excess materials, including post hole excavations.

3.5 DEMONSTRATION

A. Instruct the Owner’s personnel on proper operation and maintenance of playground components.

END OF SECTION

SECTION 129300

SITE FURNISHINGS

PART 1 GENERAL

1.00 GENERAL PROVISIONS

A. Attention is directed to the PROCUREMENT AND CONTRACTING REQUIREMENTS and all Sections within DIVISION 01, GENERAL REQUIREMENTS, which are made a part of this Section of the Specifications.

1.01 WORK INCLUDED

A. Provide all materials and equipment, and do all work necessary to furnish and install the site furnishings, as indicated on the Drawings and as specified.

1.02 RELATED WORK

A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:

1. Section 033001, CAST-IN-PLACE CONCRETE - SITEWORK.
2. Section 044302, GRANITE; Solid granite block base for wood bench top.
3. Section 321413, CONCRETE UNIT PAVING.
4. Section 321440, GRANITE PAVING.

1.03 REFERENCES

A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.

1. American Society for Testing and Materials (ASTM):

A 153	Zinc Coating (Hot-Dip) on Iron and Steel Hardware
D 648	(2001) Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position
D 2990	(2001) Tensile, Compressive, and Flexural Creep and Creep-Rupture of Plastics

1.04 SUBMITTALS

A. Complete shop drawings of each item specified shall be submitted.

B. Where appropriate, and when approved by the Architect, manufacturer's catalogue cuts may be substituted for shop drawings.

C. Submit assembly instruction drawings showing layout(s), connections, bolting and anchoring details as per manufacturer's standards.

D. Access and transport methods for sculptures and artworks shall be submitted for Architect review and approval prior to commencing relocation work.

E. A report of site furnishing parts consisting of recycled materials. Product specification data, providing test information for deflection and creep in accordance with ASTM D 648 and ASTM D 2990 for site furnishings which use plastic lumber as a component, shall be submitted. The data shall provide a comparison of deflection and creep measurements to other comparable materials.

PART 2 PRODUCTS

2.01 MATERIALS

A. Materials shall be the standard products of a manufacturer regularly engaged in the manufacture of such products. The materials provided shall be of a type with proven satisfactory usage for at least 2 years.

2.02 FASTENERS AND HARDWARE

A. Provide manufacturer's standard materials and accessories as required for assembly of units and as indicated on the assembly drawings. Provide unexposed aluminum, stainless steel or steel plates, angles and supports as required for complete assembly. Separate dissimilar materials to prevent electrolytic action.

1. Fasteners and metal components shall be cadmium-plated steel or steel hot-dipped galvanized in accordance with ASTM A 153.

2.03 REUSED SALVAGED MATERIALS

A. Materials previously salvaged under “Demo Contract” were delivered to the Owner at: City of Ithaca Streets and Facilities, 245 Pier Road, Ithaca, NY 14850. Contractor shall arrange with the City for access to salavged materials for reuse under work of this Section.

B. Existing pieces of sculpture and artwork identified on the Drawings shall be relocated and installed to locations indicated on the Drawings. Contractor shall be responsible for any damage that occurs to these pieces during the tranport, delivery and installation process. Pre-demolition photographs were taken under the “Demo Package” contract and will be used for comparison should damage to pieces be claimed by any party.

C. Items to be relocated include, but are not limited to, the following:

1. Sculpture, art, or decorative plaques and signs, including but not limited to:
   a. MLK Statue
   b. Child of Ithaca Statue
   c. City Under Foot Plaques:
      WH Miller, Architect
      Cayuga Tribe
      Underground Railroad
      Cayuga Lake
      Old Library

d. PlanetWalk Piers
   Sun
   Earth
   Mercury
   Venus
   Mars

2. 1896 Manhole cover at Trolley Circle

2.04 BENCH

A. Bench: shall be Escofet “Longo Banco”, manufactured by ESCOFET 1886, S.A. Computer Department, Ronda Universitat 20 (08007) Barcelona, Spain, distributed by Landscape Forms, Route 3, Kalamazoo, MI 49001; Phone (269) 381-0396. Fax (269) 381-3455. Website www.landscapeforms.com. E-mail: specify@landscapeforms.com, Local Rep.: Nadene Parzych, Tel. 978-460-5306; email: nadenep@landscapeforms.com, or approved equal.

1. Material: shall be Flandes Pinewood.
2. Finish: Pinewood (FSC).
3. Anchor: Screws.
4. Support: Bicromated steel with silver powdercoated finish.

2.05 TABLES AND CHAIRS

A. Mounted Table: shall be “Catena” Table, manufactured by Landscape Forms, Inc., 431 Lawndale Avenue, Kalamazoo, Michigan 49048. Toll Free (800) 521-2546. Phone (269) 381-0396. Fax (269) 381-3455. Website www.landscapeforms.com, or approved equal.

1. Table Type: Height from grade to top of table: 29 inches.
2. Diameter: 30 inches.
3. No umbrella hole.
4. Single embedded mounting.
5. Finish: Powder coated steel; Landscape Forms, Inc. “Pangard II”.
   a. Color: “Stormcloud”.

B. Mounted Table with Perforated Table Top with Chess Board Pattern: shall be “Catena” Table, manufactured by Landscape Forms, Inc., 431 Lawndale Avenue, Kalamazoo, Michigan 49048. Toll Free (800) 521-2546. Phone (269) 381-0396. Fax (269) 381-3455. Website www.landscapeforms.com, or approved equal.

1. Table Type: Height from grade to top of table: 29 inches.
2. Diameter: 30 inches.
3. No umbrella hole.
4. Single embedded mounting.
5. Finish: Powder coated steel; Landscape Forms, Inc. “Pangard II”.
   a. Color: “Stormcloud”.

C. Swiveling Chair at Mounted Tables: shall be custom designed fixed swiveling chair, manufactured by Landscape Forms, Inc., 431 Lawndale Avenue, Kalamazoo, Michigan 49048. Toll Free (800) 521-2546. Phone (269) 381-0396. Fax (269) 381-3455. Website www.landscapeforms.com, or approved equal.

D. Movable Table: shall be “Parc Centre” Table, manufactured by Landscape Forms, Inc., 431 Lawndale Avenue, Kalamazoo, Michigan 49048. Toll Free (800) 521-2546. Phone (269) 381-0396. Fax (269) 381-3455. Website www.landscapeforms.com, or approved equal.

1. Type: Round:
2. Diameter: 30 inches.
3. Height: 29-1/2 inches.
4. Free standing with adjustable levelers.
5. Finish: Powder coated steel; Landscape Forms, Inc. “Pangard II”.
   a. Color: “Bluebell”.
6. Material
   a. Table Top: Table tops are made from solid 5/16 steel plate welded to the table support.
   b. Table Support: 2-1/2” outer diameter x 0.120” wall steel tubing. Base plate 17” outer diameter x 0.375” steel.

E. Chair: shall be “Parc Centre” Chair, manufactured by Landscape Forms, Inc., 431 Lawndale Avenue, Kalamazoo, Michigan 49048. Toll Free (800) 521-2546. Phone (269) 381-0396. Fax (269) 381-3455. Website www.landscapeforms.com, or approved equal.

1. Size:
   a. Depth: 21 inches.
   b. Overall Height: 32-1/2 inches.
   c. Width: 18-1/2 inches.
   d. Seat Height: 17-3/4 inches.
2. Stackable
3. Stacking Bumper / Glide:
   a. Width: 0.85 inches.
   b. Length: 1.5 inches.
   c. Height: 0.53 inches.
4. Chair Frame: 7/16” outer diameter steel wire.
   a. With Arms, and
   b. No Arms
5. Seat & Back Panels: ¾” x 0.188” Straps
6. Finish: Powder coated steel; Landscape Forms, Inc. “Pangard II”.
   a. Color: “Bluebell”.

F. Lounge Chair: shall be “Parc Lounge” Chair, manufactured by Landscape Forms, Inc., 431 Lawndale Avenue, Kalamazoo, Michigan 49048. Toll Free (800) 521-2546. Phone (269) 381-0396. Fax (269) 381-3455. Website www.landscapeforms.com, or approved equal.

1. Size:
   a. Depth: 29-7/8 inches
   b. Overall Height: 43-1/4 inches
   c. Width: 23 inches
   d. Seat Height: 17-1/8 inches
2. Chair Frame: 1/2" outer diameter solid 1018 cold drawn carbon steel wire
   a. No Arms, and
   b. With Arms

3. Material
   a. Seat & Back Panel: For exterior or interior applications, made of HRP&O A36 3/4" x 0.188" steel straps.
   b. Stacking Bumper Glide: Size: 0.85" width x 1.5" length x 0.53" height. Made from super-tough nylon to resist damage from dragging on rough surfaces.
4. Finish: Powder coated steel; Landscape Forms, Inc. “Pangard II”.
   a. Color: “Bluebell”.

2.06 MOVABLE PLANTERS

A. Movable Planters shall be Planters Unlimited Modern Rectangle Planter, 48"L x 24"W x 24"H F1-MOD-REC482424, supplied by Hooks and Lattice 6088 Corte Del Cedro, Carlsbad, CA 92011; Toll Free in US 888-320-0626 | Tel: 760-707-5400 | Fax 760-603-0812, or approved equal.

1. Material: Fiberglass
2. Accessories: with wheels and with drainage holes
3. Finish: semi-gloss.
4. Color: two custom RAL colors TBD.

2.07 NEWSPAPER BOX

A. Newspaper Box shall be manufactured by LMG Lucid Mgmt Group Inc., 8105 Birch Bay Square St., Suite #205 Blaine, WA 98230; Telephone: 425-455-1100, or approved equal.

1. Configuration: two paid units; four free units; and one recycle unit.
2. Finish:
   a. Main unit parts are coated with e-coat finish.
   b. Inserts' parts are coated with galvanized coating and powder coat paint.
   c. Color: RAL 8019.

2.08 BIKE RACKS

A. Bicycle racks shall be the “Bola” Bike Rack, manufactured by Landscape Forms, Inc., 431 Lawndale Avenue, Kalamazoo, Michigan 49048; Toll Free (800) 521-2546; Phone (269) 381-0396; Fax (269) 381-3455;Website www.landscapeforms.com; E-mail specify@landscapeforms.com, or approved equal.

1. Size:
   a. Depth: 1-1/2 inches.
   b. Height: 32 inches.
   c. Length: 27-1/2 inches.
2. Mounting: Embedded
3. Material
   a. Outside Diameter: 1.5 inches.
   b. Wall Thickness: 0.120 inches.
4. Finish:
   a. Powder Coated ASTM A513 Carbon Steel.
   b. Color: Manufacturer’s standard color “Stormcloud”.

2.09 SECURITY BOLLARD

A. Security Bollard shall be CALPIPE PDT08080F Carbon Steel High Security Bollard, Embedded Mount, with Flat Steel Top manufactured by Calpipe Security Bollards, 12021 Woodruff Ave., Downey, CA 90241; Tel. 1-877-283-8518; Fax: 562-803-9883; Web: www.calpipebollards.com.

1. Diameter: 8 in.
2. Material: Schedule 80 steel pipe, concrete filled.
3. Height: 36 inches.
4. Top: Flat steel top
5. Mounting: Embedded Mount
6. Finish: Manufacturer's standard RAL 8019 coated finish.

2.10 UTILITY BOLLARD

A. Utility Bollard shall be Morano MOR1215-GS-PB Power Bollard, manufactured by HessAmerica, P.O. Box 28 ·Gaffney, SC 29342-0028.

1. Bollards shall be 9.6" dia., constructed of billet aluminum and galvanized structural steel, 47.8 in. above grade.
2. Finish shall be custom powdercoat finish.
   a. Color: RAL #8019.

2.11 TRASH AND RECYCLING RECEPTACLE

A. Trash and recycling receptacles shall be Big Belly Solar Compactor, manufactured by BigBelly Solar, 50 brook Road, Needham, MA 02494; Tel. 1-888-820-0300, or approved equal.

1. Compactor shall be RoHS compliant
2. Galvanized sheet metal steel interior and exterior construction(recycled content)
3. Heavy duty plastic side panels for dent and scratch resistance (recycled content)
4. Trash Bin: single bin is leak proof made out of low-density polyethylene plastic

B. Dimensions

1. Height: 50.4" (1281mm)
2. Width: 26.1 (664mm)
3. Depth: 25.9" (657mm)
4. Handle Height (ADA Compliant): 41.6" (1056mm)
5. Weight: 300 lbs (136 kg)
6. Trash Hopper Insertion Opening: 6" x 17" (152mm x 432mm)
7. Bin Volume: 32 gallons
8. Liner Bag: 32" H, 92" circumference(recommended thickness at least 2 mil)
9. Conforms to ADAH standards

C. Compaction Features

1. Compaction Force: 1250 lbs. max.(570 kg)
2. Cycle Time: 41 seconds (users can deposit trash during cycle—no lock-out)
3. Motor Size: 1/6-HP DC gear-motor

4. System Voltage: 12 Volts DC
5. Drive System: Gear-motor with chain drive (non-hydraulic); ANSI No. 40 heavy-duty chains
6. Fully automated, IC processor controlled system senses trash level, fullness and machine status
7. 3-color LED status lamps indicate compacted trash level, machine status and error codes
8. Unique design achieves deep ram penetration; Vertical ram travel provides even compaction

D. Photovoltaic System

1. Polycrystalline silicon cell module
2. Nominal Output: 30 Watts
3. Shock-dampening mount system
4. PV panel protected by polycarbonate bubble
5. Spill-proof, sealed maintenance-free 12V battery
6. Charge maintained by Pulse Width Modulator
7. Cordless, self-powered unit requires no wiring
8. Mounting Method; As indicated on the Drawings and in accordance with manufacturer's printed instructions.
9. Mounting Method: shall be surface mounted.Trash and recycling receptacles that can be anchored to resist overturning by typical use, high winds, or animals. Shall be furnished and anchored in accordance with the manufacturer's recommendations.

E. Safety features

1. CE approved
2. Fully interlocked access doors protect users and service personnel
3. Locked front trash removal door
4. Separately keyed service access
5. Fault-tolerant design for trash hopper insertion door prevents access to compaction area
6. Low-voltage system

F. Finish

1. Exterior Finish: manufacturer's standard polyester TGIC powder-coat finish for outdoor and salt-spray durability.

PART 3 EXECUTION

3.01 GENERAL

A. The Contractor shall verify that finished grades and other operations affecting mounting surfaces have been completed prior to the installation of site furnishings. Site furnishings shall be installed plumb and true, at locations indicated,in accordance with the approved manufacturer's instructions.

3.02 ASSEMBLY AND ERECTION OF COMPONENTS

A. Items shall be shipped knocked-down (KD) ready for site assembly. Packaged components shall be complete including all accessories and hardware. New parts shall be acquired from the manufacturer; substitute parts will not be accepted unless approved by the manufacturer. When the inspection of parts has been completed, the site furnishings shall be assembled and anchored according to manufacturer's instructions or as indicated. When site furnishings are assembled at the site, assembly shall not interfere with other operations or pedestrian and vehicular circulation.

3.03 ANCHORAGE, FASTENINGS AND CONNECTIONS

A. Furnish metal work, mounting bolts or hardware in ample time for securing into concrete or masonry as the work progresses. Provide anchorage where necessary for fastening furniture or furnishings securely in place. Provide, for anchorage not otherwise specified or indicated, slotted inserts, expansion shields, and power-driven fasteners, when approved for concrete; toggle bolts and through bolts for masonry; machine and carriage bolts for steel; through bolts, lag bolts, and screws for wood. Do not use wood plugs in any material. Provide non-ferrous attachments for non-ferrous metal. Make exposed fastenings of compatible materials, generally matching in color and finish the fastenings to which they are applied. Conceal fastenings where practicable.

3.04 TESTING

A. Each site furnishing shall be tested to determine a secure and correct installation. A correct installation shall be according to the manufacturer's recommendations and by the following procedure: The Contractor shall measure the physical dimensions and clearance of each installed site furnishing for compliance with manufacturer's recommendations and as indicated. Site furnishings which do not comply shall be reinstalled. Fasteners and anchors determined to be non-compliant shall be replaced. A written report describing the results of the testing shall be provided.

3.05 TABLES, CHAIRS AND BENCHES

A. Examination

1. Examine areas to receive tables, chairs and benches.
2. Notify Architect of conditions that would adversely affect installation or subsequent use.
3. Do not begin installation until unacceptable conditions are corrected.

B. Installation

1. Install tables, chairs and benches in accordance with manufacturer’s instructions at locations indicated on the Drawings.
2. Install tables, chairs and benches level.
3. Where permanent installation is indicated, anchor tables, chairs and benches securely in place.

C. Adjusting

1. Finish Damage: Repair minor damages to finish in accordance with manufacturer's instructions and as approved by Architect.
2. Component Damage: Remove and replace damaged components that cannot be successfully repaired as determined by Architect.

D. Cleaning

1. Clean tables, chairs and benches promptly after installation in accordance with manufacturer's instructions.
2. Do not use harsh cleaning materials or methods that could damage finish.

E. Protection

1. Protect installed tables, chairs and benches to ensure that, except for normal weathering, tables and benches will be without damage or deterioration at time of Substantial Completion.

F.. Concrete footings for pedestals shall be furnished and installed under Section 033001, CAST-IN-PLACE CONCRETE - SITEWORK.

3.06 MOVABLE PLANTERS

A. Planters shall be located as indicated on the Drawings.

B. Plantings and planting materials shall be furnished and installed under Section 329300, PLANTS and Section 329313, PLANTING SOILS.

3.07 TRASH AND RECYCLE RECEPTACLE

A. Examination

1. Examine areas to receive litter receptacles.
2. Notify Architect of conditions that would adversely affect installation or subsequent use.
3. Do not begin installation until unacceptable conditions are corrected.

B. Installation

1. Install litter receptacles in accordance with manufacturer's instructions at locations indicated on the Drawings.
2. Install litter receptacles level.

C. Adjusting

1. Finish Damage: Repair minor damages to finish in accordance with manufacturer's instructions and as approved by Architect.
2. Component Damage: Remove and replace damaged components that cannot be successfully repaired as determined by Architect.

D. Cleaning

1. Clean litter receptacles promptly after installation in accordance with manufacturer's instructions.
2. Do not use harsh cleaning materials or methods that could damage finish.

E. Protection

1. Protect installed litter receptacles to ensure that, except for normal weathering, litter receptacles will be without damage or deterioration at time of Substantial Completion.

3.08 BICYCLE RACK

A. Work shall be executed only by workmen experienced in the trade.

B. Install bicycle racks level and plumb at the locations indicated on the Drawings and in accordance with approved shop drawings. Coordinate bicycle racks installation with installation of the surrounding surface at grade beneath the bicycle racks.

C. Protect bicycle racks from paint spatter, splashed concrete, and other construction damage by wrapping and taping in place plastic sheeting or heavy kraft paper around the bicycle racks until adjacent work is completed. Repair any damage to the painted finish in a manner consistent with manufacturer's recommendations and with the original bicycle racks paint.

3.09 NEWSPAPER BOX

A. Newspapaer Box shall be installed level and plumb at the locations indicated on the Drawings and in accordance with manufacturer's printed instructions. Coordinate installation of newspaper box with installation of the surrounding surface at grade beneath the box.

3.10 UTILITY BOLLARDS

A. Bollards shall be located as indicated on the Drawings. Fixed bollards shall be fastened to the concrete base in strict accordance with manufacturers printed instructions. Bollards shall be positioned in the required location and firmly secured to the base.

PART 4 METHOD OF MEASUREMENT

4.01 UTILITY BOLLARD

A. The quantity to be measured for payment is a single lump sum.

PART 5 BASIS OF PAYMENT

5.01 UTILITY BOLLARD

A. The unit price bid shall include the cost of all labor, material, and equipment necessary to furnish and install the utility bollards, including excavation and backfill, conduit, wiring, foundation, adjustment to finish grade, field testing and warranty, complete, as indicated on the Drawings and specified.

B. Payment will be made under:

ITEM NO.	ITEM	PAY UNIT
129300.01	Utility Bollard	Lump Sum

END OF SECTION

SECTION 131540

WATER FEATURE MECHANICAL

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Conform to Division 01, General Requirements.

1.02 DESCRIPTION

A. Work Included:

1. Materials, labor, equipment and services necessary to furnish and install water feature mechanical systems for the water features. Systems will include jet systems, pipe systems, and valve control systems. Further, these systems include jets, piping, water tight penetrations, valves, meter, strainer, backflow preventer, and specialized hardware for the water feature as shown on the drawings or noted herein. The subcontractor of this work shall be responsible for coordinating and control of the work of section 13 1550 and shall be responsible for the entire operation of the water feature mechanical and electrical system including testing and troubleshooting
2. Commissioning, demonstrating, and adjusting the entire operation of the water features to conform to the Contract Documents.
3. Complete operations and maintenance manuals for each feature..

1.03 WORK FURNISHED BUT NOT INSTALLED UNDER THIS SECTION:

A. Not applicable

1.04 RELATED WORK SPECIFIED ELSEWHERE:

A. Division 01 General Requirements

B. 033001 Cast-in-place Concrete Sitework. for water feature basins and valve pit.

C. Division 31 Earthwork fo Granular base for pipe bedding and backfilling

D. Division 33 Site Utilities for Site Water Supply and Sewer

E. 13 1550 Water Feature Electrical for water feature wiring, conduit, valve controls, servicing, grounding, and bonding.

F. Division 26 Electrical for site lighting

1.05 QUALITY ASSURANCE

A. Qualifications:

1. Water feature mechanical system installer shall have a minimum of 10 years experience in the installation of work of this nature, and has completed a minimum of 5 water features of similar complexity.
2. The equipment supplier shall have a minimum of 10 years experience in the fabrication and supply of specialized fountain equipment and shall work closely with the installer.

B. Regulatory Requirements:

1. All work shall meet or exceed the latest standards of the Uniform Plumbing Code, Health and Safety Code, and all other applicable State and local codes and regulations set by jurisdictional authorities.

C. Materials Standards.

1. ASTM B43-09 red brass pipe schedule 40
2. ASTM B62-09 Bronze cast pipe fittings
3. ASTM B306-81 Copper drainage tube.
4. ASTM B135-82 Seamless copper pipe, standard sizes
5. ASTM B 88-83 Seamless copper water tube.
6. IAPMO IS 21-80 Copper plumbing tube and fittings (installation)
7. ASTM A240 for stainless steel plate 316L
8. UL or ETL listed equipment

1.06 SUBMITTALS

A. Product Data:

1. Provide product data for all specified equipment. Specify and mark all details and options that will be provided. Submit manufacturer's instructions specifically written for this Project. Provide complete submittals for all systems and provide in ringed binder.
2. All equipment submittals to be cross referenced and clearly marked to equipment numbers as specified in part 2 of this document.
3. Alternates shall be approved only during the tender period. Product data shall otherwise be as specified on drawings.

B. Shop Drawings:

1. Provide shop drawings for all custom fabrications. Integrate drawings to reflect coordination for work by other sections and provide input to the shop drawings provided by work of other sections as required.
2. Provide shop drawings of grates, custom pipe manifolds, jets, ss slot drains, and support brackets /angles.

C. Quality Control Submittals

1. Provide written results for pressure tests of all pipe and conduit.
2. Provide certified test report: clearly indicating compliance with Performance requirements specified herein. Pressure test all piping in grade with 50spi for min 3hr duration. Test should hold at full pressure.

D. Contract Close-out Submittals

1. Provide 6 copies of all approved product data, including any approved substitutions.
2. Provide 6 copies of approved shop drawings.
3. Provide 1 original vellum of each as built drawings showing exact pipe routing, pump systems, sizes and materials. Provide Autocad 2010 format .dwg zip file complete with all xrefs, line weight & format styles, & font files. Drawings are to be complete of as built conditions showing inverts at all bends, final pipe locations, existing found conditions, shop drawings, cut sheet submittals.
4. Provide 6 copies of operations and maintenance manuals complete in binders. Provide all also in digital pdf format (2 copies). Manuals shall include the following
   a. Names and complete contact information of installer and all suppliers of various components, manufacturers.
   b. Complete overview sheets outline of daily, weekly, monthly, yearly and other required operations and maintenance.
   c. Approved equipment data sheets complete with operations and maintenance requirements

d. Approved as built drawings
e. Autocad 2010 digital files
f. Folded prints of contract documents
g. Valve charts
h. Provide 6 organized binders for all above submittals, clearly labeling each section.
i. See also section 01700.

E. Additional Removable Parts and Equipment

1. Provide removable caps, covers, keys, and other incidental items as specified on the drawings and in equipment list.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping:

1. Deliver products in original packaging with legible manufacturer's identification
2. Acceptance at Site:
3. Materials to arrive on site in good condition, free of gouges, scratches or dents.

B. Storage and Protection:

1. Place materials in a secure place and in strict accordance with manufacturer's recommendations.
2. In the event of damage or theft of materials, make all necessary repairs and replacements to the approval of the Water Feature designer and at no additional cost to the Owner.

1.08 WATER FEATURE DESCRIPTION AND PERFORMANCE

1. The water features consists of 5 leaking rock groups and 5 mist jet system groups that are programmed and capable of operating independently. All water sprays from rock source inlets and from mist jets drains across feature surface to be collected at low end trench slot drain where the water is drained to nearby sewer. There is puddled water that forms at 3 low points of rock feature. The low points have a narrow slot drain that is piped back to valve pit where a motorized valve is programmed to dump this water on a regular adjustable time interval. There is no standing water on the mist area water feature surface.
2. The jet / leaking rock groups are to be programmed to have maximum 2 groups on at any one time, maximizing water flow at approximately 50gpm at any time.
3. All jets are to have uniform spray height, angle, and appearance. Outer sprays may be adjusted on site as directed to ensure containment. Mist jet sprays will be programmed to be on or off. The 5 groups can operate independently of each other. Programming as per specification section 13 1550.
4. Each jet group section has its own control valve and manual balancing valve for aiding in setup and servicing.
5. All the pipe and conduit slope back to the Valve Pit without traps or as noted otherwise.
6. Pipe at low points in trough as noted shall have valves or easily removable threaded caps or drain plugs to drain systems .
7. All low points of pipe in Valve Pit shall have valved drains piped to sump.

1.09 WARRANTY

C. Warrant the Work of this Section for a period of 1 year from time of acceptance to operate as specified.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Pipe

1. All circulation pipe in grade to be HDPE Series 160 pipe and fittings or as noted.
2. All water supply pipe under pressure and inside valve chamber to be red brass sch 40 or stainless steel #316 sch 40, or copper type L, insulated for condensation. All equipment to be removable without cutting of pipe. Provide flanges or unions at all equipment.
3. All pipe through concrete wall to be Red Brass schedule 40 sealed with Link-seal waterstops or non-shrink grout.
4. Where no valves are noted, provide unions at each piece of equipment to allow for easy removal.
5. All drains to waste to be copper DWV, or as noted.

B. Valves

1. All valves in circulation systems shall be bronze 3 piece full port ball valves, complete with 125lb flanges where shown, Buna-N or EPDM seats, stainless steel handle, 4 min. ANSI class locating bolts for 3”-6” valves, and all bolts and nuts stainless steel #316 as manufactured by Milwaukee Valve, Watts Industries, Jenkins, Apollo, or equal. Valves to fit schedule 40 brass pipe.
2. All valves for drains and copper supply shall be bronze 3 piece solder end or threaded end ball valves, full bore, Buna-N or EPDM seats and packing, for cold water applications. Apollo, Watts, Jenkins, Milwaukee, or equal.

C. Strainers

1. Wye strainers for jets to be stainless steel with 1 ¼” blow down, 20mesh ss strainer basket, Watts 777IS, or accepted substitute.

D. Hardware

1. All hardware cast into concrete including drains and plugs to be bronze #385 or stainless steel #304/316 as note or of approved manufacturer.
2. All hardware in pool to be bonded to meet Code.
3. All fasteners shall be stainless steel #316. All anchors shall be non corrosive water tight epoxy set or equal.
4. Fabricated hardware shall be water tight, continuously welded, of uniform finish or as otherwise specified, free of burrs and sharp edges, and complete with ground lugs. Submit shop drawings for approval.
5. Trench debris screens to be custom fabricated of stainless steel type #316 as per Drawings. Finish to be uniform finish. Submit shop drawings for approval.

E. Pipe Supports

1. Provide concrete thrust blocks at all elbows in grade.
2. All pipe supports to be fabricated of stainless steel in pool or PVC coated steel in pump vault. Place supports at all valves, bends, and suspended apparatus. Place supports on pipe to spacing that meets Code. All supports shall be adequate to support the weights of pipe, equipment, and content.

F. Pipe Water Stops

3. All penetrations through the Valve Pit walls, reservoir walls, and trench drain to be Link-Seal / Centuryline system by Thunderline, or accepted substitute. Provide

Model CS series HDPE sleeves with flange to be cast into wall. Provide Model "C" EDPM Link-Seals to seal between sleeves and pipe. Install as per manufacturers recommendations. Pipe used in conjunction with Link-seal waterstops shall be Sch 80 PVC for all pipe 3" and larger. For pipes 2" and smaller, use stainless steel #304 sch 40 or red brass sch 40 with threaded ends as needed.

2.02 Equipment List: Verify quantities prior to tendering price.

Item	Qty	Description
1	29	Bronze mist jet, complete with custom inserted cone spray nozzle. PEM Fountain #6345, custom drilled and tapped for industrial spray nozzle, Spraying Systems Full cone GG nozzle, 90 degree spray angle, .25" orifice, estimated flow 3gpm@1.5psi, 1/2" NPT, or accepted substitute. 4 Jets are spares.
2	1	2" Water Meter with control valve, strainer, and AMR technology to City of Ithaca Standards, or equal.
3	1	2" bronze wye strainer, complete with 20 mesh stainless steel strainer, 1" NPT blow down, 3" face liquid filled inlet and outlet pressure gauges 0-30psi. Watts 777SI series plus gauges, 1" blowdown valve, and flexible length of 1" hose, or accepted substitute
4	1	2" backflow preventer, reduced pressure principle type, Watts Regulator (617-688-1811) model #909 or equal
5	10	1.5" bronze mist jet / rock source fill valve, slow closing, normally closed, 24vac 1ph Asco Electric #8221 series or equal. Provide continuous duty solenoid valve.
6	10	Automatic flow control unit, 1.5" NPT, rated for 9-36gpm @ 2-32psi, Griswold Flow Control Threaded mini #3534/3538 with cartridges to match design output as per drawings, or equal.
7	5	Custom fabricated red brass 1.5" sch 40 pipe/ cast bronze fittings for rock source manifolds, complete with bronze capped ends, ½"id red brass feeds brazed to 1.5" pipe as detailed. Central 1.5"NPT bronze inlet tee to feed pipe below. Provide loose ½"id x 3" long pipe stubs to be epoxied into underside of rocks. Provide 3/4" Fernco rubber connector couplings complete with all stainless gear clamps for each ½" feed. 7A: 2 x 12 feeds, 7B: 2x 8 feeds, 7C:1x 3 feeds. Submit shop drawings for approval.
8	3	Custom fabricated stainless steel #316L slot drains of 1/8" plate, welded water tight, with spacer tabs at 6" on center, welded watertight to bottom 1.5" solid end pipe with 1.5" NPT central connection. Pipe to have ¼" x 3" slots to allow water to drain into pipe, set at 4" on center along top length. Lengths approx.: 8A: 60", 8B: 58", 8C:18". Provide complete with Fernco 1.5" rubber connector with all stainless gear clamps to connect cast in stub to underside of drain. Provide continuous removable black open cell foam in slot to screen out debris, set top ½" below top. Submit shop drawings for approval.
9	3	Motorized 1.5"NPT rock puddle pool dump ball valve. Valve normally open failsafe. Gemini Valve 24vac 89 series full port complete with manual override, or equal.
10	28	1.5"NPT Red brass sch 40 water stop with stop leak flange and bonding lug. PEM Fountain #6384-1 or accepted substitute.
11	2	Traffic type low voltage push button in watertight box to augment low flow programming of water displays. Details TBD. Interface with controls.

PART 3 - EXECUTION

3.01 SITE INSPECTION

A. Prior to commencing work, coordinate with interface work of other contracts. Review condition of site. Report any conflicts or discrepancies to the Project Manager which would impede work of this section.

3.02 PREPARATION

A. Protect all hardware during installation, providing plugs, caps, and or covers as required.

B. Coordinate with concrete trades for casting in of pipes and equipment, ensuring accurate locations and absolutely plumb placement of all fixtures and metal hardware noted on drawings.

C. Coordinate with electrical subtrade for bonding of all metal within 5'-0" of the pool including rebar & cast in hardware, and wiring and controls of pumps and other electrical equipment.

D. Coordinate with the lighting / submersible junction box supplier / installer for locations and requirements of light units , junction boxes, and low voltage transformer box installation requirements.

E. Coordinate with the metal fabrications contractor for custom metal fabrications as necessary.

F. Coordinate with work of site mechanical for location of drains and water supply.

3.03 INSTALLATION

A. Piping:
   1. Piping in grade shall be installed in granular fill, minimum 6" cover on all sides or as noted otherwise, and as per the manufacturer's recommendations. Prepare pipe granular base accurately with specified fall and to a compaction to avoid settlement. Infill all excavations with structural fill to avoid settlement. Where insufficient cover, encase in lean mix concrete.
   2. Provide concrete thrust blocks at all elbows in grade to meet City of Ithaca standards.
   3. Piping stubbed in niches shall be connected as detailed with rubber couplings.
   4. Slope all pipe to Valve Pit. No traps are permitted unless noted otherwise. All pipe in Valve Pit to be installed without traps and all pipes slope back to low point at pump suction. If traps cannot be avoided as approved by Water Feature Designer, install air release valves at trapped high points.
   5. Provide adequate support for the pipe and it's contents in Valve Pit that will keep the pipe in alignment and without distortion. Place non-corrosive pipe hangers at spacing recommended by code. In reservoir, use all stainless steel hangers.
   6. Piping shall be installed using equal and smooth flow design principals. Layout shall be as per drawings.
   7. Piping shall be installed to account for expansion and contraction. Offset pipe or provide expansion couplings as per manufacturer's recommendations.
   8. Protect and plug all openings in pipe during course of construction. Ensure pipe remains free of debris.
   9. Install valved drains at all low points in system.
   10. All red brass pipe to be threaded ends..
   11. All copper pipe to be solder connected with lead free solder. Insulate in Valve Pit for condensation control.
   12. All HDPE pipe to be installed with compatible insert fittings, double clamped with all stainless gear clamps at each end of joint.
   13. All pipe and fittings to be leak free at time of final inspection.

14. Insulate all copper water supply pipe and red brass pipe with removable 1/2” foam insulation.
15. After making plumbing connections at water features between cast in items and items secured to stones, pressure test to ensure water tight..

B. Equipment:

1. All hardware to be installed plumb, in a professional and workmanlike manner, and to the manufacturer’s recommendations.
2. Place equipment to maximize accessibility to components.
3. Install valves as per manufacturer’s recommendations. Pipe and fittings must be aligned to avoid placing undue pressure on valve housing.
4. All flanges to be connected with stainless steel bolts to diameters and lengths required to meet ANSI specifications.
5. All valves and equipment to be water tight. Repair any leaks.
6. All valves to be full port to match pipe sizes. Valves to operate smoothly from fully open to fully closed position. Valves in closed position must be leak free.
7. All metal equipment in pool must be bonded as per Electrical Code
8. Save all equipment cut sheet and manuals that arrive in components and place in organized binder.

3.04 FIELD QUALITY CONTROL

A. Testing:
1. Pressure test all pipe and assemblies prior to backfilling / completion as recommended by manufacturer. Pressure test at 50 PSI.
2. Pressure test Fernco rubber coupling connections to 10 psi for 1 hr duration.
3. No water loss should occur during tests. Should test fail, repair piping and repeat pressure test until criteria is passed.

3.05 TESTING AND ADJUSTMENTS PRIOR TO ON SITE TEST

A. Adjust PLC timer settings to design criteria.

B. Adjust the spray heights as necessary to keep within intended boundaries if applicable.

C. Adjust plumbness of jets and ensure angle, length, & trajectory of all jets conform to design criteria for spray patterns. All jets in each group to be uniform in appearance, angle, and spray distance.

3.06 ON SITE TEST

A. Coordinate a 1 day and evening site visit with Landscape Architects & Water Feature Designer when all systems are operational. Have jets aimed as shown on drawings. During that visit, spray patterns will be reviewed and adjusted for height, distance, and trajectory. The program sequence will be reviewed and tested with various scenarios. Based on these on site tests, programming will require adjustment. The designers will provide contractor with final programming concept to be implemented by controller programmer.

3.07 ADJUSTMENTS AFTER ON SITE TEST

A. Adjust PLC timer and choreograph settings as directed.

B. Adjust all jet spray patterns to uniform vertical and parallel sprays as directed.

3.08 CLEANING AND PROTECTION

A. Clean entire water feature area and valve pit, removing all debris and sediment. Expect to clean all systems at least 3 times.

B. Prior to operating water, clean and all piping as many times as necessary until all pipes and pool are completely clean.

C. Clean all strainers after cleaning. Mark normal clean pressure.

3.09 DEMONSTRATION

A. Prior to Final Completion, the Contractor shall demonstrate a 7 day fully automated fountain program running a daily uninterrupted time of not less than 12 hours per day. The system shall be clean, and operating as specified.

B. Supervise and be responsible for the demonstration and operation of the equipment. Make no claim for any damage to the equipment during such operation.

C. Demonstrate that all systems are operating as designed. Demonstrate automatic wind sensing control system performs properly at high, medium, and low sensing levels and PLC is properly sequenced with pumps, etc.

D. Provide 2 of any specialized tool required for maintenance of each type of component used in the system.

E. Installer to provide maintenance service for 1 year from date of Final Completion. Provide 1 service call for start-up of system. Provide 1 service call every month after start up for general inspection and adjustment. Provide 1 service call for full shutdown of system. Provide additional service calls for Warranty work.

F. Make service calls within 1 week of written request by Owner. Notify Owner of each service call schedule ensuring that Owner's personnel are present during call. During call, give additional instructions for maintenance if required to Owner's personnel and clearly document instruction in the Owner's operation

3.010 CLOSEOUT

A. At time of close-out, system shall be clean, and operating as specified.

B. Organize s on site and instruct the Owner and representative personnel in the operation and maintenance of the Water Feature Systems, describing components, equipment, servicing, and operations.

C. Be responsible for and instruct the Owner and representative personnel in 1 complete shutdown and 1 complete start up operation. Coordinate and document.

D. Submit all submittals described in Part 1 of the section.

END OF SECTION 13 1540

SECTION 131550

WATER FEATURE ELECTRICAL

PART 1 - GENERAL

1.00 GENERAL REQUIREMENTS

A. Conform to Division 01, General Requirements.

1.01 DESCRIPTION

A. Work Included:
1. Materials, labor, materials, tools, equipment, transportation, temporary construction, and special or occasional services as required to furnish and install complete operational water feature electrical systems. This includes conduit, junction boxes, stub ups, wiring of solenoid & motorized valves, push button controls, field wiring, water feature control/ BMS panel, water feature programming, grounding of all electrical appliances within 10’ of the pool, and bonding of all metal within 5’-0” of water as shown on drawings or noted herein.
2. The work of this section shall be as a subcontract to the work of Section 13 1540- Water Feature Mechanical.
3. Coordinate closely with Water Feature Mechanical Work of Section 13 1540 and electrical work of the general park done under separate Contract.

1.02 WORK FURNISHED BUT NOT INSTALLED UNDER THIS SECTION:

A. N/A

1.03 Work Furnished By Others and Installed Under This Contract:

A. Solenoid valves and motorized valves supplied by 13 15 40

1.04 Related Work Specified Elsewhere:

A. Division 01 General Requirements

B. 033001 Cast-in-place Concrete Sitework. for water feature basins and valve pit.

C. Division 31 Earthwork fo Granular base for pipe bedding and backfilling

D. Division 33 Site Utilities for Site Water Supply and Sewer

E. 13 15 40 Water Feature Mechanical for mist jets, rock source inlets, valves, piping, and metal hardware

A. 16 1100 Raceways for underground construction.

1.05 QUALITY ASSURANCE

A. Qualifications:
1. Water feature electrical system installer shall have a minimum of 10 years experience in the installation of work of this nature, and has completed a minimum of 5 water features of

similar style and complexity.

2. The equipment supplier shall have a minimum of 10 years experience in the fabrication and supply of specialized fountain equipment and shall work closely with the installer.

1.06 Regulatory Requirements:

A. All work shall meet or exceed the latest standards of the National Building Code, National Electrical Code, Health and Safety Code, ASTM, ULC, NFPA, OSHA, and all other applicable codes and regulations set by State, Local, and jurisdictional authorities.

1.07 Materials Standards

1. UL listed compliance and labeling: Comply with applicable UL standards. Provide electrical products certified and labeled by UL or Special Approvals Branch.
2. NEC compliance: Comply with requirements of section 680 of the National Electrical Code and other applicable sections.
3. NEMA Compliance: Comply with requirements of applicable NEMA standards.

1.08 SUBMITTALS

A. Product Data:
1. Provide product data for all specified equipment. Specify and mark all details and options that will be provided. Submit manufacturer's instructions specifically written for this Project.
2. Alternates shall be approved only during the tender period. Product data shall otherwise be as specified on drawings.

B. Shop Drawings:
1. Provide shop drawings for all custom fabrications. Integrate drawings to reflect coordination for work by other sections and provide input to the shop drawings provided by work of other sections as required
2. All equipment submittals shall be clearly marked and coordinated with equipment numbers specified herein.
3. Provide location drawings of all required sleeves and formed openings in cast in place or precast concrete construction.
4. Provide shop drawings of BMS controller and PLC program.
5. Provide shop drawings of complete low voltage solenoid and wind sensor system.

C. Quality Control Submittals

1. Provide certified inspection report: clearly indicating compliance with UL/ NEC requirements.

D. Contract Close-out Submittals
1. Provide 6 copies of all approved product data, including any approved substitutions.
2. Provide 6 copies of approved shop drawings.
3. Provide 2 original Autocad 2010 file & plotted drawing of each as built drawings showing control panel systems, exact conduit routing, valve systems controls, BMS interface, wiring sizes and materials.
4. Provide 6 copies of approved operation and maintenance manuals and 2 copies of complete manuals in .pdf digital format, submitted together with mechanical system submittals.
5. Coordinate with section 01700.

E. Additional Removable Parts and Equipment
1. Provide removable caps, covers, keys, and other incidental items as specified on the drawings.

1.09 SYSTEM DESCRIPTION & PERFORMANCE

A. Operation:
1. The water feature system operation is described in Water Feature Mechanical section 131540.
2. Final programming to be determined after on site demonstration of various modes. See descriptions for water feature control panel
3. The control panel shall operate all solenoid valves automatically by means of a PLC and

have a manual override. The 10 valve mist jet / rock source systems and the 3 rock puddle drain systems shall operate 13 hours per day.
4. The jets shall be interfaced to bollard pushbuttons, 2 per bollard.
5. The PLC controller is to be interfaced with building automation system. Provide on/off contacts for each solenoid valve and for high water alarm in valve chamber.
6. The system is to be grounded and bonded as per Code.

1.10 Testing:

A. The solenoid and motorized valve systems are to be tested and demonstrated that performance will be as specified. Be present at a time during construction to allow 1 day and evening on site demonstration for adjustment of nozzles and sequencing in the presence the Landscape Architect and Water Feature Designer.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping:
1. Deliver products in original unopened packaging with legible manufacturer's identification

B. Acceptance at Site:
1. Materials to arrive on site in good condition, free of gouges, scratches or dents.

C. Storage and Protection:
1. Secure materials in a secure place and in strict accordance with manufacturer's recommendations.
2. In the event of damage or theft of materials, make all necessary repairs and replacements to the approval of the Water Feature designer and at no additional cost to the Owner.

1.12 WARRANTY

A. From the date of Substantial Completion, all materials , equipment, and workmanship must be warranted for a period of 1 year.

B. Defects and deficiencies which originate or become evident during the warranty period must be repaired or replaced at no additional cost to the Contract.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General:
1. Where applicable, the product of a single manufacturer for each type of material shall be used throughout all work specified under this section.
2. All operating and maintenance instructions and part lists shall be furnished with the equipment brought to site. All these items shall be collected in 1 binder and kept in safe accessible storage throughout the construction period.
3. All materials shall be non-corrosive architectural bronze or red brass as noted. Fasteners shall be stainless steel 316 or as otherwise specified.

B. Conduit and Boxes
1. All junction boxes in Valve Pit shall be gasketed PVC UL listed type, complete with compatible connectors. Size of box shall meet code requirements for number of conductors.
2. All conduit for in grade shall be UL listed PVC schedule 40 and to sizes shown. Connections to stub ups shall be with compatible adapters.
3. All conduit in Valve Pit shall be PVC schedule 40.
4. All fittings for PVC shall be bell type unless otherwise specified.
5. All conduit connected to solenoid valves shall be liquid tight flexible non-metallic conduit complete with copper ground wire. Connectors shall be liquid tight, suitable for the conduit used.
6. Conduit supports and straps shall be PVC type or non-corrosive metal.

7. All conduit through slab shall be red brass and taped or stainless steel 304 sch 40 complete with stop leak flanges and bonding lugs as noted on drawings.
8. Warning tape shall be Thomas & Betts 6" polyethylene labeled electric line and suitable for direct burial.

C. Wire and Cable:
1. New type SOW outdoor flexible cable rated for underwater use.
2. New type single conductor stranded copper with 1000v RW90,RWU90,RWU or TWU in conduit for all voltages. Minimum size #12 for power and lighting, #14 for sensors and controls.
3. Bonding cable to be insulated #8 minimum copper stranded wire. All connection points to have cable stripped back locally, connected to bonding clamps with dielectric paste, and recovered with waterproof seal to meet Code.
4. Bonding Clamps: All bronze/brass body and U-bolt, Burndy Electrical or equal.
5. Cable ties: black polyethylene plastic.
6. Wire and cable markers shall be Electrovert type Z (wire), Electrovert type K (cable), or equal.

2.02 Equipment

A. Panels:
1. Panels shall be Nema 4X, shall bear the UL label where applicable, and also be prewired, inspected , and approved by Special Inspections.
2. Equipment as manufactured by Siemens, Allen Bradley, Klockner Moeller, or equal. Panels fabricated by qualified fountain panel builder having minimum 10 years experience in this type of water feature systems.
3. Voltage and characteristics as shown on the drawings.
4. Circuit breakers shall be molded case, trip indicating thermal-magnetic type, rated for 40°C ambient temperature, fixed mounting, with quick break switch mechanism mechanically trip free from the operating handle and conforming to applicable NEMA AB-1 Specifications.
5. Ground fault Current Interrupting circuit breakers, where indicated, shall meet the requirements for molded case, thermal magnetic breakers and shall additionally contain ground fault sensing circuit which shall trip whenever a 5ma imbalance or larger is detected.
6. Nameplates shall be blue laminated plastic, 1"x3.5" with minimum 1/8" white character size. Warning labels shall be same but with red background and white letters.

B. Equipment List: verify quantities prior to submitting price.

Interactive Fountain

Item	Qty	Description
20	5	Traffic push button activator 24vac, bollard mounted, interfaced with water feature control panel. Unit to be IP68 rated, vandal proof, rated for 10 million cycles. Cambell Company 4EVR Round (Black) http://www.pedsafety.com/Piezo_Nonmoving.html or equal. Sensor tripping sets off sequence of jet operations. Provide programming controls to prevent constant cycling. Trip sequence begins a 5 minute (adjustable) sequence of valves operation and then turns off. Trip sequence has 5 second (adjustable) off time prior to being able to be reenergized. Demonstrate potential sequences and duration times. 3 units are spares. Mounting to seatwall to be finalized. Submit shop drawings for approval.
21	28	Wet dry submersible LED 9w/12cac paver light, IP68 rated, 3x3w cool white Led cartridges 90 degree beam spread, complete with bronze 4.5" diameter surface flange with eased edge to minimize tripping issues and 2 flush mounted flange screws to secure to granite stone blow. PEM Fountain C17-002+022 or equal. Secure flange to stone with 2x ss#316 anchors. 5 lights are spares Seal flange to stone. Submit shop drawings of complete typical installation for approval.
22	1	300w 120/12vac pool /spa rated transformer, IntermaticPX300S with Nema 4X enclosure, or equal for lighting.

23 4 Flush mounted bronze junction box with up to 8x ½" conduit connections for lights. PEM Fountain J34 box with 2- 5x ½", 1- 6x1/2", and 1- 7x1/2". All complete with 1" bottom feed from vault and with bonding lug. Pot box with re-sealable 3M potting compound after connections made and tested.

24 1 Water Feature control panel / EMS sub-panel, for Nema 4X, UL listed complete with interface modules and PLC controller and internal dehumidification system.
To control & interface:
- On/off for 10x24vac slow closing normally closed autofill solenoid valves
- On/off for 3x24vac slow closing normally open motorized dump valves signal to close signal to open
- On/off for 23x 12vac LED lights
- Interface with 2x 24vac push button activator.
- All transformers to be pool / spa rated

Panel to include:
- door to have H-O-A switches for each solenoid valve(10x) & each motorized valve(3x)
- H-O-A Switch for water feature lighting
- H-O-A switch for 2x push button activators (only operate June 1-Sept 5?)
- door to have indicator lights for valves and lights on (green),
- Submit shop drawings for approval.

Sequence of operation:
- solenoid to operate from 10am to 10pm dail;y (adjustable)t. During that time, various modes will be required to be programmed into the EMS system. Each jet group will be on site tested in different combinations and different sequences. From those demonstrated combinations, certain arrangements will be chosen and selected. The Design Team will provide the control panel programmer with the final desired sequences to be implemented by the control panel programmer. Some preliminary thoughts on these sequences are as follows:
  - Possible sequences:
- Provide monitoring alarms for pump vault high water alarm
- Allow for up to 75hrs of programming after on site demonstration

C. Equipment Suppliers and Manufacturers

1. Drawings and installation specifications are based on proprietary literature from PEM Fountain Company, Decorative Fountain Company, Square D, Allen Bradley, Siemens, and Klockner & Mueller. Other manufacturers shall comply with the minimum quality standard of material and detailing indicated on the drawings or specified herein.

PART 3 - EXECUTION

3.01 SITE INSPECTION

A. Prior to commencing work, review condition of site and coordinate with interface work of other contracts. Report any conflicts or discrepancies to the Project manager which would impede work of this section.

3.02 PREPARATION

A. Protect all hardware during installation, providing plugs, caps, and or covers as required.

B. Coordinate with concrete trades for casting in of conduit, stub ups, and equipment, ensuring accurate locations and absolutely plumb placement of all fixtures and metal hardware noted on drawings.

3.03 INSTALLATION

A. Cable and Conduit:
1. Conduit shall be installed as per Code, in bedding of 6" minimum granular A on all sides, and as per the manufacturer's recommendations. Backfill remaining excavation with structural fill to avoid settlement.

2. Install conduit in maximum lengths, minimizing joints. Install in granular bedding with minimum 6” cover on all sides. Compact to 98% Standard Proctor density.
3. Provide adequate bends and snaking of pipe to accommodate differential expansion.
4. Slope all conduit to drain. No traps are permitted.
5. In Valve Pit, ensure adequate support for the conduit & cable to the valves. Install in neat and professional manner.
6. Install bond wire to all metal within 5’-0” of water feature. The insulated #6 minimum stranded wire bonding cable to have cable stripped back locally at all connection points, connected to bonding clamps with dielectric paste, and recovered with waterproof seal to meet Code. Connect to concrete rebar grid every 100 square feet or as per NEC 680. Connect to all metal cast in and free standing hardware in pool.
7. Install liquid tight conduit in short length (min 20”) to all moving equipment such as solenoid valves and motorized valves.
8. Install liquid tight conduit from junction boxes in pool jet trenches to direct burial low voltage transformers.
9. All conduit from pool must be self draining with no traps. Ensure that conduits do not drain into control panels or other equipment.
10. Install pull cord in all empty conduit.
11. When bending PVC, ensure that internal diameter is not effectively reduced.
12. In exposed areas, conduit is to be placed parallel to line of building in a professional and workmanlike manner. Group runs and space conduits evenly with 1 conduit space between conduits and make bends concentric.
13. Color code conductors throughout to identify phases, neutral, and ground by means of colored insulation. The colors are to be as follows:
14. 1ph,2 wire (ph,n) = black-white or red-white
15. 1ph,3 wire (ph,ph,n) = black-red-white
16. 3ph,4 wire (A,B,C,n) = red-black-blue-white
17. ac control = red
18. neutral = white
19. ground = green
20. foreign source = yellow
21. Number each wire termination with termination markers
22. Pull wire through conduit using proper cable lubricant. Ensure wires are not twisted or abraded.
23. Protect and plug all openings in conduit during course of construction. Ensure conduit remains free of debris.

B. Control Panels:
1. Mount panels on wall with ½” air space
2. Provide panel in location for easy servicing.
3. All panels to have 3’-0” clearance in front as per Code.
4. All hardware to be installed plumb, in a professional and workmanlike manner, and to the manufacturer’s recommendations.

3.04 FIELD QUALITY CONTROL

A. Certification;

1. Provide certificates of performance for all equipment

3.05 ON SITE TEST / DEMONSTRATION

A. Coordinate a site visit with Landscape Architect & Water Feature Designer when mist jet and rock source systems are operational. Have jets aimed as shown on drawings. During that visit, spray patterns will be reviewed and adjusted for height. Based on these on site tests, high jets may require adjustment and limits of spray heights will be determined.

B. Bollard push buttons are to be tested with various sequences.

C. Demonstrate short programs of various sequences on the mist jet / rock source groups. To be developed by the design team after to onsite demonstration.

3.06 ADJUSTMENTS AFTER ON SITE TEST

A. Adjust control system for each group program sequencing as directed.

3.07 ADJUSTMENTS

1. Adjust PLC timers for desired valve time operations.
2. Provide & adjust solenoid time delays to minimize short cycling of valves.
3. Adjust PLC programming for desired effect for animated mist jet sprays and rock source sprays.

3.08 CLEANING AND PROTECTION

1. Prior to operating system, clean all conduit and electrical equipment.

3.09 CLOSE-OUT

A. At time of close-out, system shall be clean, and operating as specified.

B. Demonstrate the autofill valve and water level sensor operate as designed. Demonstrate entire sequence of operation. Demonstrate animated system controls operate as intended. Demonstrate 1 full week of uninterrupted sequencing of a minimum 12 hour daily duration.

C. Organize a meeting on site and instruct the Owner and representative personnel in the operation and maintenance of the Water Feature System, describing components, equipment, servicing, and winter and summer operations. Be responsible for complete startup and complete shutdown of the electrical equipment in first year of operation. Coordinate meetings with that of Water Feature Mechanical.

D. Submit all submittals described in Part 1 of the section

END OF SECTION 13 1550

SECTION 221113

FACILITY WATER DISTRIBUTION PIPING

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. Attention is directed to the PROCUREMENT AND CONTRACTING REQUIREMENTS and all Sections within DIVISION 01, GENERAL REQUIREMENTS, which are made a part of this Section of the Specifications.

1.02 SUMMARY

A. Extent of water service work includes, but is not limited to the following:
   1. Furnish and install yard hydrants
   2. Furnish and install all water service piping, fittings, and appurtenances necessary for yard hydrant installation.
   3. Furnish and install all water service piping, fittings, and appurtenances necessary to extend domestic and/or fire water services to the interior of basements or areaways. This work includes coring basement walls and installing wall sleeves.
   4. Adjust valve boxes to grade.

B. Contractor shall be responsible for providing evidence of license to install plumbing in the City of Ithaca for personnel involved in the installation of domestic water and fire services.

C. Maintain water service to existing facilities, by Architect/Engineer approved means, for the duration of the contract. The City must approve all work for temporary service prior to installation.

D. Related Sections:
   1. Division 31 Section “Earth Moving”
   2. Division 31 Section “Erosion and Sediment Control”

1.03 QUALITY ASSURANCE

A. Provide pipe, pipe fittings, valves, hydrants, plugs, and all other appurtenances produced in a plant of recognized reputation that is regularly engaged in the production of these materials conforming to the specified standards.

B. Provide pipe, pipe fittings, valves, hydrants, plugs, and all other appurtenances in good quality and free from defects which would make it unfit for the use intended.

C. Provide pipe and pipe fittings, and appurtenances of the same type and of a single manufacturer.

1.04 SUBMITTALS

A. Submit catalog cut sheets and manufacturer's data and shop drawings for all necessary appurtenances.

B. Submit shop drawings, catalog cut sheets, and manufacturer's literature for all pipe and pipe fittings to include coatings and linings, material specifications, dimensions, tolerances, and all related data necessary to the installation of all specified equipment.

C. Submit manufacturer's certification that all appurtenances and pipe meet the required specifications.

D. Submit shop drawings and catalog cuts of adapters for joining of pipes of different materials and for caps and plugs at ends of pipelines.

E. Submit evidence City of Ithaca plumbing license.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Each length of pipe delivered to the site shall be clearly marked at the factory with the name of the manufacturer, class of pipe, pipe diameter and all else as required by the codes, standards, and specifications referred to under this section. Omission of this information will be cause for rejection of pipe.

B. Store all materials in accordance with manufacturer's approved instructions. Store all materials so they can be easily inspected and so they will not be damaged prior to installation.

C. Carefully handle all pipes and fittings when loading and unloading to avoid damage to pipe, coatings, or linings. Pipe or fittings with damaged coatings or linings shall be repaired or replaced by the Contractor at his expense and to the satisfaction of the Architect/Engineer. Lift pipes and fittings by hoists or lower on skid ways in a manner to avoid shock. Lower pipe into trench with derricks, rope, or suitable equipment for the safety and protection of workmen, materials, equipment, property, and the work.

D. Do not dump or drop pipe and fittings. Those that are dumped or dropped are subject to rejection by Architect/Engineer.

1.06 ABBREVIATIONS

CIP	Cast Iron Pipe
CU	Copper Service Tubing
DIP	Ductile Iron Pipe
PVC	Polyvinyl Chloride Pipe

1.07 MATERIAL TESTS

A. Various tests and checks shall be performed, as specified herein, to determine compliance with the specifications and drawings. The Contractor is advised that failure of a test is suitable grounds for the Architect/Engineer to order that portion of the work removed and reconstructed, if necessary, to meet the requirements of the Contract Documents.

1.08 JOB CONDITIONS

A. The Drawings indicate the required pipe sizes and locations of all structures, piping and appurtenances. Verify all locations and immediately notify Architect/Engineer of any discrepancies or conflicts.

B. Contractor shall verify that survey benchmark and intended elevations for the work are as indicated. Contractor shall verify existing site conditions.

C. Utilities shown on the Contract Drawings are for the convenience of the Contractor, exact locations are not guaranteed. The Contractor shall verify existing utilities with the proper authorities.

D. The Contractor shall take precautions to protect from harm the work of other contractors on site, existing facilities, as well as adjacent property. The Contractor shall be responsible for all damage or injury done to pipes, structures, utilities, pavement, buildings, property or person as a result of work to complete this contract. The Contractor at his own expense shall repair or replace such property or item to the satisfaction of the property owner, utility owner, public agency having jurisdiction, Architect/Engineer and Owner's Designated Representative

E. The Contractor's attention is directed to the fact that only designated personnel from the agency with jurisdiction over the existing water main may operate water valves along existing water mains. The Contractor shall be responsible to coordinate with each party.

F. Prior to work at existing mains, the Contractor shall expose the existing water main and have available all labor, materials, and equipment necessary to complete the installation. The existing water main shall not be shut down until, in the opinion of the Architect/Engineer, the Contractor is ready to complete the work. The water main shall only be shut down during the period of time warranted for proper connection and only if a wet tap of the existing water main is not feasible.

G. The Contractor shall coordinate with the Owner’s Designated Representative for any necessary water service shutdowns necessary to complete the work. The date, time, and duration of any service shutdowns shall be mutually agreed upon between prior to start of work.

H. Water line shall be installed in a separate trench from gas or electric utilities.

1.09 PROTECTION OF WATER AND GAS LINES FROM STORM AND SANITARY SEWER

A. Refer to water main notes provided on the Contract Drawings.

PART 2 - PRODUCTS

2.01 MATERIALS – GENERAL

A. Caps and Plugs: Watertight, of similar manufacturer and producing the same joint conditions as the pipe on which the cap or plug is placed.

B. Bedding Materials: Shall be as detailed on the Contract Drawings and as specified in Division 31 Section “Earth Moving”.

C. Pipe Adapters: Join pipes of different materials with adapters specifically manufactured for that purpose and as approved by the Architect/Engineer. Where dissimilar materials join, such that galvanic action may produce corrosion, provide dielectric couplings to preclude damage to the materials.

2.02 DUCTILE IRON PIPE – MECHANICAL OR PUSH ON JOINT

A. All ductile iron materials shall be manufactured in North America. All pipe and fittings shall be new, of good quality, strong, of even grain, and soft enough to permit drilling and cutting. Each pipe shall be free from any defects, which would make it unfit for the use intended. All pipe shall be straight, and a true circle in section with concentric inner and outer surfaces. Only gauged pipe will be allowed. Pipe to be cut during installation shall be fully gauged for field cutting. Pipe metal shall be made without any admixture of cinder iron or other inferior material.

B. All joint hardware used on water mains, pipe fittings, and appurtenances shall be made of cold formed, high strength, low-alloy steel (Cor-ten), with blue fluorocarbon coating, ASTM A242 by Birmingham Fastener, NSS Industries, or Tyler Union.

C. Pipe shall be ductile iron pipe conforming to the latest requirements of ANSI A21.51 (AWWA C151). Pipe class thickness shall be Class 52.

D. Fittings shall be compact ductile iron mechanical joint fittings conforming to the requirements of ANSI A21.53 (AWWA C153). Fittings shall equal or exceed the requirements of the main pipe and shall have a rated working pressure of 350 psi. No push-on fittings shall be allowed.

E. All pipe and fittings shall be cement mortar lined (double thickness) with asphaltic seal coat conforming to ANSI A21.4 (AWWA C104).

F. All pipe and fittings shall also be asphalt coated on the outside surface in accordance with ANSI A21.21 (AWWA C151) for pipe and ANSI 21.53 (AWWA C153) for compact fittings.

G. Pipe joints shall be rubber gasket push-on, mechanical joint, or mechanical joint anchoring type. All pipe joints shall conform to the requirements of ANSI A21.11 (AWWA C111). Lead tipped gaskets shall not be allowed.

H. Mechanical joint wedge action retainer glands for ductile iron pipe shall be manufactured according to ASTM A536, and hardware shall be cold formed, high strength, low-alloy steel (Cor-ten), with blue fluorocarbon coating, ASTM A242. Set screws are to be heat treated AISI 4140 steel cup point with square head. Bolt pattern shall be compatible with standard mechanical joint fittings. Retainer shall have fusion bonded epoxy coated body and glands. Retainer glands necessary to make proper connections between the mechanical joint fittings and push-on joint pipe shall be provided. Retainer glands shall be Megalug as manufactured by EBBA Iron Sales, Inc., Uni-flange as manufactured by Ford Meter Box Co., or One-Lok D-SLDE as manufactured by Sigma Corporation.

I. Gaskets shall be synthetic rubber for use with water supply applications. An adequate number of gaskets shall be furnished for the amount of fittings supplied.

J. The manufacturer's mark, nominal diameter of openings, and the number of degrees or fraction of the circle on all bends, shall be distinctly cast on the fittings. The pressure rating shall be distinctly marked on the fittings. Ductile iron fittings shall have the letter "DI" or "Ductile" cast on them.

K. Acceptable DIP pipe manufacturers include U.S. Pipe & Foundry, Clow Water Systems, or Griffin Pipe Products.

2.03 POLYETHYLENE TUBE ENCASEMENT

A. Polyethylene tube encasement, 8 mil thick, and polyethylene adhesive tape shall be required for ductile iron pipe encasement on hydrant anchor pipe. Material and installation procedures shall

be as specified in ANSI/AWWA C105/A21.5. Polyethylene encasement shall be manufactured by All American Poly, Repcor, or Infinity Plastics.

2.04 THRUST RESTRAINT

A. Concrete used for thrust blocks, pipe cradles, and pipe encasements shall conform to the requirements for NYSDOT Class A concrete per Standard Specification Section 501 except contain no fly ash.

2.05 YARD HYDRANT

A. Yard hydrant shall be non-freeze type with cast iron, above ground, lockable operating head and/or handle, 3/4 inch brass male hose nozzle, shutoff valve that operates below the frost line and is capable of draining when closed and shall have a 5 feet minimum bury depth. The hydrant shall be capable of operating at working pressures up to 125 p.s.i.

B. Yard hydrant shall be Murdock Super Secur, Post Hydrant, Model M-E10. Contractor shall coordinate color with Owner and/or Architect/Engineer prior to ordering materials.

C. Drainage material for base of yard hydrant shall be a washed stone or pea gravel no less than 3/8” average diameter and no greater than 1/2" average diameter.

2.06 COPPER PIPE

D. Tubing: seamless copper water tubing in accordance with ASTM B88 latest revision. For underground installation, soft annealed Type K. Furnish in straight lengths or coils as required.

E. Type L Copper shall be used in above ground locations.

F. Service fittings or couplings shall be compression type copper to copper, Mueller H-15403 as manufactured by Mueller Co., Ford C44 as manufactured by The Ford Meter Box Company, Inc. or Cambridge 119 as manufactured by Cambridge Brass, Inc.

2.04 WARNING TAPE

A. Provide detectable warning tape. Refer to Division 31 Section “Earth Moving”.

2.05 CONNECTIONS TO EXISTING PIPELINES

A. Connect to existing main as shown on the Contract Drawings. Where no details of the connections are shown, submit a proposal for approval, showing fittings, adapters, and procedures used.

PART 3 - EXECUTION

3.01 PREPARATION

A. The Contractor shall verify that points of connections to existing pipes have been excavated, elevations taken and given to the Architect/Engineer, and the Architect/Engineer has issued an authorization to proceed with the work as shown, or with modifications.

B. Thoroughly clean interiors of pipes, fittings, and appurtenances, joint surfaces, and gaskets prior to installation. Maintain pipes and fittings clean.

C. Verify that excavation is in the proper location, that pipes and structures have been installed at the correct elevations and that the subgrade has been properly prepared.

3.02 PIPE INSTALLATION - GENERAL

A. Install water lines to the required lines and grades indicated on the Drawings or as directed by the Architect/Engineer using an approved method of control. The location, lines, and depths of the pipelines, valves, and other appurtenances shown are approximate only; actual locations, lines, and depth shall be as directed by the Architect/Engineer at the time of installation.

B. For underground piping, the trench shall be excavated to the required alignment and width, and to a depth that will assure the minimum cover over the top of the water main pipe after construction has been completed. Excavation and backfilling shall conform to the requirements of Division 31 Section “Earth Moving”.

C. Pipe and fittings shall be installed in accordance with the requirements of ANSI/AWWA C-600 for ductile iron pipe according to manufacturer's latest instructions and as approved by the Architect/Engineer.

D. Carefully lower pipes, fittings and structures into the trench. Apply joint lubricant (if required) in accordance with the approved manufacturer's recommendations. Join pipe sections and fittings. Join pipe and structures.

E. Select pipe and fittings so that there will be as small a deviation as possible at the joints and so that inverts present a smooth surface. Pipe and fittings, which do not fit together to form a tight fitting joint, are not permitted.

F. Use only mechanical cutters for cutting pipe.

G. Maintain cleanliness of installed pipe, fittings and structure interiors throughout the work. Plug ends when installation is not in progress so that dirt, foreign matter, water, animals and people do not enter the work. Drainage of construction excavations through installed pipes shall not be permitted.

H. Maintain the excavation free of water during the progress of the work. No pipes or structures shall be laid in water nor shall there be any joints made up in water. No separate allowance for pumping or otherwise removing water will be made. All slides or cave-ins of the trenches or cuts shall be remedied at the expense of the Contractor, and to the satisfaction of the Architect/Engineer.

I. Dead ended lines shall be fitted with approved watertight plugs or caps specially manufactured for that purpose.

J. The Architect/Engineer may inspect each stretch of completed pipeline and structure prior to backfilling. The Contractor shall not continue with backfilling operations prior to inspection by the Architect/Engineer and utility representatives.

K. When unsuitable materials and/or conditions are encountered, the Architect/Engineer may direct the excavation to continue below grade and the trench filled with crushed stone, or the Architect/Engineer may order other corrective measures.

L. Detectable warning tape shall be placed in the open trench (above the water main or service) at a depth as shown on the Contract Drawings. The tape shall run continuously along the centerline of the water main or service, with wording facing up.

3.03 CIP AND DIP INSTALLATIONS

In addition to the general requirements of this Section, comply with the following:

A. Pipe and fittings shall be installed in accordance with the requirements of ANSI/AWWA C600 and according to manufacturer's latest printing instructions. No plugging, filing, burning in, or welding of pipe will be allowed.

B. Ductile Iron Pipe - In laying mechanical joint or push-on type pipe, take care that the spigot is centrally located in the bell. All surfaces with which the rubber gasket comes in contact shall be brushed thoroughly with a wire brush just prior to assembly, to remove all loose rust or foreign material, which may be present. The same surfaces and rubber gasket shall be brushed with lubricant just prior to slipping the gasket over the spigot end and into the bell.

C. When tightening bolts on mechanical joint pipe, it is essential that the gland be brought up toward the pipe flange evenly, maintaining approximately the same distance between the gland and the face of the flange at all points around the socket. This may be done by partially tightening the bottom bolt first, then the top bolt, next the bolts at either side, and last, the remaining bolts. Repeat this process until the proper joint tightness is attained.

3.04 ANCHORING PRESSURE PIPES

A. All fittings (e.g. tees, bends, offsets, plugs etc.) shall be solidly braced to prevent any movement due to thrust pressure. Bracing shall be accomplished with the use of cast-in-place concrete between the fittings and undisturbed soil. Thrust block dimensions shall be as shown on the detail drawings. Thrust blocks are not required at hydrant base elbows. All fittings shall require mechanical restraint (e.g. mechanical retainer glands, etc) in addition to concrete thrust blocks. Appropriate materials and installation methods shall be used for mechanically restrained joints.

3.05 CONNECTION TO EXISTING PIPELINES

A. Connect to existing pipelines in accordance with the Drawings, or as directed by the Architect/Engineer. Provide necessary adapters and specials required to make the connections.

B. Copper tubing shall be connected to corporation stops, curb stops and to existing service pipe and stops by using approved and appropriate gaskets, joint and connection materials, or fittings required to make the connection.

C. Do work at such times and in such a manner as to cause a minimum of interruption to existing services. Services damaged by work under this Contract shall be repaired immediately at no additional cost to the Owner.

D. All pipe shall be cut by an approved power saw which will produce a clean, true cut, with a smooth end at right angles to the axis of the pipe. All cut ends shall be beveled.

3.06 GENERAL INSTALLATION - APPURTENANCES

A. Valves, hydrants and appurtenances shall be stored under cover and kept drained of water.

B. Valves shall be installed with their operating stems in a vertical position. Bedding under valves shall be well compacted and firm. Concrete support blocks shall be level.

C. Buried valves shall have valve boxes or curb boxes installed centered and vertical over the valve or curb stop. The Contractor shall brace all boxes to ensure they remain in a vertical position after backfilling. The upper section of the boxes shall be adjusted to finished grade or as directed by the Architect/Engineer.

D. After trench backfilling has been made and allowed to consolidate, the valves, curb stops, post indicators, valve boxes and curb boxes shall be checked for vertical setting and shall be reset if found out of line.

E. The Contractor is responsible for maintaining and keeping hydrants, valves, valve boxes, curb stops, curb boxes, post indicators, corporation stops, and all appurtenances clean, free of debris and in the proper alignment until completion of the Contract.

F. All valves shall be joined to the pipeline with mechanical joints.

G. Hydrants shall be oriented with pumper nozzles at right angles to the curb or pavement surface (or as otherwise directed by the Architect/Engineer). All hydrants shall have bolts tightened. The Contractor shall maintain the alignment of hydrants until completion of the project and shall make necessary adjustments so that the hydrant will project the proper height over finished grade as indicated on the Contract Drawings. All hydrants shall be installed vertical and plumb at the elevation required so the breakaway flange is located above grade.

H. When installation and clean up are complete, Contractor shall remove all loose scale and foreign matter on the hydrant and paint all new or relocated hydrants per the requirements of the authority having jurisdiction. Hydrants shall be coated with two coats of rust-resisting tar below grade.

I. The hydrant drip shall be arranged to drain to a pocket filled with crushed stone. Hydrant weep holes shall not be plugged unless groundwater is encountered within 7 feet of finished grade. An L-shaped plate for identification shall be attached to all hydrants where weep holes have been plugged.

3.07 YARD HYDRANT

A. Yard hydrant shall be installed in accordance with manufacturer’s recommendations. Contractor shall report discrepancies between manufacturer recommendations and these specifications to the Architect/Engineer prior to installation of the yard hydrant.

B. Yard hydrant shall be installed such that the nozzle be no less than 24” from the finished surface and no greater than 30” from the finished surface.

C. Yard hydrant shall be installed such that the shut off valve be no less than 5’ below the finished surface.

D. Water service connections shall be made with the appropriate appurtenances as approved under this specification.

E. A minimum of one cubic foot of washed stone drain material to be installed around the valve at the base of the hydrant.

F. Overall installation shall be tested for leaks under line pressure in the presence of the Owner's representative, to verify all connections are watertight and free from leakage, prior to backfill.

G. Yard hydrant shall be carefully set and braced to insure that it remains in a vertical/plumb position during and after backfilling. Backfilling shall be made such that there is no settlement in accordance with specification 312000.

3.08 TESTING OF WATER MAINS

A. The Contractor shall conduct a pressure test of the water main after all appurtenances required in the work for the section to be tested are installed. The length of section to be tested shall be approved by the Architect/Engineer. Whenever conditions permit, as determined by the Architect/Engineer, the water main shall be tested before the trench is backfilled. The pressure test shall be witnessed by the Architect/Engineer or his designated representative.

B. The pressure test shall be done in accordance with the requirements of Section 4 of ANSI/AWWA C600 for ductile iron pipe and Section 7 of ANSI/AWWA C605 for PVC pipe. Prior to the test, the Contractor shall submit the proposed testing methods and equipment, in writing, for the Architect/Engineer's approval. Testing equipment shall be approved by and calibrated to the satisfaction of the Architect/Engineer. The Contractor shall furnish all pumps, meters, plugs, caps or other necessary equipment to conduct the test.

C. The section of pipe to be tested shall be filled with water of potable quality and all air shall be expelled from the pipe. The Contractor shall make all taps, as necessary, for releasing all of the air and for all test purposes as may be required. Taps may be installed during the laying of the water main.

D. For the pressure test, the Contractor shall raise the water pressure (based on the elevation at the lowest point in the section under test and corrected to the gauge location) to a minimum pressure of 150 pounds per square inch gauge for domestic water mains.

E. The required pressure shall be maintained for an uninterrupted period of two hours. Unless otherwise noted, the volume of water required to maintain the specified pressure as measured by the Architect/Engineer shall not exceed the limits determined by the following formula as defined in Section 4 of ANSI/AWWA C600:

$$L = \frac{SD\sqrt{P}}{133{,}200}$$

in which L is the allowable leakage in gallons per hour; S is the length of water line tested; D is the nominal diameter of the pipe, in inches; and P is the average test pressure during the leakage test in pounds per square inch gauge.

F. If a section should fail to pass the pressure test, the Contractor shall do everything necessary to locate, uncover, and replace any defective material or work to the satisfaction of the Architect/Engineer, at his own expense and without extension of time for completion of the Work. Repeated tests and repairs shall be made until the section passes the specified tests.

3.09 DISINFECTION OF WATER LINES/WATER SERVICES

A. Tapping sleeves & valve and insertion valves: All parts of the tapping equipment which will come in contact with the water on the existing main shall be washed in a chlorine solution before using.

B. Cut-in Valves: All parts of the equipment or materials exposed to the existing main, as well as the exposed existing main shall be washed in a chlorine solution before using.

C. Valves, curb stops, corporation stops, and hydrants shall be tested prior to backfilling in accordance with specifications below. All valves shall be operated during the testing and disinfection.

D. After a section of water main has been pressure tested and found acceptable, it shall be thoroughly flushed by the Contractor. Minimum flushing velocity shall be 2.5 feet per second.

E. Flows to produce a minimum velocity of 2.5 feet per second:

Pipe Size (Inches)	Flow (gpm)	Hydrant Openings @ 40 psi
4	100	one - 2-1/2"
6	220	one - 2-1/2"
8	390	one - 2-1/2"
10	610	one - 2-1/2"
12	880	one - 2-1/2"
16	1,570	two - 2-1/2"
18	1,980	two - 2-1/2"
24	3,530	one - 4-1/2" and one-2-1/2"

F. Upon completion of flushing, the Contractor shall disinfect the main, services, valves, and hydrants with chlorine solution in accordance with the requirements of AWWA C651 (Item 5.1 deleted) and in accordance with the New York State Department of Health using the continuous feed method. The strength of this solution shall be such that a residual of at least twenty-five (25) mg/l of chlorine shall be retained in the main after twenty-four (24) hours.

G. The interiors of all appurtenances and sections of water main that cannot be normally disinfected shall be swabbed by the Contractor to the satisfaction of the Architect/Engineer with a concentrated chlorine solution containing not less than 200 ppm of free chlorine before installation.

H. Disinfect all existing water lines, services, and appurtenances, which were broken, damaged, contaminated, or suspected of being contaminated as a result of work done in conjunction with this project.

I. Following disinfection, all treated water shall be thoroughly flushed from the main (minimum flushing velocity 2.5 feet per second) and bacteriological samples for total and fecal coliform and standard bacteria plate counts analysis shall be taken by an Architect/Engineer approved, Contractor-provided independent NYS Health Department approved testing laboratory. When the field free chlorine residual is less than 1.5 mg/L, two sets of samples taken 24 hours apart shall be collected from the main and from each branch. The samples will be analyzed by a NYS Health Department approved laboratory and copies of the tests forwarded to the Architect/Engineer. The main shall not be placed in service until the water has been approved for service by the Architect/Engineer.

J. If the tests results are unsatisfactory, additional flushing shall be done by the Contractor or the main shall be re-chlorinated, or both until further testing indicates the results are satisfactory. All additional testing shall be at the Contractor's expense.

3.10 TESTING OF WATER SERVICES (2" AND SMALLER)

A. Prior to backfilling the trench, water service work, including but not limited to connections, joints and unions, shall be tested for leaks under line pressure in the presence of the Architect/Engineer. Any defective work shall be repaired and retested until installation is accepted by the Architect/Engineer.

3.11 WATER VALVE BOX ADJUSTMENT

A. Prior to adjustment, the water valve box shall be checked for proper installation and alignment. Any discrepancies discovered during this process shall be brought to the attention of Architect/Engineer.

B. Prior to installation of surface treatment, the Contractor shall determine the top elevation of all valve boxes. Any discrepancies between what is indicated on the proposed plans and that constructed in the field shall be brought to the attention of Architect/Engineer.

C. Contractor shall adjust water valve box to the elevation necessary for final surface treatment.

D. Contractor shall be responsible to correct any elevation change between final surface treatment and valve box lid greater than 1/4".

3.12 FIELD QUALITY CONTROL

A. In the presence of the Architect/Engineer inspect each length of pipe and each structure delivered to the job for flaws, cracks, dimensional tolerance and compliance with the applicable specifications. Only pipes, fittings and structures accepted by the Architect/Engineer and so marked shall be installed in the work. Segments of polyethylene tubing having cuts or gouges in excess of 10% shall be cut out and removed. Undamaged portions shall be rejoined.

B. The Contractor shall inspect pipe joints and verify that they have been properly installed and made up, and free from sags, high spots, and excessive deflections.

3.13 DAMAGED FACILITIES

A. Any section of piping that is found defective in material, alignment, grade, joint, or otherwise, shall be corrected at no additional cost to the Owner.

B. In the event that dirt, debris, or any other foreign material has entered any portion of the piping or structures, flush the piping or structure with clean water. Continue the flushing process until the piping or structure is clean, as determined by Architect/Engineer.

C. Any damage done to existing utility mains their appurtenances as result of work under this contract shall be repaired or replaced by the Contractor to the satisfaction of the Architect/Engineer at no additional cost to the Owner.

PART 4 – METHOD OF MEASUREMENT

4.01 ALL ITEMS

A. The quantity to be measured for payment is the number of units installed, adjusted, relocated, replaced or removed as noted under Basis of Payment.

4.02 WATER MAIN PIPE

A. Quantity to be measured for payment shall be number of linear feet of water main pipe installed as measured along centerline of water main pipe, beginning with face of hub forming commencement of new work and extending to face of hub or spigot constituting end of that particular line of water main pipe.

B. Hydrant branch water pipe and water service pipe 4 inches and larger will be measured and included for payment as water main pipe. Quantity to be measured for payment shall be number of linear feet of hydrant branch water pipe and water service pipe installed as measured from centerline of water main pipe to which hydrant branch water pipe and water service pipe is connected, along centerline of hydrant branch water pipe and water service pipe to face of hub or spigot constituting end of that particular hydrant branch water pipe and water service pipe line.

4.03 COPPER WATER SERVICE

A. The quantity to be measured for payment shall be the number of linear feet of water service tubing installed.

4.04 CORED PENETRATION

A. The quantity to be measured for payment shall be the number of completed cored penetrations into existing buildings.

4.05 CONNECT WATER SERVICE TO EXISTING INTERNAL WATER PIPING

A. The quantity to be measured for payment shall be the number of connections actually made.

PART 5 – BASIS OF PAYMENT

5.01 ALL ITEMS

A. The unit price bid for all items shall include the cost of all labor, material, and equipment necessary to complete the work. Excavation, bedding, and backfill is included in the unit price bid. Removal of existing abandoned utilities or structures, as required to complete the work, is included in the unit price bid. Surface restoration, where applicable, will be paid for separately under their appropriate item.

5.02 DUCTILE IRON PIPE, ANCHOR PIPE, AND FITTINGS

A. Unit price bid for all items shall include cost of: water pipe; water pipe fittings; water pipe specials; shop- drawings; hardware; warning tape; concrete thrust blocks; encasement; controlled density fill; joint materials; making water pipe joints; joint restraining devices; furnishing, installing and removing disinfection/sampling taps; blow-off taps; tapping saddles for disinfection/sampling taps and blow-off taps; pressure testing; disinfection, flushing and health sample testing and fees; pavement saw cutting; additional excavation and backfill required for testing and disinfection purposes; preparation and distribution of service interruption notices; and pipe installation records.

B. Unless provided for under separate payment items in Contract Documents, cost of furnishing, installing, maintaining, and removing temporary water pipes, valves, plugs, taps, corporation stops, curb stops and boxes, blow-off water pipes, and other fittings necessary for construction of

new water main, or for providing continuous water service, shall be included in unit price bid for water main pipe.

C. Partial payment of eighty (80) percent of unit price bid will be made for installed water main pipe that has not satisfactorily passed pressure and health tests. Remaining twenty (20) percent will not be paid until water main installation has passed both pressure and health tests and has been accepted by the Health Department and City of Ithaca.

D. Unit price bid shall also include cost of: furnishing and installing ductile iron pipe and fittings, anchor pipe and fittings, anchor tees, and polyethylene tube encasement (including adhesive tape).

5.03 VALVE AND CURB BOX ADJUSTMENT

A. Unit price bid includes cost of verifying proper installation, checking assembly for defects, determining top elevation, and final adjustment to finished grade and alignment.

5.04 YARD HYDRANT

A. Unit price bid includes cost of: furnishing and installing yard hydrant, washed stone drain/bedding, connecting yard hydrant to water service, and associated testing.

5.05 COPPER WATER SERVICE

A. The unit price bid shall include the cost of: shutting down the existing water service, when required; furnishing and installing all water service tubing; pipe specials; flared connections; compression connections; gasket fittings; joint and connection materials; connection to new corporation stops, curb stops, or meters; flushing; connection to existing service; bitumastic coating for copper service; disposal of existing service pipe when removed, removal and disposal of existing curb stop and box where required; verifying location and disposition of water services; preparation and submittal of water service record information; pavement saw cutting; and pressure testing.

B. In those cases where tunneling is used in lieu of, or in combination with open trenching, payment for tunneling shall also be included in the unit price bid for water service.

5.06 CORED PENETRATION

A. The unit price bid shall include the cost for planning and coordinating the work necessary for each penetration with property owners, coring of foundation walls, installing and grouting wall pipe in place, installing carrier pipe and link seal, seal and calking penetration, mastic coatings, and repair of existing surface finish on interior finished walls.

5.07 CONNECT WATER SERVICE TO EXISTING INTERNAL WATER PIPING

A. The unit price bid shall include the cost of obtaining meter from the City, furnishing and installing the meter setter, installing meter, connection to existing piping system, and all necessary joints, piping, specials, and fittings.

Payment will be made under:

ITEM NO.	ITEM	PAY UNIT
221113.00XX	X" Ductile Iron Pipe Water Main Class 52 (Including Polyethylene Encasement, Excavation, and Backfill)	Linear Foot
221113.1401	New 3/4" Copper Water Service (Including Excavation and Backfill)	Linear Foot
221113.1402	New 2" Copper Water Service (Including Excavation and Backfill)	Linear Foot
221113.1404	New 1.5" Copper Water Service (Including Excavation and Backfill)	Linear Foot
221113.1405	New 2" Copper Water Service (Including Excavation and Backfill)	Linear Foot
221113.26	Yard Hydrant (Including Excavation and Backfill)	Each
221113.30	Adjust Existing Water Valve Box to Grade (Including Excavation and Backfill)	Each
221113.40	Adjust Existing Curb Box to Grade (Including Excavation and Backfill)	Each
221113.50	Cored Penetration of Existing Building for 0.75” to 2" Water Service (Including Excavation and Backfill)	Each
221113.60	Cored Penetration of Existing Building for 4” to 6" Water Service (Including Excavation and Backfill)	Each
221113.70	Connect New 1” to 2” Water Service to Existing Internal Water Piping (Including meter setter and meter, meter provided by City)	Each

END OF SECTION

SECTION 260010

BASIC ELECTRICAL WORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this and the other sections of Division 26.

1.02 SUMMARY

B. This Section includes general administrative and procedural requirements for electrical installations. The following administrative and procedural requirements are included in this Section to expand the requirements specified in Division 1:

1. Submittals.
2. Record documents.
3. Maintenance manuals.
4. Rough-ins.
5. Electrical installations.
6. Cutting and patching.
7. Codes, Permits and Inspections.

1.03 SUBMITTALS

C. General: Follow the procedures specified in Division 1 Section "SUBMITTALS."

B. It is the responsibility of the contractor to assure that all submittals meet or exceed the written specification for that item. The submittal shall be complete and provide comprehensive information so that there is no question or doubt concerning the size, model, color, etc. of the equipment to be provided.

1.04 RECORD DOCUMENTS

D. Prepare record documents in accordance with the requirements in Division 1 Section "PROJECT CLOSEOUT." In addition to the requirements specified in Division 1, indicate installed conditions for:

8. Major raceway systems, size and location, for both exterior and interior; locations of control devices; distribution and branch electrical circuitry; and fuse and circuit breaker size and arrangements.
9. Equipment locations dimensioned from prominent building lines.
10. Approved substitutions, Contract Modifications, and actual equipment and materials installed.

1.05 MAINTENANCE MANUALS

E. Prepare maintenance manuals in accordance with Division 1 Section "PROJECT CLOSEOUT." In addition to the requirements specified in Division 1, include the following information for equipment items:

11. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
12. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions.
13. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and re-assembly; aligning and adjusting instructions.
14. Servicing instructions and lubrication charts and schedules.

1.06 STORAGE AND HANDLING

F. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

1.07 QUALITY ASSURANCE

A. All Electrical Components, Devices, and Accessories shall be Listed and labeled as defined in NFPA 70, Article 100, by Underwriters Laboratories or a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 1 - PRODUCTS

2.01 FIRESTOPPING - Comply with firestopping requirements as specified in Division 26 section titled “Penetration Firestopping”.

PART 3 - EXECUTION

3.01 ROUGH-IN:

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

B. Refer to equipment specifications in Divisions 2 through 16 for rough-in requirements.

3.02 ELECTRICAL INSTALLATIONS

C. General: Sequence, coordinate, and integrate the various elements of electrical systems, materials, and equipment. Comply with the following requirements:

15. Coordinate electrical systems, equipment, and materials installation with other site components.
16. Verify all dimensions by field measurements.

17. Arrange for chases, slots, and openings in other site components during progress of construction, to allow for electrical installations.
18. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
19. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the Work.
20. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
21. Coordinate connection of electrical systems with exterior underground utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
22. Install systems, materials, and equipment to conform with approved submittal data to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements refer the conflict to the Engineer for resolution.
9. Install electrical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
230. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

3.03 CODES, PERMITS AND INSPECTIONS

D. Make installation in accordance with the latest revision of the National Electric Code (NFPA 70) and codes of any governing body having jurisdiction over the construction.

E. All tests, inspections, permits and fees required for the electrical portion of the Contract, and as outlined under this Section, shall be obtained and paid for under this Section.

F. After completion of the work, furnish the Owner with a Certificate of Final Inspection from an inspection agency acceptable to the authority having jurisdiction at each project location. Final payment will not be approved without certification from a Third Party Inspection Agency.

3.04 CUTTING AND PATCHING

G. General: Perform cutting and patching in accordance with Division 1 Section "CUTTING AND PATCHING." In addition to the requirements specified in Division 1, the following requirements apply:

24. Perform cutting, fitting, and patching of electrical equipment and materials required to:
    a. Uncover work to provide for installation of ill-timed Work.
    b. Remove and replace defective Work.
    c. Remove and replace Work not conforming to requirements of the Contract Documents.
25. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.
26. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.
27. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.

3.05 SELECTIVE DEMOLITION

H. General: Demolish, remove, demount, and disconnect all existing electrical materials and equipment. Remove all electrical work made obsolete by new installations.

B. Disposal and Cleanup: Remove from the site and legally dispose of demolished materials and equipment.

C. Salvaged Materials: Remove and protect materials indicated to be reinstalled.

PART 4 – METHOD OF MEASUREMENT

4.01 CONNECTION TO EXISTING ELECTRIC NETWORK

I. The quantity to be measured for payment is the number of connections made from NYSEG power point to electric utility enclosure. This item does not include temporary power connections necessary during construction.

4.02 DEMOLITION OF EXISTING LIGHTING SYSTEM AND TEMPORARY LIGHTING SYSTEM

A. The quantity to be measured for payment is a lump sum for each item.

PART 5 – BASIS OF PAYMENT

5.01 ALL ITEMS

A. The unit price bid for all items shall include the cost of all labor, material, and equipment necessary to complete the work. Excavation, bedding, and backfill is included in the unit price bid. Removal of existing abandoned utilities or structures, as required to complete the work, is included in the unit price bid. Surface restoration, where applicable, will be paid for separately under their appropriate item.

5.02 DEMOLITION OF EXISTING LIGHTING SYSTEM

A. The unit price bid shall include the cost of de-energizing existing street lights, removal and salvage of existing light poles and luminaires, excavation and salvage of designated pole foundations, excavation and disposal of designated pole foundations, removal of conductors to source, delivery of salvaged poles and foundations to an Owner designated site.

5.03 TEMPORARY LIGHTING SYSTEM

A. The unit price bid shall include the cost of installation and removal of temporary light poles, fixtures, conductors, conduits, junction boxes, and connections to maintain the temporary lighting system throughout the construction period. The unit price bid shall include periodic modifications necessary to maintain the functionality of the temporary lighting system when the construction fence is required to be moved to facilitate construction. The unit price bid shall include the cost of employing an electrician, licensed in the City of Ithaca, to perform the necessary electrical work.

Payment will be made under:

ITEM NO.	ITEM	PAY UNIT
260010.10	Connect to Existing Electric Network	Each
260010.20	Demolition of Existing Lighting System	Lump Sum
260010.30	Temporary Lighting System (Installation and Removal)	Lump Sum

END OF SECTION

SECTION 260142

ELECTRICAL CONNECTIONS FOR EQUIPMENT

Part 1 GENERAL

1.01 SCOPE OF WORK

A. Work of this Section shall be performed in accordance with the requirements of the Contract Documents, including but not limited to Instructions to Bidders, Agreement and General Conditions and General Requirements.

1.02 DESCRIPTION OF WORK

A. Extent of electrical connections for equipment is indicated by drawings and schedules. Electric connections are hereby defined to include connections used for providing electrical power to equipment.

1.03 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of electrical connectors and terminals, of types and ratings required, and ancillary connection materials, including electrical insulating tape, electrical flux, and cable ties, whose products have been in satisfactory use in similar service for not less than 5 years.

B. NEC Compliance: Comply with applicable portions of NEC as to type products used and installation of electrical power connections (terminals and splices), for junction boxes, motor starters, and disconnect switches.

C. UL Compliance: Comply with UL Std 486A, "Wire Connectors and Soldering Lugs for Use With Copper Conductors" including, but not limited to, tightening of electrical connectors to torque values indicated. Provide electrical connection products and materials which are UL listed and labeled.

PART 2 PRODUCTS

2.01 MATERIALS AND COMPONENTS

A. General: For each electrical connection indicated, provide complete assembly of materials, including but not necessarily limited to, pressure connectors, terminals (lugs), electrical insulating tape, electrical solder, electrical soldering flux, heat-shrinkable insulating tubing, cable ties, solderless wire nuts, and other items and accessories as needed to complete splices and termination of types indicated.

B. Metal Conduit, Tubing and Fittings: Provide metal conduit, tubing and fittings of types, grades, sizes and weights (wall thicknesses) indicated for each type service. Where types and grades

are not indicated, provide proper selection as determined by Installer to fulfill wiring requirements and comply with NEC requirements for raceways. Provide products complying with Division-26 section "Raceways and Boxes for Electrical Systems".

C. Wire, Cable and Connectors: Provide wires, cables, and connectors complying with Division-26 section "Low Voltage Electrical Power Conductors and Cables".

D. Connectors and Terminals: Provide electrical connectors and terminals which mate and match, including sizes and ratings with equipment terminals and are recommended by equipment manufacturer for intended applications.

E. Electrical Connection Accessories: Provide electrical insulating tape, heat-shrinkable insulating tubing and boots, electrical solder, electrical soldering flux, wire nuts and cable ties as recommended for use by accessories manufacturers for type services indicated.

PART 3 EXECUTION

3.01 INSPECTION

A. Inspect area and conditions under which electrical connections for equipment are to be installed and notify Engineer in writing of conditions detrimental to proper completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.02 INSTALLATION OF ELECTRICAL CONNECTIONS

A. Install electrical connections as indicated; in accordance with connector manufacturer's written instructions and with recognized industry practices, and complying with applicable requirements of UL, NEC and NECA's "Standard of Installation" to ensure that products fulfill requirements.

B. Coordinate with other work, including wires/cables, raceway and equipment installation, as necessary to properly interface installation of electrical connections for equipment with other work.

C. Connect electrical power supply conductors to equipment conductors in accordance with equipment manufacturer's written instructions and wiring diagrams. Mate and match conductors of electrical connections for proper interface between electrical power supplies and installed equipment.

D. Maintain existing electrical service and feeders to occupied areas and operational facilities, unless otherwise indicated, or when authorized otherwise by Owner. Provide temporary service during interruptions to existing facilities. When necessary, schedule momentary outages for replacing existing wiring systems with new wiring systems. When that "cutting-over" has been successfully accomplished, remove, relocate, or abandon existing wiring as indicated.

E. Cover splices with electrical insulating material equivalent to, or of greater insulation resistivity rating, than electrical insulation rating of those conductors being spliced.

F. Prepare cables and wires, by cutting and stripping covering armor, jacket, and insulation properly to ensure uniform and neat appearance where cables and wires are terminated. Exercise care to avoid cutting through tapes which will remain on conductors. Also avoid "ringing" copper conductors while skinning wire.

G. Trim cables and wires as short as practicable and arrange routing to facilitate inspection, testing and maintenance.

H. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturers published torque tightening values for equipment connectors. Accomplish tightening by utilizing proper torquing tools, including torque screwdriver, beam-type torque wrench, and ratchet wrench with adjustable torque settings. Where manufacturer's torquing requirements are not available, tighten connectors and terminals to comply with torquing values contained in UL's 486A.

I. Provide flexible conduit for final motor connections, and other electrical equipment connections, where subject to movement and vibration.

J. Provide liquid-tight flexible conduit for final connection of motors and for other electrical equipment where subject to movement and vibration, and where subjected to one or more of the following conditions:

1. Exterior location.
2. Moist or humid atmosphere where condensate can be expected to accumulate.
3. Water spray.
4. Dripping oil, grease, or water.

K. Fasten identification markers to each electrical power supply wire/cable conductor which indicates their voltage, phase and feeder number in accordance with Division-26 section " Identification for Electrical Systems". Affix markers at each terminal conductor, as close as possible to the point of connection.

3.03 FIELD QUALITY CONTROL

A. Upon completion of installation of electrical connections, and after circuitry has been energized with rated power source, test connections to demonstrate capability and compliance with requirements. Ensure that direction of rotation of each motor fulfills requirement. Correct malfunctioning units at site, then retest to demonstrate compliance.

PART 4 – METHOD OF MEASUREMENT (None)

PART 5 – BASIS OF PAYMENT

A. Cost of work for this section shall be included in the price bid for related items. No separate payment.

END OF SECTION

SECTION 260519

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

1.03 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

1.04 ACTION SUBMITTALS

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

1.05 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the International Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the International Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

PART 2 PRODUCTS

2.01 CONDUCTORS AND CABLES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Insulated Wire Corp.; a Leviton Company.

2. General Cable Corporation.
3. Senator Wire & Cable Company.
4. Southwire Company.

B. Copper Conductors: Comply with NEMA WC 70.

C. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN.

2.02 CONNECTORS AND SPLICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems, Inc.
2. Hubbell Power Systems, Inc.
3. O-Z/Gedney; EGS Electrical Group LLC.
4. 3M; Electrical Products Division.
5. Tyco Electronics Corp.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 EXECUTION

3.01 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.

3.02 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type THHN-THWN, single conductors in raceway.

B. Exposed Feeders: Type THHN-THWN, single conductors in raceway.

C. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.

D. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.

E. Class 1 Control Circuits: Type THHN-THWN, in raceway.

F. Class 2 Control Circuits: Power-limited cable, concealed in building finishes.

3.03 INSTALLATION OF CONDUCTORS AND CABLES

A. 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.

B. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

C. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

D. Support cables according to Division 26 Section "Hangers and Supports for Electrical Systems."

E. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."

3.04 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 and UL 486B.

B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

3.05 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Division 26 Section "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.06 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.

B. Perform tests and inspections and prepare test reports.

C. Tests and Inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors, and conductors feeding the following critical equipment and services for compliance with requirements.

2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

D. Test Reports: Prepare a written report to record the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

E. Remove and replace malfunctioning units and retest as specified above.

PART 4 – METHOD OF MEASUREMENT

4.01 CONDUCTORS

A. The conductors to be quantified for payment shall be the total horizontal length measured in a straight line from hand hole, manhole, pull box, and/or fixture, plus an allowance of 5-ft for terminations, slack within the conduit, etc.

PART 5 – BASIS OF PAYMENT

5.01 ALL ITEMS

A. The unit price bid for all items shall include the cost of all labor, material, and equipment necessary to complete the work.

5.02 CONDUCTORS

A. The unit price bid includes the cost of conductors, pull wire, miscellaneous equipment connections, and splicing where necessary.

Payment will be made under:

ITEM NO.	**ITEM**	**PAY UNIT**
260519.02	250 KCMILS Conductor (Including Misc Equipment Connections, and Splicing)	Lineare Foot
260519.04	#4/0 Conductor (Including Misc Equipment Connections, and Splicing)	Linear Foot
260519.06	#6 Conductor (Including Misc Equipment Connections, and Splicing)	Linear Foot
260519.08	#8 Conductor (Including Misc Equipment Connections, and Splicing)	Linear Foot
260519.10	#10 Conductor (Including Misc Equipment Connections, and Splicing)	Linear Foot
260519.12	#12 Conductor (Including Misc Equipment Connections, and Splicing)	Linear Foot

END OF SECTION

SECTION 260526

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes: Grounding systems and equipment.

B. Section includes grounding systems and equipment, plus the following special applications:
1. Underground distribution grounding.

1.03 ACTION SUBMITTALS

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

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency and testing agency's field supervisor.

B. Field quality-control reports.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1.06 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. 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.

C. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 PRODUCTS

2.01 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:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
4. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
5. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

2.02 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. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, pressure type with at least two bolts.

1. Pipe Connectors: Clamp type, sized for pipe.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.03 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet in diameter.

PART 3 EXECUTION

3.01 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. 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.

3.02 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. Lighting circuits.
3. Receptacle circuits.
4. Single-phase motor and appliance branch circuits.
5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.

3.03 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.

B. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

3.04 LABELING

A. Comply with requirements in Division 26 Section "Identification for Electrical Systems" Article for instruction signs. The label or its text shall be green.

B. Install labels at the telecommunications bonding conductor and grounding equalizer and at the grounding electrode conductor where exposed.

1. Label Text: "If this connector or cable is loose or if it must be removed for any reason, notify the facility manager."

3.05 FIELD QUALITY CONTROL

A. 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.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal and at individual ground rods. Make tests at ground rods before any conductors are connected.

a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
b. Perform tests by fall-of-potential method according to IEEE 81.

4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

B. Grounding system will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

D. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.

E. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

PART 4 – METHOD OF MEASUREMENT (None)

PART 5 – BASIS OF PAYMENT

A. Cost of work for this section shall be included in the price bid for related items. No separate payment.

END OF SECTION

SECTION 260533

RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.03 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. EPDM: Ethylene-propylene-diene terpolymer rubber.

C. FMC: Flexible metal conduit.

D. LFMC: Liquidtight flexible metal conduit.

E. LFNC: Liquidtight flexible nonmetallic conduit.

F. RNC: Rigid nonmetallic conduit.

1.04 SUBMITTALS

A. Product Data: For wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.

1. Custom enclosures and cabinets.

C. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Structural members in the paths of conduit groups with common supports.
2. Plumbing items and architectural features in the paths of conduit groups with common supports.

D. Qualification Data: For professional engineer and testing agency.

E. Source quality-control test reports.

1.05 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.01 METAL CONDUIT AND TUBING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems, Inc.
2. Alflex Inc.
3. Allied Tube & Conduit; a Tyco International Ltd. Co.
4. Anamet Electrical, Inc.; Anaconda Metal Hose.
5. Electri-Flex Co.
6. Manhattan/CDT/Cole-Flex.
7. Maverick Tube Corporation.
8. O-Z Gedney; a unit of General Signal.
9. Wheatland Tube Company.

B. Rigid Steel Conduit: ANSI C80.1.

C. FMC: Zinc-coated steel.

D. LFMC: Flexible steel conduit with PVC jacket.

E. Fittings for Conduit (Including all Types and Flexible and Liquidtight), and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
2. Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch, with overlapping sleeves protecting threaded joints.

F. Joint Compound for Rigid Steel Conduit: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

2.02 METAL WIREWAYS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Cooper B-Line, Inc.
2. Hoffman.
3. Square D; Schneider Electric.

B. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 3R, unless otherwise indicated.

C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wireway Covers: Hinged type.

E. Finish: Manufacturer's standard enamel finish.

2.03 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
2. EGS/Appleton Electric.
3. Erickson Electrical Equipment Company.
4. Hoffman/Pentair.
5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
6. O-Z/Gedney; a unit of General Signal.
7. RACO; a Hubbell Company.
8. Robroy Industries, Inc.; Enclosure Division.
9. Scott Fetzer Co.; Adalet Division.
10. Spring City Electrical Manufacturing Company.
11. Thomas & Betts Corporation.
12. Walker Systems, Inc.; Wiremold Company (The).
13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.

B. Hinged-Cover Enclosures: NEMA 250, Type 316 Stainless, with continuous-hinge cover with flush latch, unless otherwise indicated.

1. Metal Enclosures: Stainless Steel, finished inside and out with manufacturer's standard enamel.

C. Cabinets:

1. NEMA 250, Type 316 galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door(s) in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.

PART 3 - EXECUTION

3.01 RACEWAY APPLICATION

A. Comply with the following indoor applications, unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: RNC.

2. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
3. Damp or Wet Locations: RNC,Rigid steel conduit as indicated on drawings.
4. Raceways for Optical Fiber or Communications Cable Risers in Vertical Shafts: RNC.
5. Raceways for Concealed General Purpose Distribution of Optical Fiber or Communications Cable: RNC.
6. Boxes and Enclosures: NEMA 250, Type 4, nonmetallic in damp or wet locations.

B. Minimum Raceway Size: ¾"-inch trade size.

C. Raceway Fittings: Compatible with raceways and suitable for use and location.

3.02 INSTALLATION

A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.

B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."

E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.

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. 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.

J. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for recessed and semi-recessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

3.03 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

PART 4 – METHOD OF MEASUREMENT

4.01 BOLLARD ELECTRIC COMPONENTS

A. The quantity to be measured for payment shall be the number of bollards where electric components are installed.

PART 5 – BASIS OF PAYMENT

5.01 ALL ITEMS

A. The unit price bid for all items shall include the cost of all labor, material, and equipment necessary to complete the work.

5.02 BOLLARD ELECTRIC COMPONENTS

A. The unit price bid shall include the cost of: furnishing and installing all electric components as specified in the Contract Drawings and making all necessary connections.

Payment will be made under:

ITEM NO.	**ITEM**	**PAY UNIT**
260533.01	Bollard Electric Components	Each

END OF SECTION

SECTION 260543

UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Conduit, ducts, and duct accessories for direct-buried and concrete-encased duct banks, and in single duct runs.
2. Cored penetrations to existing buildings for telecom services.
3. Handholes and boxes.

1.3 DEFINITION

1. RNC: Rigid nonmetallic conduit.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Duct-bank materials, including separators and miscellaneous components.
2. Accessories for manholes, handholes, boxes**,** and other utility structures.
3. Warning tape.

B. Shop Drawings for Factory-Fabricated Handholes and Boxes Other Than Precast Concrete: Include dimensioned plans, sections, and elevations, and fabrication and installation details, including the following:

1. Duct entry provisions, including locations and duct sizes.
2. Cover design.
3. Grounding details.
4. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.

1.5 INFORMATIONAL SUBMITTALS

A. Duct-Bank Coordination Drawings: 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. Product Certificates: For concrete and steel used in precast concrete handholes, as required by ASTM C 858.

C. Qualification Data: For professional engineer and testing agency.

D. Source quality-control test reports.

E. Field quality-control test reports.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

B. Comply with ANSI C2.

C. Comply with NFPA 70.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver ducts to Project site with ends capped. Store nonmetallic ducts with supports to prevent bending, warping, and deforming.

B. Store precast concrete underground utility structures at Project site as recommended by manufacturer to prevent physical damage. Arrange so identification markings are visible.

C. Lift and support precast concrete units only at designated lifting or supporting points.

1.8 PROJECT 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 Architect or Owner's Designated Representative no fewer than seven days in advance of proposed interruption of electrical service.
2. Do not proceed with interruption of electrical service without Architect or Owner's Designated Representative written permission.

1.9 COORDINATION

A. Coordinate layout and installation of ducts, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field.

B. Coordinate elevations of ducts and duct-bank entrances into handholes, and boxes with final locations and profiles of ducts and duct banks as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations from those indicated as required to suit field conditions and to ensure that duct runs drain to handholes, and as approved by Architect.

PART 2 - PRODUCTS

2.1 CONDUIT

A. RNC: NEMA TC 2, Type EPC-40-PVC, UL 651, with matching fittings by same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B.

B. GRC: Comply with ANSI C80.1 and UL 6.

2.2 NONMETALLIC DUCTS AND DUCT ACCESSORIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ARNCO Corp.
2. Beck Manufacturing.
3. Cantex, Inc.
4. CertainTeed Corp.; Pipe & Plastics Group.
5. Condux International, Inc.
6. ElecSys, Inc.
7. Electri-Flex Company.
8. IPEX Inc.
9. Lamson & Sessions; Carlon Electrical Products.
10. Manhattan/CDT; a division of Cable Design Technologies.
11. Spiraduct/AFC Cable Systems, Inc.

B. Duct Accessories:

1. Duct Separators: Factory-fabricated rigid PVC interlocking spacers, sized for type and sizes of ducts with which used, and selected to provide minimum duct spacings indicated while supporting ducts during concreting or backfilling.
2. Warning Tape: Underground-line warning tape specified in Division 26 Section "Identification for Electrical Systems."

2.3 PRECAST CONCRETE HANDHOLES AND BOXES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Carder Concrete Products.
2. Christy Concrete Products.
3. Elmhurst-Chicago Stone Co.
4. Oldcastle Precast Group.
5. Riverton Concrete Products; a division of Cretex Companies, Inc.
6. Utility Concrete Products, LLC.
7. Utility Vault Co.
8. Wausau Tile, Inc.

B. Comply with ASTM C 858 for design and manufacturing processes.

C. Description: Factory-fabricated, reinforced-concrete, monolithically poured walls and 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.

1. Frame and Cover: Weatherproof cast-iron frame, with cast-iron cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.

2. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
3. Cover Legend: Molded lettering, As indicated for each service.
4. Configuration: Units shall be designed for flush burial and have open bottom, unless otherwise indicated.
5. Extensions and Slabs: Designed to mate with bottom of enclosure. Same material as enclosure.

   a. Extension shall provide increased depth of 12 inches (300 mm).
   b. Slab: Same dimensions as bottom of enclosure, and arranged to provide closure.

D. Polymer Concrete Handholes and Boxes with Polymer Concrete Cover: Molded of sand and aggregate, bound together with a polymer resin, and reinforced with steel or fiberglass or a combination of the two.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Armorcast Products Company.
   b. Carson Industries LLC.
   c. CDR Systems Corporation.
   d. NewBasis.

2.4 SOURCE QUALITY CONTROL

A. Test and inspect precast concrete utility structures according to ASTM C 1037.

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 a independent testing agency.
2. Strength tests of complete boxes and covers shall be by either an independent testing agency or the 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.

2.5 UTILITY STRUCTURE ACCESSORIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Bilco Company (The).
2. Campbell Foundry Company.
3. Carder Concrete Products.
4. Christy Concrete Products.
5. East Jordan Iron Works, Inc.
6. Elmhurst-Chicago Stone Co.
7. McKinley Iron Works, Inc.
8. Neenah Foundry Company.
9. NewBasis.
10. Oldcastle Precast Group.

11. Osburn Associates, Inc.
12. Pennsylvania Insert Corporation.
13. Riverton Concrete Products; a division of Cretex Companies, Inc..
14. Strongwell Corporation; Lenoir City Division.
15. Underground Devices, Inc.
16. Utility Concrete Products, LLC.
17. Utility Vault Co.
18. Wausau Tile, Inc.

PART 3 - EXECUTION

3.1 UNDERGROUND DUCT APPLICATION

A. Ducts for Electrical Feeders 600 V and Less: RNC, NEMA Type EPC-40-PVC, in concrete-encased duct bank, unless otherwise indicated.

B. Ducts for Electrical Branch Circuits: RNC, NEMA Type EPC-40-PVC, in direct-buried duct bank, unless otherwise indicated.

C. Underground Ducts for Telephone, Communications, or Data Utility Service Cables: RNC, NEMA Type EPC-40-PVC, in concrete-encased duct bank, unless otherwise indicated.

D. Underground Ducts Crossing Paved Paths, Walks Driveways and Roadways: RNC, NEMA Type EPC-40-PVC, encased in reinforced concrete.

3.2 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-10 structural load rating.
2. Units in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Polymer concrete, SCTE 77, Tier 15 structural load rating.
3. Units in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Polymer concrete units, SCTE 77, Tier 8 structural load rating.

3.3 EARTHWORK

A. Excavation and Backfill: Comply with Division 31 Section "Earth Moving," but do not use heavy-duty, hydraulic-operated, compaction equipment.

B. Restore surface features at areas disturbed by excavation and reestablish 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. Comply with Division 32 Sections "Turf and Grasses" and "Plants."

D. Cut and patch existing pavement in the path of underground ducts and utility structures according to Division 01 Section "Cutting and Patching."

3.4 DUCT INSTALLATION

A. Slope: Pitch ducts a minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope ducts from a high point in runs between two manholes to drain in both directions.

B. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 48 inches, both horizontally and vertically, at other locations, unless otherwise indicated.

C. Joints: Use solvent-cemented joints in ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in same plane.

D. Building Wall Penetrations: Make a transition from underground duct to rigid steel conduit at least 10 feet (3 m) outside the building wall without reducing duct line slope away from the building, and without forming a trap in the line. Use fittings manufactured for duct-to-conduit transition. Install conduit penetrations of building walls as specified in Division 26 Section "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

E. Sealing: Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15-psig hydrostatic pressure.

F. Pulling Cord: Install 100-lbf- test nylon cord in ducts, including spares.

G. Concrete-Encased Ducts: Support ducts on duct separators.

1. Separator Installation: Space separators close enough to prevent sagging and deforming of ducts, with not less than 4 spacers per 20 feet (6 m) of duct. Secure separators to earth and to ducts to prevent floating during concreting. Stagger separators approximately 6 inches (150 mm) between tiers. 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.
2. Concreting Sequence: Pour each run of envelope between manholes or other terminations in one continuous operation.
    a. Start at one end and finish at the other, allowing for expansion and contraction of ducts as their temperature changes during and after the pour. Use expansion fittings installed according to manufacturer's written recommendations, or use other specific measures to prevent expansion-contraction damage.
    b. If more than one pour is necessary, terminate each pour in a vertical plane and install 3/4-inch (19-mm) reinforcing rod dowels extending 18 inches (450 mm) into concrete on both sides of joint near corners of envelope.
3. Pouring Concrete: Spade concrete carefully during pours to prevent voids under and between conduits and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Use a plank to direct concrete down sides of bank assembly to trench bottom. Allow concrete to flow to center of bank and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-bank application.
4. Reinforcement: Reinforce concrete-encased duct banks where they cross disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.

5. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
6. Minimum Space between Ducts: 3 inches (75 mm) between ducts and exterior envelope wall, 2 inches (50 mm) between ducts for like services, and 4 inches (100 mm) between power and signal ducts.
7. Depth: Install top of duct bank at least 24 inches (600 mm) below finished grade in areas not subject to deliberate traffic, and at least 30 inches (750 mm) below finished grade in deliberate traffic paths for vehicles, unless otherwise indicated.
8. Stub-Ups: Use manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Extend concrete encasement throughout the length of the elbow.
9. Stub-Ups: Use manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.

    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete.
    b. Stub-Ups to Equipment: For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of base. Install insulated grounding bushings on terminations at equipment.

10. Warning Tape: Bury warning tape approximately 12 inches (300 mm) above all concrete-encased ducts and duct banks. Align tape parallel to and within 3 inches (75 mm) of the 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.

H. Direct-Buried Duct Banks:

1. Support ducts on duct separators coordinated with duct size, duct spacing, and outdoor temperature.
2. Space separators close enough to prevent sagging and deforming of ducts, with not less than 4 spacers per 20 feet of duct. Secure separators to earth and to ducts to prevent displacement during backfill and yet permit linear duct movement due to expansion and contraction as temperature changes. Stagger spacers approximately 6 inches between tiers.
3. Excavate trench bottom to provide firm and uniform support for duct bank. Prepare trench bottoms as specified in Division 31 Section "Earth Moving" for pipes less than 6 inches in nominal diameter.
4. Install backfill as specified in Division 31 Section "Earth Moving."
5. After installing first tier of ducts, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand-place backfill to 4 inches over ducts and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, make final duct connections at end of run and complete backfilling with normal compaction as specified in Division 31 Section "Earth Moving."
6. Install ducts with a minimum of 3 inches between ducts.
7. Depth: Install top of duct bank at least 24 inches below finished grade, unless otherwise indicated.
8. Set elevation of bottom of duct bank below the frost line.
9. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.

10. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.

    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
    b. For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.

3.5 INSTALLATION OF CONCRETE HANDHOLES, AND BOXES

A. Precast Concrete Handhole Installation:

1. Comply with ASTM C 891, unless otherwise indicated.
2. Install units level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances.
3. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1-inch (25-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.

B. Elevations:
1. Install handholes with bottom below the frost line, 24” below grade.
2. Handhole Covers: In paved areas and trafficways, set surface flush with finished grade. Set covers of other handholes 1 inch (25 mm) above finished grade.
3. Where indicated, cast handhole cover frame integrally with handhole structure.

C. Drainage: Install drains in bottom of manholes where indicated. Coordinate with drainage provisions indicated.

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 ducts to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of ducts, and seal joint between box and extension as recommended by the manufacturer.

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.

C. Elevation: In paved areas and trafficways, set so cover surface will be flush with finished grade. Set covers of other handholes 1 inch above finished grade.

D. Install handholes and boxes with bottom below the frost line, 24” 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 the enclosure.

F. Field-cut openings for ducts and 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.

3.7 GROUNDING

A. Ground underground ducts and utility structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."

3.8 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:

1. Demonstrate capability and compliance with requirements on completion of installation of underground ducts and utility structures.
2. Pull aluminum or wood test mandrel through duct to prove joint integrity and test for out-of-round duct. Provide mandrel equal to 80 percent fill of duct. If obstructions are indicated, remove obstructions and retest.
3. Test manhole and handhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Division 26 Section "Grounding and Bonding for Electrical Systems."

B. Correct deficiencies and retest as specified above to demonstrate compliance.

3.9 CLEANING

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

B. Clean internal surfaces of manholes, including sump. Remove foreign material.

PART 4 – METHOD OF MEASUREMENT

4.01 ALL ITEMS

A. The quantity to be measured for payment is the number of units installed, adjusted, relocated, replaced or removed as noted under Basis of Payment.

4.02 CONDUIT

A. The quantity to be measured for payment shall be the number of linear feet of conduit installed.

4.03 HANDHOLES

A. The quantity to be measured for payment shall be the number of handholes installed.

4.04 CORED PENETRATION

A. The quantity to be measured for payment shall be the number of completed cored penetrations into existing buildings.

PART 5 – BASIS OF PAYMENT

5.01 ALL ITEMS

A. The unit price bid for all items shall include the cost of all labor, material, and equipment necessary to complete the work. Excavation, sand bedding, and backfill is included in the unit price bid. Removal of existing abandoned utilities or structures, as required to complete the work, is included in the unit price bid. Surface restoration, where applicable, will be paid for separately under their appropriate item.

5.02 CONDUIT

A. The unit price bid shall include the cost of: furnishing and installing new conduit, fittings, conduit cradles, warning tape, couplings and insulating bushings, connecting conduit to manholes, pull wire, and 2x4 marker posts.

B. The unit price bid shall include the cost of maintenance and protection of traffic in accordance with the requirements of the Manual of Uniform Traffic Control Devices and the NYS supplement where conduit is installed within vehicular pavement areas.

C. Concrete encasement of underground conduits will be paid separately.

5.03 HANDHOLES

A. The unit price bid shall include the cost of: furnishing and installing handholes complete. Payment shall include connections to electrical components.

5.04 CONNECT DUCT BANK TO EXISTING TELCOM MANHOLE

A. The unit price bid shall include the cost of coring or otherwise modifying existing structure to accept new duct bank, grouting annular space between conduit and existing wall of structure, and coordination with Verizon to complete the work.

B. The unit price bid shall include the cost of maintenance and protection of traffic in accordance with the requirements of the Manual of Uniform Traffic Control Devices and the NYS supplement where existing manholes are installed within vehicular pavement areas.

5.05 CORED PENETRATION

A. The unit price bid shall include the cost for planning and coordinating the work necessary for each penetration with property owners, coring of foundation walls, installing and grouting casing pipe in place, seal and calking penetration, mastic coatings, and repair of existing surface finish on interior finished walls.

Payment will be made under:

ITEM NO.	**ITEM**	**PAY UNIT**
260543.0201	3/4” Sched 40 PVC Conduit, For Concrete Encasement (Including Excavation and Backfill; Concrete Paid Separately)	Linear Foot

260543.0202	1” Sched 40 PVC Conduit, For Concrete Encasement (Including Excavation and Backfill; Concrete Paid Separately)	Linear Foot
260543.0203	1 1/4” Sched 40 PVC Conduit, For Concrete Encasement (Including Excavation and Backfill; Concrete Paid Separately)	Linear Foot
260543.0205	2” Sched 40 PVC Conduit, For Concrete Encasement (Including Excavation and Backfill; Concrete Paid Separately)	Linear Foot
260543.0206	2 1/2” Sched 40 PVC Conduit, For Concrete Encasement (Including Excavation and Backfill; Concrete Paid Separately)	Linear Foot
260543.0207	4” Sched 40 PVC Conduit, For Concrete Encasement (Including Excavation and Backfill; Concrete Paid Separately)	Linear Foot
260543.0401	3/4” Sched 40 PVC Conduit, Bedded in Sand (Including Excavation, Sand Bedding, and Backfill)	Linear Foot
260543.0402	1” Sched 40 PVC Conduit, Bedded in Sand (Including Excavation, Sand Bedding, and Backfill)	Linear Foot
260543.0403	1 1/4” Sched 40 PVC Conduit, Bedded in Sand (Including Excavation, Sand Bedding, and Backfill)	Linear Foot
260543.0407	4” Sched 40 PVC Conduit, Bedded in Sand (Including Excavation, Sand Bedding, and Backfill)	Linear Foot
260543.0607	4” GRC Conduit, Bedded in Sand (Including Excavation, Sand Bedding, and Backfill)	Linear Foot
260543.08	Connect Duct Bank to Existing Telcom Manhole (Including Excavation and Backfill)	Each
260543.10	Handhole, 17” x 30” x 24”d (Including Excavation and Backfill)	Each
260543.12	Handhole, 30” x 48” x 24”d (Including Excavation and Backfill)	Each
260543.20	Cored Penetration of Existing Building for 4” Telcom Service (Including Excavation and Backfill)	Each

END OF SECTION

SECTION 260544

SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Sleeve-seal systems.
2. Sleeve-seal fittings.
3. Grout.
4. Silicone sealants.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Wall Sleeves:

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

C. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

D. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

E. Sleeves for Rectangular Openings:

1. Material: Galvanized sheet steel.
2. Minimum Metal Thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and with no side larger than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
b. For sleeve cross-section rectangle perimeter 50 inches (1270 mm) or more and one or more sides larger than 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Advance Products & Systems, Inc.
b. CALPICO, Inc.
c. Metraflex Company (The).
d. Pipeline Seal and Insulator, Inc.
e. Proco Products, Inc.

2. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Stainless steel.
4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.

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. Presealed Systems.

2.4 GROUT

A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.5 SILICONE SEALANTS

A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.

B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Comply with NEMA VE 2 for cable tray and cable penetrations.

C. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.

B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

PART 4 – METHOD OF MEASUREMENT (None)

PART 5 – BASIS OF PAYMENT

A. Cost of work for this section shall be included in the price bid for related items. No separate payment.

END OF SECTION

SECTION 260545

CONDUIT INNERDUCT

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. Attention is directed to the PROCUREMENT AND CONTRACTING REQUIREMENTS and all Sections within DIVISION 01, GENERAL REQUIREMENTS, which are made a part of this Section of the Specifications.

1.02 SUMMARY

A. Extent of inner duct work includes, but is not limited to the following: furnish and installation of innerduct.

B. Related sections:
   1. Division 26 Section “Underground Ducts and Raceways for Electrical Systems”

1.03 DEFINITIONS

A. ENT – Electrical Non-metallic Tubing

1.04 SUBMITTALS

A. Contractor shall submit cut sheet information for chosen inner duct material, size, and manufacturer.

1.05 QUALITY ASSURANCE

A. All innerduct material shall be the product of a single manufacturer who can furnish evidence of satisfactory evidence in the project of high quality products of the type indicated and specified.

B. All innerduct material shall be of good quality ad free from defects that would make it unfit for the use intended.

1.06 STORAGE AND HANDLING

A. Deliver innerduct to project site with ends capped. Keep ends capped until such time innerduct is installed.

B. Store material according to manufacturer recommendations.

PART 2 - MATERIALS

2.01 INNER DUCTS

A. Ducting and any associated equipment shall be electrical non-metallic tubing as listed and labeled as defined in NFPA 70.

B. Ducting and any associated equipment shall be electrical non-metallic tubing shall comply with NEMA TC 13 and UL 1653.

PART 3 – EXECUTION

3.01 GENERAL

A. Contractor is responsible to ensure that all existing ducting is free from debris, foreign materials, etc. before proceeding with installation of innerduct.

PART 4 – METHOD OF MEASUREMENT

4.01 INNERDUCT

A. The quantity to be measured for payment shall be the number of linear feet of innerduct installed.

PART 5 – BASIS OF PAYMENT

5.01 INNERDUCT

A. The unit price bid shall include the cost of all labor, equipment and materials necessary to provide and install the innerduct. The unit price bid shall include the cost of furnishing and installing new innerduct and pull wire.

Payment will be made under:

ITEM NO.	**ITEM**	**PAY UNIT**
260545.XXX	X” Conduit Innerduct	Linear Foot

END OF SECTION

SECTION 260553

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Warning labels and signs.
5. Instruction signs.
6. Equipment identification labels.
7. Miscellaneous identification products.

1.3 ACTION SUBMITTALS

A. Product Data: For each electrical identification product indicated.

B. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.

C. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

1.4 QUALITY ASSURANCE

A. Comply with ANSI A13.1

B. Comply with NFPA 70.

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

D. Comply with ANSI Z535.4 for safety signs and labels.

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

1.5 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 POWER RACEWAY IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.

B. Colors for Raceways Carrying Circuits at 600 V or Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage and system or service type.

C. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.2 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

C. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.3 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

C. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.4 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

C. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

2.5 INSTRUCTION SIGNS

A. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch.

2.6 EQUIPMENT IDENTIFICATION LABELS

A. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

2.7 CABLE TIES

A. Plenum-Rated Cable Ties: Self extinguishing, UV stabilized, one piece, self locking.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F, According to ASTM D 638: 7000 psi.
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F.
5. Color: Black.

2.8 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in Division 09 painting Sections for paint materials and application requirements. Select 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.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

F. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands 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.

G. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

H. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:

1. Outdoors: UV-stabilized nylon.

I. Painted Identification: Comply with requirements in Division 09 painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A, and 120 V to ground: Identify with self-adhesive vinyl label. Install labels at 10-footmaximum intervals.

B. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.

1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder and branch-circuit conductors.

a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
b. Colors for 208/120-V Circuits:

1) Phase A: Black.
2) Phase B: Red.
3) Phase C: Blue.
4) Neutral: White.

c. Colors for 240/120-V Circuits:

1) L1: Black.
2) L2: Red.
3) Neutral: White.

d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

C. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.

D. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.

E. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.

F. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

G. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:
   a. Outdoor Equipment: Engraved, laminated acrylic or melamine label ½ inches high.
   b. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
   c. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

2. Equipment to Be Labeled:

   a. Panelboards: Type written directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be self-adhesive, engraved, laminated acrylic or melamine label.
   b. Enclosures and electrical cabinets.
   c. Access doors and panels for concealed electrical items.
   d. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
   e. Emergency and optional standby system boxes and enclosures.

f. Enclosed switches.
g. Enclosed circuit breakers.
h. Enclosed controllers.
i. Power transfer equipment.
j. Contactors.
k. Power-generating units.

PART 4 – METHOD OF MEASUREMENT (None)

PART 5 – BASIS OF PAYMENT

A. Cost of work for this section shall be included in the price bid for related items. No separate payment.

END OF SECTION

SECTION 260923

LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Time switches.
2. Photoelectric switches.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show installation details for occupancy and light-level sensors.

1. Interconnection diagrams showing field-installed wiring.
2. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each type of lighting control device to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 TIME SWITCHES

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Cooper Industries, Inc.
2. Intermatic, Inc.

3. Invensys Controls.
4. Leviton Manufacturing Co., Inc.
5. NSi Industries LLC; TORK Products.
6. Tyco Electronics; ALR Brand.

B. Electronic Time Switches: Solid state, programmable, with alphanumeric display; complying with UL 917.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Contact Configuration: SPST.
3. Contact Rating: 20-A ballast load, 120-/240-V ac.
4. Programs: Eight on-off set points on a 24-hour schedule.
5. Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program on selected channels.
6. Astronomic Time: All channels.
7. Automatic daylight savings time changeover.
8. Battery Backup: Not less than seven days reserve, to maintain schedules and time clock.

2.2 OUTDOOR PHOTOELECTRIC SWITCHES

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Cooper Industries, Inc.
2. Intermatic, Inc.
3. NSi Industries LLC; TORK Products.
4. Tyco Electronics; ALR Brand.

B. Description: Solid state, with SPST dry contacts rated for 1800-VA tungsten or 1000-VA inductive, to operate connected relay, contactor coils, or microprocessor input; complying with UL 773A.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Light-Level Monitoring Range: 1.5 to 10 fc (16.14 to 108 lux), with an adjustment for turn-on and turn-off levels within that range, and a directional lens in front of the photocell to prevent fixed light sources from causing turn-off.
3. Time Delay: Fifteen second minimum, to prevent false operation.
4. Surge Protection: Metal-oxide varistor.
5. Mounting: Twist lock complies with NEMA C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure.

2.3 LIGHTING CONTACTORS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Allen-Bradley/Rockwell Automation.
2. ASCO Power Technologies, LP.
3. Eaton Corporation.

4. General Electric Company;
5. Square D.

B. Description: Electrically operated and mechanically held, combination-type lighting contactors complying with NEMA ICS 2 and UL 508.

1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
3. Enclosure: Comply with NEMA 250.
4. Provide with control and pilot devices as indicated on Drawings, matching the NEMA type specified for the enclosure.

2.4 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller thanNo. 14 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

A. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.2 WIRING INSTALLATION

A. Wiring Method: Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is ¾" inch (18.75 mm).

B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.

C. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.

D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.3 IDENTIFICATION

A. Identify components and power and control wiring according to Section 260553 "Identification for Electrical Systems."

1. Identify controlled circuits in lighting contactors.
2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.

B. Label time switches with a unique designation.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Lighting control devices will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices.

PART 4 – METHOD OF MEASUREMENT (None)

PART 5 – BASIS OF PAYMENT

A. Cost of work for this section shall be included in the price bid for related items. No separate payment.

END OF SECTION

SECTION 262416

PANELBOARDS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
1. Lighting and appliance branch-circuit panelboards.

1.03 DEFINITIONS

A. SVR: Suppressed voltage rating.

B. TVSS: Transient voltage surge suppressor.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types and details for types other than NEMA 250, Type 3R.
3. Detail bus configuration, current, and voltage ratings.
4. Short-circuit current rating of panelboards and overcurrent protective devices.
5. Include evidence of NRTL listing for series rating of installed devices.
6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
7. Include wiring diagrams for power, signal, and control wiring.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Field Quality-Control Reports:

1. Test procedures used.

2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

C. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.07 MAINTENANCE MATERIAL 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. Keys: Two spares for each type of panelboard cabinet lock.

1.08 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

D. 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.

E. Comply with NEMA PB 1.

F. Comply with NFPA 70.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.

B. Handle and prepare panelboards for installation according to NEMA PB 1.

1.10 PROJECT CONDITIONS

A. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of electric service.
2. Do not proceed with interruption of electric service without Owner's written permission.
3. Comply with NFPA 70E.

1.11 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

1.12 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Enclosures: Surface-mounted cabinets.

1. Rated for environmental conditions at installed location.

a. Wet Locations: NEMA 250, Type 3R.

2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
4. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
5. Finishes:

a. Panels and Trim: Steel and galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
b. Back Boxes: Galvanized steel.
c. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components.

6. Directory Card: Inside panelboard door, mounted in metal frame with transparent protective cover.

B. Incoming Mains Location: Top and bottom.

C. Phase, Neutral, and Ground Buses:

1. Material: Tin-plated aluminum.
2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.

D. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Tin-plated aluminum.
2. Main and Neutral Lugs: Compression type.
3. Ground Lugs and Bus-Configured Terminators: Compression type.

E. Service Equipment Label: NRTL labeled for use as service equipment for panelboards or load centers with one or more main service disconnecting and overcurrent protective devices.

F. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

G. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.02 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains: Circuit breaker or lugs only.

D. Branch Overcurrent Protective Devices: Plug-in circuit breakers, replaceable without disturbing adjacent units.

E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.03 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

a. Standard frame sizes, trip ratings, and number of poles.
b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
d. Multipole units enclosed in a single housing or factory assembled to operate as a single unit.
e. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
f. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

2.04 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

B. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.

B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.

C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install panelboards and accessories according to NEMA PB 1.1.

B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

C. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

D. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.

E. Install filler plates in unused spaces.

F. Stub four 1-inch empty conduits into nearest handhole.

G. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

H. Comply with NECA 1.

3.03 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 26 05 53 "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

3.04 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.

2. Test continuity of each circuit.

E. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

F. Panelboards will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.05 ADJUSTING

A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.

B. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.

1. Measure as directed during period of normal system loading.
2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

3.06 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

PART 4 – METHOD OF MEASUREMENT (None)

PART 5 – BASIS OF PAYMENT

A. Cost of work for this section shall be included in the price bid for related items. No separate payment.

END OF SECTION

SECTION 262816

FREE-STANDING ENCLOSURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Enclosures.

1.03 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.

B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Field quality-control reports.

1. Test procedures used.

2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

C. Manufacturer's field service report.

1.06 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Source Limitations: Obtain devices, components, and accessories, within same product category, from single source from single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

D. 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.

E. Comply with NFPA 70.

1.07 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F (minus 30 deg C) and not exceeding 104 deg F (40 deg C).
2. Altitude: Not exceeding 6600 feet (2010 m).

B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Construction Manager no fewer than seven days in advance of proposed interruption of electric service.
2. Indicate method of providing temporary electric service.
3. Do not proceed with interruption of electric service without Construction Manager's written permission.
4. Comply with NFPA 70E.

1.08 COORDINATION

A. Coordinate layout and installation of components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.01 ENCLOSURES

A. Enclosed equipment: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

1. Outdoor Locations: NEMA 250, Type 4X, stainless steel, free-standing.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

B. Comply with NECA 1.

3.03 IDENTIFICATION

A. Comply with requirements in Section 260553 "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.04 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

B. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.05 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

PART 4 – METHOD OF MEASUREMENT

4.01 ALL ITEMS

A. The quantity to be measured for payment is the number of units installed, adjusted, relocated, replaced or removed as noted under Basis of Payment.

4.02 ELECTRIC UTILITY ENCLOSURE

A. The quantity to be measured for payment shall be a lump sum for each enclosure.

4.03 SNAKEHEAD BOX

B. The quantity to be measured for payment shall be the number of snakehead boxes installed.

PART 5 – BASIS OF PAYMENT

5.01 ALL ITEMS

A. The unit price bid for all items shall include the cost of all labor, material, and equipment necessary to complete the work. Excavation, bedding, and backfill is included in the unit price bid. Removal of existing abandoned utilities or structures, as required to complete the work, is included in the unit price bid. Surface restoration, where applicable, will be paid for separately under their appropriate item.

5.02 ELECTRIC UTILITY ENCLOSURE

A. Unit price bid shall include the cost of furnishing and installing concrete housekeeping pad, weather-proof enclosure, all internal and attached equipment specified, connections, and terminations required to complete the intended work. Equipment specified includes, but is not limited to electric panels and sub panels complete with associated breakers, service disconnects, detection equipment, meter box, programmable relays, contactors, time clock, etc.

5.03 SNAKEHEAD BOX

A. Unit price bid shall include the cost of furnishing and installing a complete snakehead box, including but not limited to; weather proof enclosure, mounting hardware and support, and conduit connections.

Payment will be made under:

ITEM NO.	**ITEM**	**PAY UNIT**
262816.0102	Electric Utility Enclosure, Complete – Cayuga Street	Lump Sum

262816.0104	Electric Utility Enclosure, Complete – Bank Alley	Lump Sum
262816.0106	Electric Utility Enclosure, Complete – Aurora Street	Lump Sum
262816.0108	Electric Utility Enclosure, Complete – Stage	Lump Sum
262816.20	Snakehead Box	Lump Sum

END OF SECTION

SECTION 265613

EXTERIOR LIGHTING FIXTURES

PART 1 GENERAL

1.00 DESCRIPTION

A. Provide and install lighting fixtures as shown on drawings and as specified in this and all related Sections.

1.01 RELATED SECTIONS

A.	26 5613 Appendix A	Exterior Lighting Schedule
B.	26 5613 Appendix B	Exterior Lighting Cut Sheets

1.02 DEFINITIONS

A. The term Architect refers to the Architect, Interior Designer, Lighting Designer or Owner's Representative individually or collectively.

1.03 GENERAL REQUIREMENTS

A. Provide all lighting fixtures as shown complete with all lamps, completely wired, controlled and securely attached to supports.

B. Where a catalog number and a narrative or pictorial descriptions are provided, the written description shall take precedence and prevail.

C. General Contractor shall provide electrical subcontractor with entire lighting specification (including fixture illustrations and sketches); electrical subcontractor shall provide each specified manufacturer with complete information about the fixtures they will supply.

D. Type of fixtures shall be as indicated alphanumerically and as specified.

E. Fixture details shown may be modified by the manufacturer provided all of the following conditions have been met:

1. Fixture performance is equal or improved;

2. Structural, mechanical, electrical, safety, and maintenance characteristics are equal or improved;

3. Cost to the Owner is reduced or equal.

4. Modifications have been reviewed by the Architect and have been approved by the Architect in writing.

1.04 STANDARDS

A. The standards and regulating committees referred to in this specification and to which compliance with is required are:

1. UL Underwriters Laboratories
2. NRTL Nationally Recognized Testing Laboratory
3. NEC National Electric Code
4. ANSI American National Standards Institute
5. ASTM American Society of Testing and Materials
6. NEMA National Electrical Manufacturers Association
7. IEC International Electrotechnical Commission

B. All fixtures and assembled components shall be new, of good quality, and be approved by and bear the label of UL for the applicable location and conditions (wet, damp, dry, etc.) or other approved testing agencies, i.e. CSA, ETL, unless otherwise specified in writing.

C. All fixtures shall meet all required local, state and/or national building, electrical and energy codes and regulations.

1.05 BIDDING

A. Follow bidding procedures as described in Division 01 of this specification.

B. Provide unit and alternate prices as required in Section 26 5613 Appendix A Exterior Lighting Schedule.

1.06 SUBSTITUTIONS

A. Bidders' attention is called to the following procedure to be followed in submitting alternate fixture manufacturers than those specified:

1. Bidders wishing to obtain approval on brands other than those specified by name and/or catalog number in Section 26 5613 Appendix A Exterior Lighting Schedule, shall submit their requests not later than ten (10) business days before the bid opening. Approval will be in the form of an addendum to the specifications issued to all prospective bidders indicating that the additional brand or brands are approved as equal to those specified as far as the requirements of the project are concerned. If the bidders do not elect to obtain prior approval during the time so specified, the Owner has no obligation to review or consider any such article after the contract award.

2. If the bidder wishes to substitute fixtures from alternate manufacturers, his attention is called to Section 2.01, GENERAL MATERIAL REQUIREMENTS of PART 2 - PRODUCTS. In addition, he shall note that the dimensions of visible parts of many fixtures (for example, the aperture diameters of incandescent fixtures) are binding to the bidder and cannot be changed without prior approval by the Architect.

3. Contractor shall pay professional fees (at current standard hourly rates) and reimburse expenses directly to all designers (Architect, Engineer, Lighting Designer, et. al.) for time spent reviewing substitutions proposed by the

Contractor. If payment by the Contractor is not made within 60 days of invoice date, the Owner shall deduct the amount due from subsequent payments to the Contractor in order to reimburse designers.

4. Request for approval shall be accompanied by working fixture samples (with an appropriate lamp, complete photometric, mechanical and electrical data, list of materials and finishes and unit cost to the Owner) of both the specified brand and the proposed substitutes as required to make complete comparison and evaluation. These samples shall be in addition to those required by Lighting Fixture Specification. The above data shall be delivered separately to the Architect and the Lighting Designer. The fixture samples shall be furnished and installed, at the bidder's expense, at the location selected by the Architect. In addition, the bidder shall furnish the Architect and the Lighting Designer with the name and location of at least one completed project where each proposed substitute has been in operation for a period of at least six (6) months, as well as the names and addresses of the Owner, the Lighting Designer and the Architect of record.

1.07 SUBMITTALS

A. For standard catalog items with no modifications, submit catalog cut sheets prepared by the manufacturer which clearly show all elements to be supplied and all corresponding product data (including lamping; ballast manufacturer and model number; voltage; accessories or options and any miscellaneous items detailed in the written description of the specification.) If cut sheet shows more than one (1) fixture type, all non-applicable information shall be crossed out.

B. For standard cataloged fixtures:

1. Submit one sample cone for each fixture type for review. Submit a certificate of compliance with Alzak finish requirements with all requests for approval.

2. When more than one louver panel occurs in a fixture, submit as a part of shop drawings the dimensioned layout of individual louver panels and supporting "tee" members.

C. For custom fixtures, modified fixtures or linear fluorescent fixtures mounted in continuous rows, submit an engineered line drawing prepared by the manufacturer showing all details of construction, lengths of runs, lamping layout, pendant locations, power locations, finishes and list of materials. Drawings must be to scale. Contractor shall provide manufacturer with field dimensions where required. If scallop shields, wallwash reflectors or baffles are required, drawings shall indicate relative position to wall or adjacent vertical surface.

D. For all submittals under paragraphs A through C above, manufacturer shall provide submittals with fixture installation instruction sheets.

E. For all submittals under paragraphs A through C above, manufacturer shall provide submittals within two weeks of receipt of order. All submittals shall have project name and fixture type clearly shown.

F. Fixture cuts and shop drawings shall be submitted in quantities and format as described in the general conditions section the specification.

G. The Architect shall make the final determination as to whether or not the submittal contains sufficient information and reserves the right to request a shop drawing if the fixture cut is insufficient.

H. COLD CATHODE AND NEON: Shop drawings shall be submitted for approval and maintenance. Shop drawings shall include scale plans and details showing method of installation of lampholders, lamps, reflectors, transformer housings and secondary feeds, as well as a complete bill of materials. Contractor shall furnish field dimensions to manufacturers so that they may properly fabricate lamps to fit. Field dimensions required shall be shown on shop drawings. Shop drawings shall be revised after receipt of field dimensions to show exact locations of lampholders and lamps. A copy of these revised shop drawings shall be given to the Owner for his use in lamp replacements and maintenance. Full-size cartoons of lamp configuration shall be submitted, when required.

I. MOCK-UPS

1. It shall be the responsibility of the Contractor to provide a mock-up of the lighting fixture or lighting systems as indicated in the fixture description. The mock-up shall be erected within a time period and in a location that is acceptable to the Architect.

2. The mock-up installation shall closely conform to the conditions of the actual installation as to: height, distance from architectural surfaces, number and type of lamps, material, color and etc. The Contractor shall submit a written description of each proposed mock-up with drawings in order to obtain the Architect's approval prior to commencement of each mock-up.

3. The purpose of the mock-up will be to study the general appearance and performance of the intended lighting systems. At that time, certain minimal test variations may be requested as to lamp location, lamp type, reflector shape, color and etc. Final modifications, if any, shall be considered a part of these Specifications and shall be accomplished with no additional cost to the Owner.

J. SAMPLES

1. It shall be the responsibility of the Contractor to provide a sample(s) fixture as indicated in Section 26 5613 Appendix A Exterior Lighting Schedule. When samples are called for the manufacturer shall provide two working samples complete with lamp, ballast (rated for 120 Volt operation) and 6’ pig-tail with 3-prong Edison plug.

2. The sample(s) shall be shipped to a location that is determined by the Architect. Shipping and return shipping costs shall be provided as part of the contract.

3. The purpose of the sample is to review manufacturing techniques, detailing, lamping and scale. Sample fixtures must be approved prior to fabrication of fixtures for the project. Minor modifications, if any, shall be considered part of these Specifications and shall be accomplished with no additional cost to the Owner.

4. Sample fixtures may not be used on the project.

1.08 EXTRA STOCK

A. Furnish to the Owner and store at the site where directed, extra stock of each type of lighting fixture type and lamp type installed in the Project in quantities as required by Owner, packaged in manufacturer's unopened cartoons and identified as to contents by fixture type.

B. Furnish items above with appropriate quantity of each exposed trim, fastener, bracket and other items as required for a complete installation.

1.09 WARRANTIES

A. All fixtures and workmanship shall be guaranteed free of defects and fully operational for a minimum of one year after the acceptance of the project by the Owner. Any fixtures or workmanship found to be defective during the warranty period will be either fixed or replaced by the Contractor at no cost to the Owner.

B. Ballasts for fluorescent fixtures shall be covered by a five year warranty and high intensity discharge fixtures shall be covered by a two year warranty against defects in workmanship or material. Warranty shall include in-warranty service program providing for payment of authorized labor charges incurred in replacement of inoperative, in- warranty ballasts.

PART 2 PRODUCTS

2.00 GENERAL MATERIAL REQUIREMENTS

A. Ferrous mounting hardware and accessories shall be finished using either a galvanic or phosphate primer/baked paint process to prevent corrosion and discoloration of adjacent materials.

B. For weatherproof and vaportight installation, painted finishes of fixtures and accessories shall be weatherproof enamel using proper primers or hot dipped galvanized and bonderized epoxy, in accordance with manufacturer's requirements. Unless otherwise specified all painted surfaces shall have a life expectancy of not less than twenty years.

1. Hangers shall be conduit with chemically resistant, weatherproof, baked enamel finish.

2. Where dissimilar metal parts come in contact with each other, apply to both surfaces a coating material to prevent corrosion.

3. Colors shall be as specified in the Section 26 5613 Appendix A Exterior Lighting Schedule.

C. Fasteners shall be manufactured of non-magnetic stainless steel or anodized aluminum, except in indoor applications where galvanized steel shall be acceptable.

D. Fixtures shall be free of light leaks and shall be designed to provide sufficient ventilation of lamps and ballasts including vent holes where required.

E. Outdoor fixtures shall have wire mesh corrosion resistant screens in the vent holes properly sized to prevent incursion of insects, small animals, and/or other small rodents.

F. All sheet metal work shall be free from tool marks and dents and shall have accurate angles bent as sharp as compatible with the gauges of the required metal. All intersections and joints shall be formed true and of adequate strength and structural rigidity to prevent any distortion after assembly. All sheet metal shall be free of light leaks. All edges shall be finished so there are no sharp edges exposed. All miters shall be in accurate alignment with abutting intersecting members. Piecing of plates in individual runs in single planes and the use of spliced pieces or filler material to cover defective workmanship shall not be acceptable. Sheet metal work shall be properly fabricated so that planes will not deform (i.e. become concave or convex, due to normal expected ambient and operating conditions).

G. Lampholders shall hold lamps securely against normal vibrations and maintenance handling. Provide solid nickel or nickel-and-silver-plated contacts in lampholders for the following types of lamps:

1. Mogul screw base incandescent, metal halide, and high pressure sodium.

2. Lamps in outdoor fixtures.

3. Tungsten-halogen lamps.

H. Wiring channels and lampholder mountings shall be rigid and accurately made.

I. Reflector Cones:

1. Provide 45° lamp and lamp image cut-off unless otherwise specified. In fixtures where upper reflector is separate from cone, cut-off shall be 45° unless otherwise specified.

2. Plastic materials shall not be used for reflector cones or aperture plates.

3. Fixtures in which reflector cones are riveted or welded to housing or where removal of cone requires pressure to be applied to finished surface of reflector shall not be acceptable.

4. Cone flange shall be formed as an integral part of the cone and shall have identical color and finish as the cone, except as shown. The flange major surface shall be perpendicular to the cone axis. The width of the flange shall adequately cover the ceiling opening without light leaks. No fixture parts (housing, mounting frame, etc.) shall be visible between the ceiling surface and the edge of the cone flange. The same requirement shall be applicable to fixtures where main reflector extends down to the bottom edge of the fixture without a separate cone. In such case, the flange shall be formed as an integral part of the main reflector.

5. Reflector cones shall be manufactured of uniform gauge, not less than 0.032" thick, high purity aluminum Alcoa 3002 alloy free of spin marks or other defects or blemishes caused during manufacturing.

6. The finish of the inner surface of the reflector shall be highly specular as produced under the Alzak process. The reflector shall have an anodic coating of not less than four mils thick. The reflector inner surface shall be free of water spotting and shall maintain a reflectivity ratio of not less than 85% on clear specular finish. The reflector shall have a low iridescence finish free from multiple colors seen from normal viewing angles. Colors shall be derived from dyes supplied by Sandoz Chemical Company or approved equal.

7. The reflecting surface of the cone shall be tested for proper sealing. Test per ASTM B136-63T.

8. Fixtures with Alzak reflector cones, unless otherwise specified, must be furnished by the same manufacturer.

9. Reflector cone retention devices shall not deform cone in any manner whatsoever.

10. Submit a certificate of compliance with Alzak finish requirements with all requests for approval.

J. Lenses:

1. Fresnel:

   a. Lens shall have uniform brightness throughout the entire visible area at angles from 45° to 90° from vertical, without bright spots or striations.

   b. Lens shall have opaque risers; color shall be as specified in Section 26 5613 Appendix A Exterior Lighting Schedule.

   c. Finish of visible regress surface of door shall be matte baked enamel paint, special color as selected by Architect.

   d. All fixtures with fresnel lenses, unless otherwise specified, must be furnished by the same manufacturer.

2. Glass:

   a. Flat glass lenses shall be heat tempered borosilicate glass unless otherwise noted.

   b. Glass finishes, i.e. sandblasting, etching, polishing shall be performed as described in the fixture description.

3. Acrylic:

   a. Lenses shall be of injection molded crystal clear material 100% virgin acrylic (except as shown). For lenses with male pattern of pyramids or

cones, specified minimum thickness refers to distance from flat surface to base of pyramids (cones), or thickness of undisturbed material. For lenses with female pattern, specified minimum thickness refers to overall thickness of material.

b. Lenses shall fully eliminate lamp images when viewed from all directions within the 45° to 90° angle from vertical when the ratio of lamp spacing to the distance from lamp underside to top of lens does not exceed 1.50. Within the viewing angle from 0° to 45° the ratio of maximum brightness (under a lamp) to minimum brightness (between lamps) shall not exceed 3 to 1.

c. Finishes, i.e. sandblasting, etching, polishing shall be performed as described in the fixture description.

K. Louvers:

1. Parabolic:

a. Louvers shall be continuously bound in channel formed frame, finish and color as specified or as selected.

b. Louver shall provide a minimum visual cut-off to the lamp of 45°.

c. The finish of the inner surface of the reflector shall be highly specular as produced under the Alzak process. The reflector shall have an anodic coating of not less than four mils thick. The reflector inner surface shall be free of water spotting and shall maintain a reflectivity ratio of not less than 85% on clear specular finish. The reflector shall have a low iridescence finish free from multiple colors seen from normal viewing angles.

2. Flat Blade:

a. Provide flat blade louvers within formed frame, finish and color as specified.

b. Louvers to provide minimum of 45° degree cut-off from lamp image.

c. Blade thickness to minimum .125” flat steel.

L. In adjustable fixtures, aiming and positive locking devices shall be provided.

M. Fixtures with an adjustable lamp and using a lamp with an asymmetrical light pattern shall have an aiming stop which can be permanently set so that the lamp shall remain correctly positioned after service or relamping.

N. Fluorescent Fixtures:

1. Hot Cathode:

a. Housing:

1) No. 22 minimum gauge steel, bonderized or equal rust protected, or No. 16 gauge aluminum rigid construction, suitable for continuous row mounting where indicated.

2) Finish: Baked enamel paint finish unless otherwise specified, color as specified or as selected.

3) Exterior Fixture Finishes:

a) Unless otherwise specified, all painted surfaces shall have an outdoor life expectancy of not less than 20 years. Surfaces shall be prepared, primed, and material applied in accordance with the manufacturer's requirements.

b) Color: Colors shall be as specified under Section Section 26 5613 Appendix A Exterior Lighting Schedule.

b. Reflector: Minimum 85% reflectance.

c. Lightshields:

2) Frames: Provide extruded aluminum frames with mitered corners filled and ground smooth. Provided with concealed hinges and invisible latching.

3) No cross bars shall be permitted over lightshields.

d. Lampholders:

1) Lampholders shall be UL listed, and meet IEC-60400, “International Standard: Lampholders for tubular fluorescent lamps and startholders”.

e. For rapid start lamps on single ballasts, provide one (1) grounding lampholder per lamp. Lampholders operating with open circuit voltage in excess of 300 volts shall be safety type and shall open supply circuit when lamp is removed from lampholder.

1) Mount lamps used in rapid start circuits 430mA and below: within 1/2" of grounded metal as long as the lamp.

2) 800mA and 1500mA lamps: mount within 1" of grounded metal as long as the lamp.

f. Fluorescent fixtures shall conform to NEMA Standards, including references to fixture dimensions and temperature ratings.

g. Ballasts shall be electronic high power factor (greater than 90%), ballast factor (greater than 87%) and approved by UL (UL 935 listed). Ballasts shall be certified for voltage and number of lamps specified and equipped with internal thermal protectors unless otherwise specified.

1) Ballasts shall have a Crest Factor of less than one and seven tenths.

2) Ballasts for indoor applications shall be "Class P".

3) Provide multi-lamp ballasts where possible including continuous rows of one-lamp fixtures, and one-lamp ballasts only where the fixture layout does not permit the use of multi-lamp ballasts.

4) Ballast shall be a dedicated ballast to operate a specific lamp, i.e., T8 ballasts specifically for a T8 lamp.

5) All ballasts shall operate at the voltage as described in Section 26 5613 Appendix A Exterior Lighting Schedule and confirmed on electrical drawings. Ballasts shall operate lamps properly through the following supply voltage ranges:

a) Rated voltage +/- 10%
b) Universal voltage of 108 to 305V on 50 or 60Hz supply

6) Ballast shall tolerate sustained open circuit and short circuit output conditions without damage.

7) Frequency shall be 20 Khz or greater except as noted without any discernible flicker (<3% flicker index).

8) Ballast shall have input current total harmonic distortion not to exceed 10% of the fundamental harmonic (60 Hz).

9) Ballast shall not contain PCB materials.

10) Ballast shall provide transient immunity as recommended by ANSI C62.41-1991 location Category A2.

11) Ballast shall be encapsulated to ensure maximum thermal and structural integrity.

12) Ballast minimum sound ratings:

    a) 265 mA: Class 'A'

    b) 430 mA: Class 'A'

    c) 800 mA: Class 'B'

    d) 1500 mA: Class 'C'

13) All fixtures installed in exterior or unheated interior spaces shall be supplied with ballasts which start lamps down to 0°F unless noted otherwise.

14) Ballasts for T5, T5HO, and CFL lamps shall incorporate auto resetting lamp shutdown circuitry for end of lamp life protection thereby allowing for re-lamping without the need to cycle power.

15) Program Rapid start ballasts shall be used when the lamps are to be frequently turned on/off (with cycles of less than 3 hours). Otherwise ballast shall provide instant starting sequence consistent with ANSI standard C82.11-1993.

16) Ballast shall be manufactured in an ISO 9002 certified facility.

17) Manufacturer shall have minimum 15 years of manufacturing experience.

18) Ballast, unless specified otherwise, shall be same manufacturer and model in each fixture of the same type. Acceptable ballast manufacturers unless otherwise noted are:

a) Advance

b) Universal Lighting Technologies

c) Osram/Sylvania

d) Lutron

h. Lighting fixtures recessed in a hung ceiling where the space above the hung ceiling is used as a plenum chamber for either supply or return air for the air conditioning system shall be designed, manufactured and wired to conform to NEC Article 300-22.

2. When specified, fluorescent luminaires shall have radio frequency interference (RFI) or electromagnetic interference filters. Filters shall either be integral or external to the ballast, but must be integral to the luminaire assembly with one filter per ballast and shall suppress electromagnetic interference in the AM radio band from 500 to 1700 kHz. Filters shall also be in the circuit serving the lighting fixture.

O. Incandescent Fixtures:

1. Incandescent fixtures, unless otherwise specified, shall be operated at 90% of rated lamp voltage by means of a bucking transformer at the distribution panel for extended lamp life. Bucking transformers shall not be used on those circuits where dimmers are used. Refer to Electrical Engineers drawings and Specifications for manufacturer, quantity and size of bucking transformers required. (Refer to Section 26 5613 Appendix A Exterior Lighting Schedule, for lamp voltages.)

2. Housing:

a. Steel, bonderized or equal rust protected or aluminum, rigid construction. Minimum gauge thickness shall be as follows:

1) Exterior locations: No. 18 gauge steel, No. 14 gauge aluminum.

b. Finish: Baked enamel finish (except when otherwise specified).

1) Concealed interior surfaces (this applies to interior hardware, lampholders, yokes, brackets, etc.): matte black.

2) Concealed exterior surfaces: matte black.

3) Visible surfaces: color and texture as specified below for each fixture type or as selected.

4) Exterior Fixture Finishes:

a) Unless otherwise specified, all painted surfaces shall have an outdoor life expectancy of not less than 20 years. Surfaces shall be prepared, primed, and material applied in accordance with the manufacturer's requirements.

b) Color: Colors shall be as specified under Section 26 5613 Appendix A Exterior Lighting Schedule.

3. Reflector Cones: refer to "Reflector Cones", above.

4. Reflectors not visible within normal viewing angles shall be highly specular as produced under the Alzak process, except when otherwise specified. Minimum reflectance shall be 85%.

5. Provide safety devices for removable fixture elements (cones, reflectors, lenses and fixture doors, etc.). Safety devices shall support removable elements when not in normal operating position, and be detachable if necessary. This device shall not interfere with fixture performance, maintenance, or the seating of any fixture element, and shall not be visible during normal fixture operation.

6. Thermal protection device shall be provided as required by code.

P. High Intensity Discharge Fixtures:

1. Housing, where applicable:

a. Steel bonderized or equal rust protected, or aluminum, rigid construction. Minimum gauge thickness shall be as follows:

1) Exterior locations: No. 18 gauge steel, No. 14 gauge aluminum.

b. Finish: Baked enamel finish.

1) Concealed surfaces: matte black.

2) Visible surfaces: color and texture as specified below for each fixture type or as specified in Section 26 5613 Appendix A Exterior Lighting Schedule.

3) Exterior Fixture Finishes:

a) Unless otherwise specified, all painted surfaces shall have an outdoor life expectancy of not less than 20 years. Surfaces shall be prepared, primed, and material applied in accordance with the manufacturer's requirements.

b) Color: Colors shall be as specified under Section 26 5613 Appendix A Exterior Lighting Schedule.

c. Lampholder housing: cast aluminum with integral heat radiating fins to assure cool lamp base operation.

d. Fixture housing design shall provide for top and bottom relamping, unless otherwise specified.

2. Reflector: High purity (not less than 99.0%) aluminum. Specular finish shall be achieved by mechanical- and electro-polishing. Reflector shall be anodized to prevent surface corrosion or deterioration. The reflectance shall not be less than 85%.

3. Provide safety devices for removable fixture elements (cones, reflectors, lenses, fixture doors, etc.). Safety devices shall support removable elements when not in normal operating position, and be detachable if necessary. This device shall not interfere with fixture performance, maintenance, or the seating of any fixture element, and shall not be visible during normal fixture operation.

4. Magnetic Ballasts: High power factor, UL approved constant wattage auto-transformer type for voltage and lamp specified - 60 hertz.

a. Ballasts shall be designed in accordance with all applicable ANSI specifications including ANSI C82.4 and shall comply with UL 1029.

b. Ballasts shall have a normal ambient operating temperature of 104 degrees F.

c. The light output shall not vary more than 11% with a +/- 5% voltage variation in high reactance circuit

d. The light output shall not vary more than 5% with +/- 10% voltage variation in CWA circuit.

e. Lamp drop out voltage shall not exceed minus 25% of the rated voltage for the high reactance circuit and minus 30% for the CWA circuit.

f. Ballasts located indoors shall be encased in a housing which provides necessary wiring compartments and provisions for required electrical connectors or devices.

g. Ballast components shall be surrounded with a thermosetting fill to assure adequate heat dissipation and quiet operation.

h. Ballasts shall be provided with necessary mounting hardware and vibration dampers.

i. Ballasts for outdoor use shall be encased in watertight enclosures with proper outdoor wiring devices. Ballasts shall be suitable for starting lamps at temperatures between -29°C, and 41°C.

5. Electronic Metal Halide ballasts:

a. Unless specified otherwise, shall be same manufacturer and model in each fixture of the same type.

b. Shall have an input voltage range with a variation of at least +/- 20% and +/- 1% lamp regulation resulting in greater lamp stability in areas with poor power regulation.

c. Output shall be “square wave” with an operating frequency of less than 200 Hz.

d. Shall incorporate a “Turn Off” shutdown safety feature not exceeding a response time of 3 seconds to prevent excessive ignition, undue system stress and improved long term performance of the ballast under the following conditions: no lamp, failed lamp, end of life lamp, leaker lamps and other sustained abnormal conditions such as rectification and glow mode.

e. Shall comply with FCC Part 18 Class A. The manufacturer shall provide documentation of compliance with non-consumer limits for EMI & RFI.

f. Shall have a Total Harmonic Distortion (THD) less than 10%.

g. Shall have a lamp Crest Factor of les than 1.3.

h. Shall have a Power Factor of not less than 96%.

i. Shall be sound rated “A”.

j. Shall be equipped with internal thermal protection to shut down the ballast when operating temperatures reach unacceptable levels.

k. Shall be UL and CUL “Listed or Recognized” for 120v and 277v applications and CE “Listed” for 220 to 240v 50 Hz applications.

l. Shall incorporate a metal case and be suitable for recessed use.

m. Shall be designated Type 1 – Outdoor

n. Shall be capable of remote mounting with a distance of not less than 10’-0”.

o. Shall incorporate Electrolytic Capacitor(s) with minimum rating of 8,000 hours at 105 degrees C and a minimum life expectancy exceeding 64,000 hours at 75 degrees C.

p. Manufacturer shall offer a Five (5) year product warranty.

q. Manufacturer shall have a minimum of fifteen (15) experience in the manufacture of electronic power lighting products, two (2) years experience in the manufacture of Electronic Metal Halide ballasts and no less than fifty thousand (50,000) units installed worldwide.

r. The specified lamps shall be approved and/or warranted by the lamp manufacturer for use with the designated Electronic Metal Halide ballast.

s. Shall have built in circuit protection.

t. Shall have a designated ballast factor of 1.0.

u. Acceptable ballast manufacturers unless otherwise noted are:

1) Aromat

2) Hatch

3) Metro-light

6. Lighting fixtures recessed in a hung ceiling where the space above the ceiling is used as a plenum chamber for either supply or return air for the air conditioning system shall be designed, manufactured, and wired to conform with NEC Article 300-22.

7. Provide clear glass safety lens in all Metal Halide fixtures unless otherwise noted.

Q. Solid State Lighting / Light Emitting Diode (LED) Lamps and Luminaires:

1. General:

a. Luminaire manufacturer shall have a minimum of five (5) years experience in the manufacture and design of LED products and systems and no less than one hundred (100) North American installations.

b. Unless otherwise specified, all LED luminaires and power/data supplies shall be provided by a single manufacturer to ensure compatibility.

c. All components, peripheral devices and control software are to be provided by and shall be the responsibility of a single entity. All components shall perform successfully as a complete system and shall operate as described in Lighting Designer’s Control Narrative documents or Section 26 06 50.16, Lighting Fixture Schedule.

d. Provide submittals as described in Part 1 above.

e. Include all components necessary for a complete installation. Provide all power supplies, synchronizers, data cables, and data terminators for a complete working system.

f. All LED sources used in the LED luminaire shall be of proven quality from established and reputable LED manufacturers and shall have been fabricated after 2007. Acceptable LED lamp manufacturers unless otherwise noted are:

1) Cree, Inc.
2) Philips Lighting
3) Nichia Corporation
4) Norlux
5) Opto Technology, Inc.
6) Osram Optronic Semiconductors

2. Replacement and Spares:

a. Manufacturer shall provide written guarantee of the following:

1) Manufacturer will keep record of original bin for each LED module and have replacement modules from the same bin available for three (3) years after date of installation.

2) Manufacturer will keep an inventory of replacement parts (source assembly, power and control components).

3) Manufacturer's LED system will not become obsolete for ten (10) years: Manufacturer will provide exact replacement parts, or provide upgraded parts that are designed to fit into the original luminaire and provide equivalent distribution and lumen output to the original, without any negative consequences.

b. All parts of system shall replaceable in field. Manufacturer shall provide written guarantee of the following:

1) Manufacturer has in place a written recycling and re-use program, and will accept returned product and/or components for recycling or re-use.

2) Manufacturer will properly dispose of non-recyclable components that are deemed harmful to the environment.

c. System shall carry a full warranty for five (5) years. Manufacturer shall be responsible for cost of labor not to exceed $50 per individual part, and cost of shipping, to replace any component of the system that fails within 2 years of installation.

3. Products and Components – Performance

a. LED luminaires and components shall be UL listed or UL classified.

b. LED luminaires and components shall be CE certified.

c. LED luminaires and components shall be PSE marked.

d. All LED luminaires shall be subjected to the following JEDEC Reliability Tests for Lead-free Semiconductors: HTOL, RTOL, LTOL, PTMCL, TMSK, Mechanical Shock, Variable Vibration Frequency, SHR, Autoclave.

e. To ensure luminaire quality, luminaire shall have been tested under accelerated life test conditions including an operating temperature span of 360 degrees F, and cyclic loading up to 60G.

f. All products included in system shall use Mil-Std 810F, Random Vibration 7.698g as a minimum standard. In installations subject to vibration, luminaire shall be installed with vibration isolation hardware to sufficiently dampen vibrations.

g. All LED components shall be mercury and lead-free.

h. All manufacturing processes and materials shall conform to the requirements of the European Union's Restriction on the Use of Hazardous Substances in Electrical and Electronics Equipment (RoHS) Directive, 2002/95/EC.

i. LEDs shall comply with ANSI/NEMA/ANSLG C78.377-2008 – Specifications for the Chromaticity of Solid State Lighting Products. Color shall remain stable throughout the life of the lamp. Color shall match approved sample.

j. LEDs shall comply with IESNA LM-80 – Standards for Lumen Maintenance of LED Lighting Products

k. White LEDs shall have a rated source life of 50,000 hours under normal operating conditions. RGB LEDs shall have a rated source life of 100,000 hours. LED “rated source life” is defined as the time when a minimum of 70% of initial lumen output remains.

l. Luminaire assembly shall include a method of dissipating heat so as to not degrade life of source, electronic equipment, or lenses. LED luminaire housing shall be designed to transfer heat from the LED board to the outside environment. Luminaire housing shall have no negative impact on life of components.

m. Manufacturer shall supply in writing a range of permissible operating temperatures in which system will perform optimally.

n. High power LED luminaires shall be thermally protected using one or more of the following thermal management techniques: metal core board, gap pad, and/or internal monitoring firmware

o. LEDs shall be adequately protected from moisture or dust in exterior applications.

p. For wet and damp use, LED-based luminaires itself shall be sealed, rated, and tested for appropriate environmental conditions, not accomplished by using an additional housing or enclosure. Such

protection shall have no negative impact on rated life of source or components, or if so, such reductions shall be explicitly brought to the attention of the designer.

q. All hardwired connections to LED luminaires shall be reverse polarity protected and provide high voltage protection in the event connections are reversed or shorted during the installation process.

r. The LED luminaire shall be operated at constant and carefully regulated current levels. LEDs shall not be overdriven beyond their specified nominal voltage and current.

s. RGB LED luminaires shall utilize an equal combination of high brightness red, blue and green LEDs, unless otherwise noted, to provide up to 16.7 million additive RGB colors and shall be capable of at least 8-bit control.

t. Manufacturer shall be able to provide supporting documentation of the product meeting third party regulatory compliance.

u. Manufacturer shall ensure that products undergo and successfully meet appropriate design and manufacturability testing including Design FMEA, Process FMEA, Environmental Engineering Considerations and Laboratory Tests, IEC standards and UL/CE testing.

v. All LED luminaires (100% of each lot) shall undergo a minimum twenty-four (24) hour burn-in during manufacturing, prior to shipping.

w. Manufacturer shall provide Luminaire Efficacy (lm/W), total luminous flux (lumens), luminous intensity (candelas) chromaticity coordinates, CCT and CRI. optical performance, polar diagrams, and relevant luminance and illuminance photometric data. Provide data in IES file format in accordance with IES LM-79-2008, based on test results from an independent Nationally Recognized Testing Laboratory.

x. Power / data supply shall have the following:

1) Supply outputs shall have current limiting protection.
2) Supply shall provide miswiring protection.
3) Supply shall have power factor correction.
4) Supply shall provide connections that are conduit-ready or clamp-style connections in the case of low-voltage wiring.
5) Supply shall come with a housing that meets a minimum IP20 rating for dry location installation unless located in a damp or wet location.
6) Supply shall be UL listed for Class 1 or Class 2 wiring

R. Wiring:

1. Voltage Rating

a. For voltages up to 120 volts fixture wiring shall be rated for 300 volts minimum.

b. For voltages above 120 volts fixture wiring shall be rated for 600 volts minimum.

2. Temperature Rating - Internal to Fixture

a. All wiring shall be code-approved for fixture wiring, and shall comply with the following temperature ratings unless fixture design or local codes require higher temperature wire.

b. Incandescent

1) minimum rated between lampholder(s) and separately mounted junction box or internal transformer.

2) minimum rated between internal transformer and separately mounted junction box.

3) Tungsten-halogen lamp seal temperature shall not exceed 350°C at ambient of 25°C when tested per UL Bulletin 57, Par. 328-334. Submit certified heat test data by independent testing laboratory.

c. Fluorescent

1) minimum rating between lampholder(s) and internal ballast.

2) minimum between ballast and separate junction box, or connection within integral wireway.

d. High Intensity Discharge

1) minimum rating between lampholder(s) and separate junction box or connections with ballast components.

2) minimum rating between core and coil ballast components and separate junction box.

3) minimum rating between encased and potted ballast components and separate junction box.

3. Temperature Rating - External to Fixture

a. All flexible cord wiring between fixture components or to electrical receptacle and not in wireways shall have a minimum temperature rating of 105°C.

b. Cord type shall be suitable for application and shall be fitted with proper strain relief and watertight entries where required by application.

c. Splices

d. Splices internal to fixture shall be made within separate splice compartments and shall utilize nylon insulated crimped connections or insulated quick disconnects.

e. Splices to branch circuit wiring in separate junction boxes shall utilize flame retardant thermoplastic caps with fully seated helical metal spring and threaded entry.

4. No internal wiring shall be visible at normal viewing angles, i.e., above 45° from vertical. Use additional wire clamps if necessary. Anticipate increased visibility if fixtures are mounted on or recessed within a sloping surface.

5. Any fixture fed from more than one panel, i.e., for normal and night or emergency operation, shall have separate neutrals to each panel.

6. Furnish code-approved wiring in ceiling cavities forming air plenums.

S. Lamps:

1. Hot cathode fluorescent lamps:

a. Shall be 3000° Kelvin, with 85 CRI or greater except as shown. Refer to Section 26 5613 Appendix A Exterior Lighting Schedule for details.

b. All lamps, except as specified, shall be of the same manufacturer:

1) General Electric
2) North American Philips
3) Osram/Sylvania

c. T8 fluorescent lamps shall be of the “high performance” or “super” T8 type with extended lamp life and low mercury content.

1) Four foot long 32 watt lamps shall have an initial lumen output of 3100 lumens, minimum.
2) Four foot long lamps shall have a mean efficacy of 92 mean lumens per nominal wattage, minimum.
3) Four foot long lamps shall have a rated lamp life of 24,000 hours or greater based on 3 hours per start if operated in rapid start mode.
4) Mercury content in lamps shall be TCLP-compliant.
5) Lamp lumen depreciation shall not be less than 92% of initial lamp lumens at 20,000 hours rated lamp life.
6) Ballasts used with these lamps shall be a NEMA Premium electronic ballast, no substitutions allowed.

2. Incandescent lamps:

a. 120 volt, except as shown. Refer to Section 26 Section 26 5613 Appendix A Exterior Lighting Schedule for details. All lamps, except as specified, shall be of the same manufacturer:

1) General Electric
2) North American Philips
3) Osram/Sylvania

b. Energy saving type lamps which use an electronic diode shall not be used unless otherwise specified in Section 26 5613 Appendix A Exterior Lighting Schedule.

3. High intensity discharge lamps:

a. Refer to Section 26 5613 Appendix A Exterior Lighting Schedule for details. All lamps, except as specified, shall be of the same manufacturer:

1) General Electric
2) North American Philips
3) Osram/Sylvania
4) Venture

T. Pole/Luminaire Assemblies:

1. Supply luminaires, davit arms, brackets, poles, handhole covers, base components, and all other accessories complete by specified manufacturer who will be responsible for proper fitting of all elements.

2. Manufacturer will supply assembly to withstand 100 mph winds with a 1.3 gust factor without permanent deflection.

3. Manufacturer shall be responsible for design of and structural integrity of complete base (i.e., concrete dimensions, rebar requirements, grounding and conduit requirements, drainage and ground compaction requirements).

PART 3 EXECUTION

3.01 SHIPPING AND STORAGE

A. All fixtures received at the site shall be stored in clean and dry space until fixtures are installed.

B. Manufacturer shall clearly mark each box with fixture designation prior to shipping.

C. Reflector cones, baffles, louvers, aperture plates, and decorative elements of fixtures shall be packed by the manufacturer separate from the housing (body, stem, etc.) of the fixture.

3.02 LOCATION

A. Locations of fixtures are shown diagrammatically. Verify exact location and spacing with Reflected Ceiling Plans, Landscape/Site Plans and other reference data before ordering of fixtures and during installation.

B. Notify Architect about field conditions at variance with Contract Documents before commencing installation.

C. Coordinate space conditions with other trades before ordering of fixtures.

D. Pendant mount, as approved, surface type fixtures where required to meet space conditions.

E. Coordinate length of continuous-run fluorescent fixtures with adjacent walls, partitions, coffers and other architectural elements as required.

1. Continuous runs shall be defined as the optimal combination of 3’ and 4’ lamp length as necessary to complete runs with no more than 6” of free space at either end of the run as provided by the contractor.

3.03 INSTALLATION

A. Provide accessories as required for landscape or building construction type indicated on Finish Schedule. Fixture catalog numbers do not necessarily denote specific mounting accessories for type of surface in which a fixture may be installed.

B. Provide adequate and sturdy support for each lighting fixture. Contractor shall be responsible for verifying weight and mounting method of all fixtures and furnish and install suitable supports. Fixture mounting assemblies shall comply with all local seismic codes and regulations.

C. Install rows of fixtures accurately on straight lines unless otherwise indicated on drawings. Coordinate with mechanical and landscape work.

D. Install fixtures with vent holes free of air blocking obstacles.

E. Where plaster ceilings occur, furnish plaster frames for setting under other applicable sections. Direct the setting and be responsible for correct location; make sure the bottom of frame is flush with finished ceiling, forming screed edge for finished plaster.

1. Fixtures shall be supported by plaster frames utilizing yokes or leveling lugs.

a. Fixtures and support elements shall not be mounted to or in contact with ducts or pipes.

b. Yoke shall have channel cross section of sufficient gauge, and shall support a fixture by means of not fewer than two (2) bolts each.

2. Lighting fixtures recessed in ceilings or soffits which have a fire resistive rating of one hour or more shall be enclosed in a box which has a fire resistive rating equal to that of the ceiling or soffit.

F. Contractor shall be responsible for adjusting aperture rings on all ceiling or soffit recessed fixtures to accommodate various ceiling material thickness. Contractor shall responsible for coordinating the cut-out size in ceiling to ensure aperture covers cut-out entirely. The bottom of aperture rings shall be flush with finished ceiling or not more that 1/16" above. Under no circumstances will the aperture ring extend below the finished ceiling surface.

G. For fixtures with variable position lampholder assemblies Contractor shall confirm prior to installation proper lampholder (socket) position in field, and shall adjust, if necessary, after coordination with manufacturer.

H. Surface Mounted Fixtures: Support surface mounted fixtures from structural members other than ceiling tees.

I. Pendant Mounted Fixtures:

1. Pendant mounted fixtures shall be supported from structural framework of ceiling or from inserts cast into slab.

2. All pendants shall have swivel aligners located at the top ends; pendants shall be 1/2" rigid steel conduit unless specifically indicated otherwise on drawings or in specifications.

3. All fluorescent pendant and surface mounted fixtures shall be supported with two (2) supports per four foot section or three (3) per eight foot section unless otherwise recommended by manufacturer.

J. Bracket Mounted Fixtures: For each bracket fixture, provide flanged metal stem attached to outlet box, with threaded end suitable for supporting the fixture rigidly in design position. Flanged part of fixture stud shall be of broad base type, secured to outlet box at not fewer than three (3) points.

K. Top Relamping Fixtures: Top relamping fixtures shall have the necessary top-relamping screws loosened and moderately tightened, prior to installation, to assure ease of operation when relamping is required.

L. Fluorescent Fixtures: Replace noisy ballasts as directed, at no cost to the Owner.

M. High Intensity Discharge Fixtures: Replace noisy ballasts as directed, at no cost to the Owner.

N. Solid State Lighting / Light Emitting Diode (LED) Fixtures:

1. Color Changing or Programming Support

a. Provide installation and commissioning support to the electrical contractor as required to achieve a complete and operational system that meets the intent of the Control Narrative.

b. In addition to the above, provide a factory representative for up to 2 number visits not to exceed 16 hours for field calibration and programming in the presence of the Lighting Designer.

O. Mask the trims and bottoms of all lighting fixtures if necessary to protect the fixture during construction.

P. At the completion of construction clean the bottoms, the trim, the reflecting surfaces, lenses, baffles, louvers and reflector cones of all lighting fixtures so as to render them free of any material, substance or film foreign to the fixture. If the

luminaires are deemed dirty by the Architect at the completion of the project, the Contractor shall clean them at no additional cost to the Owner. Luminaire components whose finishes are damaged shall be replaced at no cost to the Owner.

Q. Ascertain and ensure that all lamps installed are exactly as specified for each fixture type.

R. Replace all burned-out or inoperative lamps, and inoperative ballasts in all high intensity discharge and fluorescent fixtures before the building is accepted by the Owner so that all lighting fixtures will be in first-class operating condition.

S. Re-lamp all specified H.I.D. fixtures used as construction work lights with new specified lamps. No H.I.D. lamps shall have a burning hours difference which exceeds forty (40) hours.

T. Re-lamp all specified incandescent fixtures used as construction work lights with new specified lamps. No incandescent lamps shall have a burning hours difference which exceeds forty (40) hours.

U. Provide labor and materials for final aiming of all adjustable fixtures under the Architect's supervision. Aiming shall take place immediately before building is turned over to Owner, after regular working hours where required.

PART 4 - METHOD OF MEASUREMENT

4.01 EXTERIOR LIGHTING SYSTEM

A. The quantity to be measured for payment is a single lump sum.

PART 5 - BASIS OF PAYMENT

5.01 EXTERIOR LIGHTING SYSTEM

A. The unit price bid shall include the cost of all labor, material, and equipment necessary to furnish and install all lights and light poles, as well as the catenary light system cable and rod assembly, including excavation and backfill, conduit, wiring, foundation, adjustment to finish grade, field testing and warranty, complete, as indicated on the Drawings and specified.

Payment will be made under:

ITEM NO.	ITEM	PAY UNIT
265613.01	Exterior Lighting System	Lump Sum

END OF SECTION

SECTION 265613 – APPENDIX A

EXTERIOR LIGHTING SCHEDULE

Type		Mfr/Catalog #	Lamping	Electrical	Notes
EX1		Selux "Discera 600 Catenary" #DSC6L-R5-C-6TL500-30-POWER LENGTH-SP(RAL 8019)-208 Description: Catenary suspended 23-5/8" diameter x 5-5/8" tall gasketed LED downlight with 1-58W 3000K white LED (64 system watts), die-cast aluminum housing, tool-less steel latch, galvanized steel suspension bracket, tempered screened glass lens, high transmittance custom molded Type V optical distribution lenses, custom RAL 8019 polyester powder coat fixture finish, stainless steel catenary mounting, and integral LED driver.	1 - 58W 3000K white LED (included); 64 System Watts	Integral LED driver Voltage: Shall be Specified by Electrical Engineer	Location: Pedestrian Way 1. Fixture shall have a custom RAL 8019 finish. 2. Fixture shall be mounted 20'-0" AFF to the bottom of the fixture. 3. Fixtures shall be catenary mounted from poles specified and provided by others. 4. Fixture mounts on support cables as detailed by the Structural Engineer. Refer to architectural drawings for mounting heights. 5. Fixtures shall be ordered with the necessary mounting hardware for installation on a complete system. 6. Power cord length coordination required. 7. Fixture shall have a 5-year warranty. 8. Fixture shall be U.L. listed and labeled "suitable for wet locations." 9. Electrical Engineer shall verify voltage and emergency operation.

Type		Mfr/Catalog #	Lamping	Electrical	Notes
EX2		Selux "Discera 600 LED Pole Type I & III" #DSC6L-R1-R3-L2-4TL500-30-POWER LENGTH-SP(RAL 8019)-208-SM3085A (fixtures) + AT74-20-SP(RAL 8019)-BC10-REC-T35 (pole) Description: Fixtures: Pole top mounted gasketed LED dark-sky compliant downlight with 2-58W (64 system watts) 3000K LED fixture heads, die-cast low copper aluminum alloy housing, cast fitter, double welded steel long mounting arm, tool-less steel latch, tempered and screened glass lens, high transmittance custom molded Type I and Type III optical distributions lenses, removable LED light engine, custom RAL 8019 polyester powder coat fixture finish, surge protection device, and integral LED driver. Pole: 7" to 4" tapered 20' spun 6063 alloy aluminum pole, cast 356 alloy aluminum anchor base, die-cast base cover, 120V 15a GFCI receptacle with weather-proof cover located at 8'-0" high, 3.5" tennon, 3/4" diameter knockout with weather-proof plug located at 10'-0" high, and custom RAL 8019 polyester powder coat fixture finish.	2 - 58W 3000K white LED (included); 64 System Watts	Integral LED driver Voltage: Shall be Specified by Electrical Engineer	Location: Bank Alley 1. Fixture shall be supplied with (1) Type I fixture head and (1) Type III fixture head mounted at 180 degrees. 2. Power cord length coordination required. 3. Pole shall be provided with a 3/4" diameter knockout with weather-proof plug at 10'-0" high for future security camera installation. 4. Fixture shall have a custom RAL 8019 finish. 5. Fixture to be U.L. listed and labeled "suitable for wet locations." 6. Refer to base and anchorage detail by Architect / Civil engineer. Provide pole to meet local and AASHTO requirements for EPA of fixture configuration. Architect / Civil Engineer shall coordinate pole anchorage detail to concrete base. 7. Provide detailed shop drawings noting base and anchorage detail, pole specifications conforming to all applicable codes, electrical requirements, and photometric characteristics. 8. Provide shop drawings noting mounting arm configurations, fixture heights on the pole, hand hole and receptacle locations. 9. Architect shall verify pole and fixture finish. 10. Pole shall be provided with a 120V 15a GFCI receptacle located 8'-0" high. 11. Electrical Engineer shall verify voltage and emergency operation. 12. Fixtures shall have a 5-year warranty.

Type		Mfr/Catalog #	Lamping	Electrical	Notes
EX2A		Selux "Discera 600 LED Pole Type I & II" #DSC6L-R1-R2-L2-4TL500-30-POWER LENGTH-SP(RAL 8019)-208-SM3085A (fixtures) + AT74-20-SP(RAL 8019)-BC10-REC-T35 (pole) Description: Fixtures: Pole top mounted gasketed LED dark-sky compliant downlight with 2-58W (64 system watts) 3000K LED fixture heads, die-cast low copper aluminum alloy housing, cast fitter, double welded steel long mounting arm, tool-less steel latch, tempered and screened glass lens, high transmittance custom molded Type I and Type II optical distributions lenses, removable LED light engine, custom RAL 8019 polyester powder coat fixture finish, surge protection device, and integral LED driver. Pole: 7" to 4" tapered 20' spun 6063 alloy aluminum pole, cast 356 alloy aluminum anchor base, die-cast base cover, 120V 15a GFCI receptacle with weather-proof cover located at 8'-0" high, 3.5" tennon, banner hangers, 3/4" diameter knockout with weather-proof plug located at 10'-0" high, and custom RAL 8019 polyester powder coat fixture finish.	2 - 58W 3000K white LED (included); 64 System Watts	Integral LED driver Voltage: Shall be Specified by Electrical Engineer	Location: Bank Alley 1. Fixture shall be supplied with (1) Type I fixture head and (1) Type II fixture head mounted at 180 degrees. 2. Power cord length coordination required. 3. Pole shall be provided with a 3/4" diameter knockout with weather-proof plug at 10'-0" high for future security camera installation. 4. Fixture shall have a custom RAL 8019 finish. 5. Fixture to be U.L. listed and labeled "suitable for wet locations." 6. Refer to base and anchorage detail by Architect / Civil engineer. Provide pole to meet local and AASHTO requirements for EPA of fixture configuration. Architect / Civil Engineer shall coordinate pole anchorage detail to concrete base. 7. Provide detailed shop drawings noting base and anchorage detail, pole specifications conforming to all applicable codes, electrical requirements, and photometric characteristics. 8. Provide shop drawings noting mounting arm configurations, fixture heights on the pole, hand hole and receptacle locations. 9. Architect shall verify pole and fixture finish. 10. Pole shall be provided with a 120V 15a GFCI receptacle located 8'-0" high. 11. Electrical Engineer shall verify voltage and emergency operation. 12. Fixtures shall have a 5-year warranty.

Type		Mfr/Catalog #	Lamping	Electrical	Notes
EX2B		Selux "Discera 600 LED Pole Type III" #DSC6L-R3-L2-4TL500-30-POWER LENGTH-SP(RAL 8019)-208-SM3085A (fixtures) + AT74-20-SP(RAL 8019)-BC10-REC-T35 (pole) Description: Fixtures: Pole top mounted gasketed LED dark-sky compliant downlight with 2-58W (64 system watts) 3000K LED fixture heads, die-cast low copper aluminum alloy housing, cast fitter, double welded steel long mounting arm, tool-less steel latch, tempered and screened glass lens, high transmittance custom molded Type III optical distribution lenses, removable LED light engine, custom RAL 8019 polyester powder coat fixture finish, surge protection device, and integral LED driver. Pole: 7" to 4" tapered 20' spun 6063 alloy aluminum pole, cast 356 alloy aluminum anchor base, die-cast base cover, 120V 15a GFCI receptacle with weather-proof cover located at 8'-0" high, 3.5" tennon, banner hangers, 3/4" diameter knockout with weather-proof plug located at 10'-0" high, and custom RAL 8019 polyester powder coat fixture finish.	2 - 58W 3000K white LED (included); 64 System Watts	Integral LED driver Voltage: Shall be Specified by Electrical Engineer	Location: Bank Alley 1. Fixture shall be supplied with (2) Type III fixture heads mounted at 180 degrees. 2. Power cord length coordination required. 3. Pole shall be provided with a 3/4" diameter knockout with weather-proof plug at 10'-0" high for future security camera installation. 4. Fixture shall have a custom RAL 8019 finish. 5. Fixture to be U.L. listed and labeled "suitable for wet locations." 6. Refer to base and anchorage detail by Architect / Civil engineer. Provide pole to meet local and AASHTO requirements for EPA of fixture configuration. Architect / Civil Engineer shall coordinate pole anchorage detail to concrete base. 7. Provide detailed shop drawings noting base and anchorage detail, pole specifications conforming to all applicable codes, electrical requirements, and photometric characteristics. 8. Provide shop drawings noting mounting arm configurations, fixture heights on the pole, hand hole and receptacle locations. 9. Architect shall verify pole and fixture finish. 10. Pole shall be provided with a 120V 15a GFCI receptacle located 8'-0" high. 11. Electrical Engineer shall verify voltage and emergency operation. 12. Fixtures shall have a 5-year warranty.

Type		Mfr/Catalog #	Lamping	Electrical	Notes
EX3		BK Lighting "El Dorado" #CUS-1207-58-ED-LED-E22-WFL/WFL-A9/A9-RAL 8019-12/12-11/11-B/B-MOD INTEGRAL TRANSFORMER-MOD COLUMN MOUNTING Description: Column mounted LED direct/indirect sconce with 2-8.4W 3100K white LEDs, machined aluminum housing, machined aluminum 1" deep bezel with 90 degree cutoff cap with weep-hole, hermetically sealed tempered glass lens, soft focus lens, honeycomb baffle, 36 degree wide flood field changeable reflector, modified lockable rotating mounting, modified column mounting, custom RAL 8019 polyester powder coat finish, integral 12VAC transformer, adjust-e-lume technology, and integral LED dimming driver.	2 - 8.4W 3100K white LEDs (included)	Integral transformer and LED dimming driver Voltage: Shall be Specified by Electrical Engineer	Location: Pavilion & Gateways 1. Fixture shall be modified to accommodate mounting to a round column. 2. Fixture shall be modified to allow for lockable fixture rotation. 3. Fixture shall be modified to accommodate an integral transformer and dimming driver. 4. Fixture shall have a custom RAL 8019 finish. 5. Mounting heights vary - verify mounting height with architectural details and elevations. 6. Electrical Engineer shall verify voltage and emergency operation. 7. Fixtures shall have a 5-year warranty.
EX4		BK Lighting "Integral Artistar WFL" #AR-LED-TR-e22-WFL-A9-RAL 8019-12-11-B-6-VOLTS-WM Description: Surface mounted LED adjustable accent light with 1-8.4W 3100K white LED, machined aluminum housing, machined aluminum 1" deep bezel with 90 degree cutoff cap, 360 degree rotation and 180 degree vertical adjustment knuckle, hermetically sealed glass lens, soft focus lens, honeycomb baffle, 36 degree wide flood field changeable reflector, custom RAL 8019 polyester powder coat finish, integral 12VAC transformer, and integral LED dimming driver.	1 - 8.4W 3100K white LEDs (included)	Integral transformer and LED dimming driver Voltage: Shall be Specified by Electrical Engineer	Location: Pavilion 1. Fixture may require a custom canopy to conceal the jbox - coordination required. 2. Fixture shall have a custom RAL 8019 finish. 3. Fixture mounts to pavilion structure - refer to architectural drawings and elevations for mounting details. 4. Fixture installation shall be neat and clean - confirm all conduit runs with architect. 5. Electrical Engineer shall verify voltage and emergency operation. 6. Fixtures shall have a 5-year warranty.

Type		Mfr/Catalog #	Lamping	Electrical	Notes
EX4A		BK Lighting "Integral Artistar MFL" #AR-LED-TR-e22-MFL-A9-RAL 8019-12-11-B-6-VOLTS-WM Description: Surface mounted LED adjustable accent light with 1-8.4W 3100K white LED, machined aluminum housing, machined aluminum 1" deep bezel with 90 degree cutoff cap, 360 degree rotation and 180 degree vertical adjustment knuckle, hermetically sealed glass lens, soft focus lens, honeycomb baffle, 25 degree medium flood field changeable reflector, custom RAL 8019 polyester powder coat finish, integral 12VAC transformer, and integral LED dimming driver.	1 - 8.4W 3100K white LEDs (included)	Integral transformer and LED dimming driver Voltage: Shall be Specified by Electrical Engineer	Location: Pavilion 1. Fixture may require a custom canopy to conceal the jbox - coordination required. 2. Fixture shall have a custom RAL 8019 finish. 3. Fixture mounts to pavilion structure - refer to architectural drawings and elevations for mounting details. 4. Fixture installation shall be neat and clean - confirm all conduit runs with architect. 5. Electrical Engineer shall verify voltage and emergency operation. 6. Fixtures shall have a 5-year warranty.
EX5	NOT USED	NOT USED Description:			
EX6		Bega "Recessed Wall Luminaire LED" #2196LED-VOLTS-FINISH Description: Recessed 9.5" wide x 2.5" high LED steplight with 1-6.7W 3000K white LED (8.5 system watts), die-cast and extruded aluminum housing, one-piece die-cast aluminum louvered faceplate, clear tempered glass lens with translucent white ceramic coating, stainless steel captive screws, and integral LED driver.	1 - 8.5W 3000K white LED (included)	Integral LED driver Voltage: Shall be Specified by Electrical Engineer	Location: Stairs 1. Architect shall verify fixture finish. 2. Fixtures shall be centered in stair face - refer to architectural drawings and elevations for mounting information. 3. Electrical Engineer shall verify voltage and emergency operation. 4. Fixtures shall have a 5-year warranty.
EX7	NOT USED	NOT USED Description:			

Type		Mfr/Catalog #	Lamping	Electrical	Notes
EX7A	NOT USED	NOT USED Description:			
EX8		Selux "Discera 600 LED Head Type I" #DSC6L-R1-L1-4TL500-30-POWER LENGTH-SP(RAL 8019)-208-SM3085A (fixture) Description: Pole mounted gasketed LED dark-sky compliant downlight with 1-58W (64 system watts) 3000K LED fixture head, die-cast low copper aluminum alloy housing, cast fitter, tool-less steel latch, tempered and screened glass lens, high transmittance custom molded Type I optical distribution lenses, removable LED light engine, custom RAL 8019 polyester powder coat fixture finish, surge protection device, and integral LED driver.	1 - 58W 3000K white LED (included); 64 System Watts	Integral LED driver Voltage: Shall be Specified by Electrical Engineer	Location: Pedestrian Way 1. Fixture shall be supplied with (1) Type I fixture head. 2. Mounting arm to be mounted to a pole via a slip fitter (pole and slip fitter provided by others). 3. Power cord length coordination required. 4. Architect shall verify mounting height of the fixture head on the pole - Coordination required. 5. Fixture shall have a custom RAL 8019 finish. 6. Fixture to be U.L. listed and labeled "suitable for wet locations." 7. Electrical Engineer shall verify voltage and emergency operation. 8. Fixtures shall have a 5-year warranty.

Type		Mfr/Catalog #	Lamping	Electrical	Notes
EX9		Selux "Ritorno LED Retrofit Kit" #RLRK-NO SHADE-RRS-L55-3000-SP(RAL 8019)-208-SM2059G-LESS POLE Description: Pole mounted (provided by others) LED uplight with 1-55W 3000K white LED, sealed IP65 cast housing, symmetrical optical distribution, tempered flat glass lens, pole mounting fitter, and integral LED driver.	1 - 55W 3000K white LED (included)	Integral LED driver Voltage: Shall be Specified by Electrical Engineer	Location: Gateways 1. Fixture shall be mounted to an angled pole (provided by others) using a pole fitter to slip fit over a tenon (provided by others) - coordination required. 2. Fixture shall have welded and grinded shade mounting holes for clean smooth finish. 3. Fixture shall have a custom RAL 8019 finish. 4. Fixture to be U.L. listed and labeled "suitable for wet locations." 5. Architect shall verify fixture finish. 6. Structural Engineer shall verify mounting, pole requirements, and anchorage detail to concrete base. 7. Electrical Engineer shall verify voltage and emergency operation. 8. Fixtures shall have a 5-year warranty.

Type		Mfr/Catalog #	Lamping	Electrical	Notes
EX10		Selux "Discera 600 LED Head Type IV" #DSC6L-R4-L1-4TL500-30-POWER LENGTH-SP(RAL 8019)-208-SM3085A (fixture) + AT74-20-SP(RAL 8019)-BC10-REC-T35 (pole) Description: Fixture: Pole mounted gasketed LED dark-sky compliant downlight with 1-58W (64 system watts) 3000K LED fixture head, die-cast low copper aluminum alloy housing, cast fitter, double welded steel long mounting arm, tool-less steel latch, tempered and screened glass lens, high transmittance custom molded Type IV optical distribution lenses, removable LED light engine, custom RAL 8019 polyester powder coat fixture finish, surge protection device, and integral LED driver. Pole: 7" to 4" tapered 20' spun 6063 alloy aluminum pole, cast 356 alloy aluminum anchor base, die-cast base cover, 120V 15a GFCI receptacle with weather-proof cover located at 8'-0" high, 3.5" tennon, banner hangers, 3/4" diameter knockout with weather-proof plug located at 10'-0" high, and custom RAL 8019 polyester powder coat fixture finish.	1 - 58W 3000K white LED (included); 64 System Watts	Integral LED driver Voltage: Shall be Specified by Electrical Engineer	Location: Pedestrian Way 1. Fixture shall be supplied with (1) Type IV fixture head. 2. Power cord length coordination required. 3. Pole shall be provided with a 3/4" diameter knockout with weather-proof plug at 10'-0" high for future security camera installation. 4. Fixture shall have a custom RAL 8019 finish. 5. Fixture to be U.L. listed and labeled "suitable for wet locations." 6. Refer to base and anchorage detail by Architect / Civil engineer. Provide pole to meet local and AASHTO requirements for EPA of fixture configuration. Architect / Civil Engineer shall coordinate pole anchorage detail to concrete base. 7. Provide detailed shop drawings noting base and anchorage detail, pole specifications conforming to all applicable codes, electrical requirements, and photometric characteristics. 8. Provide shop drawings noting mounting arm configurations, fixture heights on the pole, hand hole and receptacle locations. 9. Architect shall verify pole and fixture finish. 10. Pole shall be provided with a 120V 15a GFCI receptacle located 8'-0" high. 11. Electrical Engineer shall verify voltage and emergency operation. 12. Fixtures shall have a 5-year warranty.

SECTION 265613 – APPENDIX B

EXTERIOR LIGHTING CUT SHEETS

Date: _____ Customer: _____

Project: ITHACA COMMONS UPGRADE AND REPAIR - SURFACE IMPROVEMENT PACKAGE

Type: _____ Qty: _____

selux

Discera 600 LED Catenary

Order Code:

DSC6L	Series	DSC6L Discera 600 LED					
_____	Optics	R1 Type I Distribution	R2 Type II Distribution	R3 Type III Distribution	R4 Type IV Distribution	R5 Type V Distribution	
_____	Mounting	C Catenary					
_____	Light Engine	4TL300 40W LED/ 46 W system	6TL500 58W LED/ 64W system				
_____	CCT	30 3000K	45 4500K			for other CCT please consult factory	
_____	Power Cord Length	12	15	18	20	25	XX Add 2' if double mounting is used
_____	Finish	WH White	BK Black	BZ Bronze	SV Silver	SP Specify Premium Color	
_____	Voltage	120	208	240	277	347	480
_____	Options	DM Dimming (0-10V)	HLxx Hi-Lo Switching Please consult factory for settings				

Product Modifications

Please list modification requirements for review by factory:

Approvals

Date:

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In a continuing effort to offer the best product possible, we reserve the right to change, without notice, specifications or materials that in our opinion will not alter the function of the product. Specification sheets found at www.selux.us are the most recent versions and supercede all other printed or electronic versions.

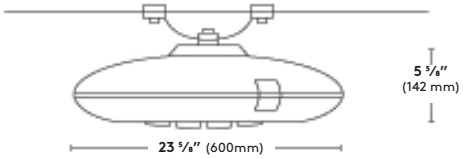
Project: **Ithaca Commons Repair and Upgrade** **Date:** **12 December 2013** **Type:**

Project # **11143.00** **EX1**

LIGHT FIXTURE CUT SHEET Note: This document is for information only. Refer to specifications for all catalog numbers, lamps, finishes, etc.

selux

DSC6L



Net Weight (lbs.):

Specifications

1. Luminaire Housing - Made from high pressure die-cast, low copper aluminum alloy.

2. Tool-less latch - Two tool-less steel latches for easy access to lamp chamber and maintanence.

3. Catenary Mounting - Catenary mounting system made from stainless steel; adjustable tilt +/- 16° stainless steel suspension cable by others.

4. Gasketing - (not shown) Silicone gasket provides seal at door and glass opening.

5. Glass Lens - Tempered, screened glass lens protects and helps seal optical chamber.

6. LED Light Engine - (Not shown) High efficacy LED light engine with 60,000 hour life until L70. Available with3000K or 4500K CCT and a CRI of 80. Protection class IP67.

7. Optics - (Not shown) High transmittance custom molded lenses create IES distribution types I, II, III, IV and V with IDA-Approved "Dark Sky Friendly" performance.

8. LED Driver - (Not shown) High power factor, High efficiency constant current LED driver. 120-277 VAC input. Protection class IP67. 347/480V with step down transformer.

9. Access Door - Lower casting features tempered glass lens and a stainless steel hinge that attaches to upper casting on mounting arm side. Other side is secured with tool-less latches.

10. Surge Protection - (Not shown) 3-Pole Surge protection device safeguards electrical components from indirect lighting strikes and surges up to (10kA and 10kV). RoHS compliant.

Exterior Luminaire Finish - Selux utilizes a high quality Polyester Powder Coating. All Selux luminaires and poles are finished in our Tiger Drylac certified facility and undergo a five stage intensive pretreatment process where product is thoroughly cleaned, phosphated and sealed. Selux powder coated products provide excellent salt and humidity resistance as well as ultraviolet resistance for color retention. All products are tested in accordance with test specifications for coatings from ASTM and PCI.

Standard exterior colors are White (WH), Black (BK), Bronze (BZ), and Silver (SV). Selux premium colors (SP) are available, please specify from your Selux color selection guide.

5 Year Limited LED Luminaire Warranty - Selux offers a 5 Year Limited Warranty to the original purchaser that the Discera 600 LED Catenary luminaire shall be free from defects in material and workmanship for up to five (5) years from date of shipment. This limited warranty covers the fixture, LED driver and LED light engine when installed and operated according to Selux instructions. Fixture suitable for ambient temperature of 40° C (104° F). For details and exclusions, see "Selux Terms and Condition of Sale."

Listings and Ratings: Tested to IESNA LM-79-08 and LM-80 test standards at 25° C ambient temperature. Rated for wet location.

Visit selux.us for our LED End of Life recycling policy.

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Project:	**Ithaca Commons Repair and Upgrade**	**Date:**	**12 December 2013**	**Type:**
Project #	**11143.00**			**EX1**

LIGHT FIXTURE CUT SHEET Note: This document is for information only. Refer to specifications for all catalog numbers, lamps, finishes, etc.

Date: _____ Customer: _____

Project: ITHACA COMMONS REPAIR AND UPGRADE - SURFACE IMPROVEMENT PACKAGE

Type: _____ Qty: _____

selux

Discera 600 LED

Order Code:

DSC6L	Series	DSC6L Discera 600 LED					
_____	Optics	R1 Type I Distribution	R2 Type II Distribution	R3 Type III Distribution	R4 Type IV Distribution	R5 Type V Distribution	
_____	Mounting	S1 Single Short Arm	S2 Double Short Arm@180°	L1 Single Long Arm	L2 Double Long Arm @180°	SW Short Arm Wall Mount	LW Long Arm Wall Mount
_____	Light Engine	4TL350 40W LED/ 46W System	4TL500 58W LED/ 64W System				
_____	CCT	30 3000K	45 4500K			for other CCT please consult factory	
_____	Power Cord Length	12	15	18	20	25	XX Add 2' if double mounting is used
_____	Finish	WH White	BK Black	BZ Bronze	SV Silver	SP Specify Premium Color	
_____	Voltage	120	208	240	277	347	480
_____	Options	DM Dimming (0-10V)	HLxx Hi-Lo Switching (please consult factory for settings)				

SM 3085A

Product Modifications

Please list modification requirements for review by factory:

Approvals

Date:

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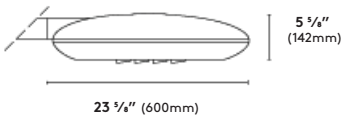
Project: **Ithaca Commons Repair and Upgrade** **Date:** **12 December 2013** **Type:**

Project # **11143.00** **EX2**

LIGHT FIXTURE CUT SHEET Note: This document is for information only. Refer to specifications for all catalog numbers, lamps, finishes, etc.

selux

DSC6L



Net Weight (lbs.):

Specifications

1. Luminaire Cover - Made from high pressure die-cast, low copper aluminum alloy.

2. Tool-less latch - Two tool-less steel latches for easy access to lamp chamber and maintanence.

3. Mounting Arm - Welded steel with powder coat finish.

4. Fitter - Cast fitter for direct connection to standard short and long arms.

5. Gasketing - Silicone gasket provides seal at door and glass opening.

6. Glass Lens - Tempered, screened glass lens protects and helps seal optical chamber.

7. LED Light Engine - High efficacy LED light engine with 60,000 hour life until L70. Available with3000K or 4500K CCT and a CRI of 80. Protection class IP67.

8. Optics - (Not shown) High transmittance custom molded lenses create IES distribution types I, II, III, IV and V with IDA-Approved "Dark Sky Friendly" performance.

9. LED Driver - (Not shown) High power factor, High efficiency constant current LED driver. 120-277 VAC input. Protection class IP67. 347/480V with step down transformer.

10. Surge Protection - (Not shown) 3-Pole Surge protection device safeguards electrical components from indirect lighting strikes and surges up to (10kA and 10kV). RoHS compliant.

11. Access Door - Lower casting features tempered glass lens and a stainless steel hinge that attaches to upper casting on mounting arm side. Other side is secured with tool-less latches.

5 Year Limited LED Luminaire Warranty - Selux offers a 5 Year Limited Warranty to the original purchaser that the Discera 600 LED luminaire shall be free from defects in material and workmanship for up to five (5) years from date of shipment. This limited warranty covers the LED driver and LED array when installed and operated according to Selux instructions. Fixture suitable for ambient temperature of 40° C (104° F). For details and exclusions, see "Selux Terms and Condition of Sale."

Listings and Ratings: Luminaire and LED tested to IP65 and IESNA LM-79-08 standards. LED tested to LM-80 standards. Luminaire and LED tested at 25°C ambient temperature.

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In a continuing effort to offer the best product possible, we reserve the right to change, without notice, specifications or materials that in our opinion will not alter the function of the product. Specification sheets found at www.selux.us are the most recent versions and supercede all other printed or electronic versions.

Project: Ithaca Commons Repair and Upgrade **Date:** 12 December 2013 **Type:** EX2

Project # 11143.00

LIGHT FIXTURE CUT SHEET Note: This document is for information only. Refer to specifications for all catalog numbers, lamps, finishes, etc.

AT64/AT74 6" - 4" / 7" - 4" Round Tapered Aluminum Poles

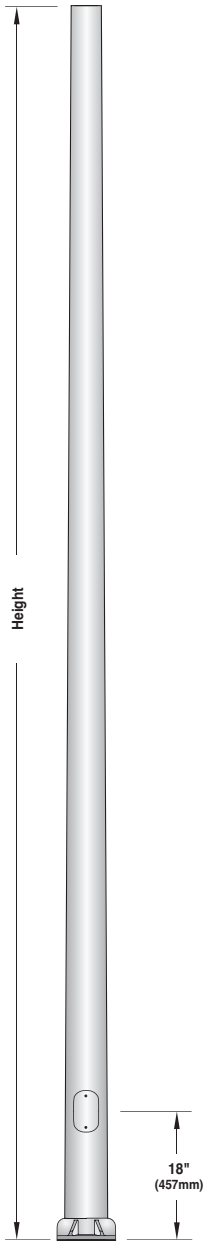
selux

Project: _____

Type: _____ **Qty:** _____

Ordering Format: _____ – _____ – _____ – _____ – _____ – _____

Series / Height / Finish / Option / Option / Option



Pole Series	Height	Wall Thickness	EPA Information (ft²)					Finish	Options
			70 mph	80 mph	90 mph	100 mph	110 mph		
AT64	12 12 ft.	0.156	20.0	20.0	16.3	13.1	10.7	**WH** White **BK** Black **BZ** Bronze **SV** Silver **SP** Specify Premium Color	**BC9** Optional base cover for AT64 poles only **BC10** Optional base cover for AT74 poles only **REC** GFCI Receptacle **REC2** GFCI Receptacle with weather-proof in-use cover **T30** Supplied with Ø3" Tenon, 4" high **T35** Supplied with Ø3 1/2" Tenon, 4 1/2" high For PC or PCT refer to fixture spec sheets (where applicable). For other options please consult factory.
AT64	14 14 ft.	0.156	20.0	17.7	13.7	10.9	8.9		
AT64	16 16 ft.	0.156	19.0	14.1	10.8	8.6	7.0		
AT64	18 18 ft.	0.156	15.7	11.5	8.7	6.9	5.5		
AT64	20 20 ft.	0.156	13.5	9.6	7.1	5.6	4.4		
AT64	23 23 ft.	0.156	10.0	6.8	4.8	3.7	2.8		
AT74	18 18 ft.	0.156	20.0	17.7	13.7	10.9	8.8		
AT74	20 20 ft.	0.156	20.0	14.9	11.4	9.0	7.3		
AT74	23 23 ft.	0.156	15.8	11.4	8.5	6.6	5.3		
AT74	24 24 ft.	0.156	14.8	10.5	7.8	6.0	4.7		
AT74	25 25 ft.	0.156	13.4	9.5	7.0	5.4	4.2		

Other heights available, consult factory. EPA Calculations allow for 1.3 Gust Factor

Standard Specifications

Pole Shaft - Pole shaft is spun from seamless 6063 alloy aluminum which is heat treated to a T6 temper.

Anchor Base - Anchor base is cast from 356 alloy aluminum which is heat treated to a T6 temper. The anchor base casting and shaft are joined by a continuous circumferential weld at the outside top and inside bottom of the anchor base.

Access Hole - The opening measures 3" x 5" (76 x 127mm) for 6" Dia. poles 4" x 6" (102 x 152mm) for 7" Dia. poles, with a cast 356 aluminum tempered to a T6 condition reinforced frame. Frame is supplied with integral ground lug connection located inside pole. Flush fitting cover is supplied with tamper resistant fasteners.

Anchor Bolts - Pole is supplied with four steel hot dip galvanized anchor bolts, 3/4" x 17" for 6" poles and 1" x 36" for 7" poles, each with two nuts, two flat washers and one lock washer.

Nut Cover - Poles come standard with cast aluminum nut covers.

Exterior Luminaire Finish - Selux utilizes a high quality Polyester Powder Coating. All Selux luminaires and poles are finished in our Tiger Drylac certified facility and undergo a five stage intensive pretreatment process where product is thoroughly cleaned, phosphated and sealed. Selux powder coated products provide excellent salt and humidity resistance as well as ultra violet resistance for color retention. All products are tested in accordance with test specifications for coatings from ASTM and PCI.

Standard exterior colors are White (WH), Black (BK), Bronze (BZ), and Silver (SV). Selux premium colors (SP) are available, please specify from your Selux color selection guide. Hot Dip Galvanized finish (GV) on all steel parts also available.

All Poles are constructed per AASHTO standards for structural supports for highway signs, luminaires and traffic signals as published in 1994.

A consideration of field conditions such as (but not limited to) wind zone, height, vibration must be given by the designer/specifier for the appropriate application.

Performance of poles is dependent upon proper support/attachment of pole to adequate foundation design. Selux does not design or offer recommendations for foundations. EPA values assume that the bottom of the pole is at grade level.

Call Selux (1-800-SELUXCS) if there are any questions, or for any assistance in determining suitability with appropriate fixtures.

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FAX (845) 834-1401
www.selux.us
A64-74-0913-01 (ss-v3.1)

NRTL Listed (i.e. UL, CSA)

Union Made Affiliated with **IBEW** *Local 363*

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Project: Ithaca Commons Repair and Upgrade **Date:** 12 December 2013 **Type:**

Project # 11143.00 **EX2**

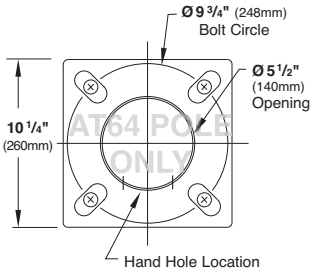
LIGHT FIXTURE CUT SHEET Note: This document is for information only. Refer to specifications for all catalog numbers, lamps, finishes, etc.

AT64/AT74 6"-4"/7"-4" Round Tapered Aluminum Poles

selux

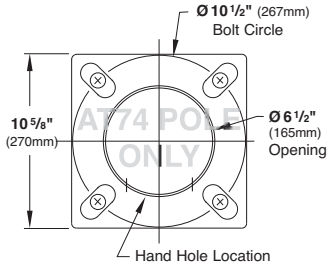
Bolt Circle (AT64)

Use caution when setting anchor bolts. Bolts must be vertically straight and centered on dimensions shown.

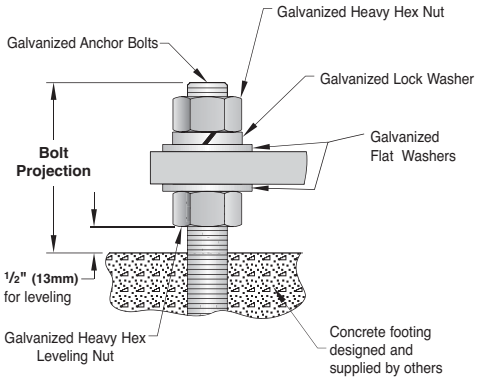


Bolt Circle (AT74)

Use caution when setting anchor bolts. Bolts must be vertically straight and centered on dimensions shown.



Anchor Bolt Detail

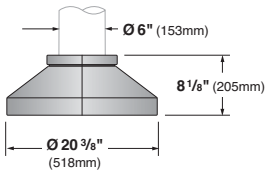


Note: Adequate drainage must be provided in concrete foundation.

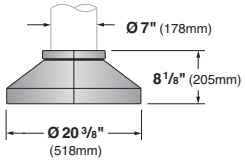
Additional Spec Information

Pole Series	Top Diameter	Bottom Diameter	Handhole Size	Base Size	Conduit Opening	Bolt Size	Bolt Circle	Bolt Projection
AT64	4"	6"	3" x 5"	10 1/4" x 10 1/4"	5 1/2"	3/4" x 17"	9 3/4"	3 1/2"
AT74	4"	7"	4" x 6"	10 5/8" x 10 5/8"	6 1/2"	1" x 36"	10 1/2"	4 1/8"

BC9 Optional Base Cover (AT64)
Die cast aluminum, two-piece field installable base cover.



BC10 Optional Base Cover (AT74) Die cast aluminum, two-piece field installable base cover.



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A64-74-0913-02 (ss-v3.1)

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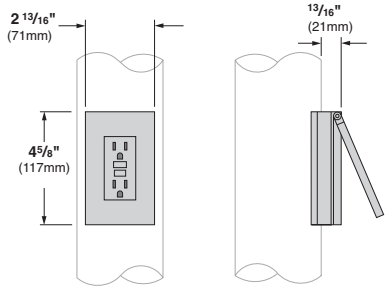
Project: Ithaca Commons Repair and Upgrade **Date:** 12 December 2013 **Type:**

Project # 11143.00 **EX2**

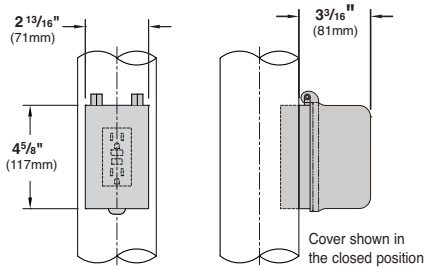
LIGHT FIXTURE CUT SHEET Note: This document is for information only. Refer to specifications for all catalog numbers, lamps, finishes, etc.

Optional Accessories

GFCI Receptacle with flat cover (REC) - GFCI duplex receptacle with cast base welded to pole and gasketed, provided with weather-proof, self-closing non-lockable cover; located 36" (915mm) from base of pole, inline with handhole. Receptacle is intended only for portable tools or other portable equipment to be connected to outlet only when attended by operating personnel. For use with 120v applications only, for other fixture voltages, please consult factory for wire segregation requirements.



GFCI Receptacle with in-use cover (REC2) - GFCI duplex receptacle with cast base welded to pole and gasketed, provided with weather-proof, self-closing lockable in-use cover; located 36" (915mm) from base of pole, inline with handhole. Receptacle is intended only for portable tools or other portable equipment to be connected to outlet only when attended by operating personnel. For use with 120v applications only, for other fixture voltages, please consult factory for wire segregation requirements.



*Physical size subject to change pending availability

Photo Cell (PC) - Twist lock photocell mounted to aluminum cap which attaches to pole top or can be remotely located. Can be oriented for optimum performance. *Refer to fixture spec sheet to determine if this option is applicable.*

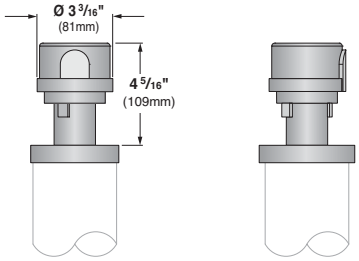
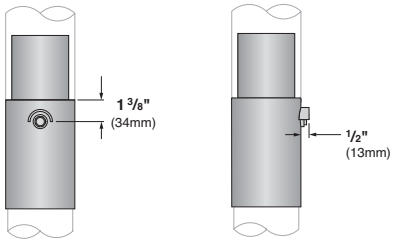


Photo Cell Tenon (PCT) - Button type photocell mounted in cast aluminum pole top tenon. Tenon has integral cast visor to prevent false start/stop cycle and can be oriented for optimum performance. *Refer to fixture spec sheet to determine if this option is applicable.*



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Date: _____ Customer: _____

Project: ITHACA COMMONS REPAIR AND UPGRADE - SURFACE IMPROVEMENT PACKAGE

Type: _____ Qty: _____

selux

Discera 600 LED

Order Code:

DSC6L	Series	DSC6L Discera 600 LED					
_____	Optics	R1 Type I Distribution	R2 Type II Distribution	R3 Type III Distribution	R4 Type IV Distribution	R5 Type V Distribution	
_____	Mounting	S1 Single Short Arm	S2 Double Short Arm@180°	L1 Single Long Arm	L2 Double Long Arm @180°	SW Short Arm Wall Mount	LW Long Arm Wall Mount
_____	Light Engine	4TL350 40W LED/ 46W System	4TL500 58W LED/ 64W System				
_____	CCT	30 3000K	45 4500K			for other CCT please consult factory	
_____	Power Cord Length	12	15	18	20	25	XX Add 2' if double mounting is used
_____	Finish	WH White	BK Black	BZ Bronze	SV Silver	SP Specify Premium Color	
_____	Voltage	120	208	240	277	347	480
_____	Options	DM Dimming (0-10V)	HLxx Hi-Lo Switching (please consult factory for settings)				

SM 3085A

Product Modifications

Please list modification requirements for review by factory:

Approvals

Date:

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In a continuing effort to offer the best product possible, we reserve the right to change, without notice, specifications or materials that in our opinion will not alter the function of the product. Specification sheets found at www.selux.us are the most recent versions and supercede all other printed or electronic versions.

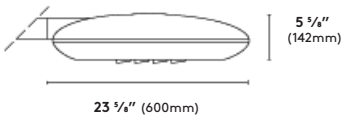
Project: **Ithaca Commons Repair and Upgrade** **Date:** **12 December 2013** **Type:**

Project # **11143.00** **EX2A**

LIGHT FIXTURE CUT SHEET Note: This document is for information only. Refer to specifications for all catalog numbers, lamps, finishes, etc.

selux

DSC6L



Net Weight (lbs.):

Specifications

1. Luminaire Cover - Made from high pressure die-cast, low copper aluminum alloy.

2. Tool-less latch - Two tool-less steel latches for easy access to lamp chamber and maintanence.

3. Mounting Arm - Welded steel with powder coat finish.

4. Fitter - Cast fitter for direct connection to standard short and long arms.

5. Gasketing - Silicone gasket provides seal at door and glass opening.

6. Glass Lens - Tempered, screened glass lens protects and helps seal optical chamber.

7. LED Light Engine - High efficacy LED light engine with 60,000 hour life until L70. Available with3000K or 4500K CCT and a CRI of 80. Protection class IP67.

8. Optics - (Not shown) High transmittance custom molded lenses create IES distribution types I, II, III, IV and V with IDA-Approved "Dark Sky Friendly" performance.

9. LED Driver - (Not shown) High power factor, High efficiency constant current LED driver. 120-277 VAC input. Protection class IP67. 347/480V with step down transformer.

10. Surge Protection - (Not shown) 3-Pole Surge protection device safeguards electrical components from indirect lighting strikes and surges up to (10kA and 10kV). RoHS compliant.

11. Access Door - Lower casting features tempered glass lens and a stainless steel hinge that attaches to upper casting on mounting arm side. Other side is secured with tool-less latches.

5 Year Limited LED Luminaire Warranty - Selux offers a 5 Year Limited Warranty to the original purchaser that the Discera 600 LED luminaire shall be free from defects in material and workmanship for up to five (5) years from date of shipment. This limited warranty covers the LED driver and LED array when installed and operated according to Selux instructions. Fixture suitable for ambient temperature of 40° C (104° F). For details and exclusions, see "Selux Terms and Condition of Sale."

Listings and Ratings: Luminaire and LED tested to IP65 and IESNA LM-79-08 standards. LED tested to LM-80 standards. Luminaire and LED tested at 25°C ambient temperature.

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Project: **Ithaca Commons Repair and Upgrade** **Date:** **12 December 2013** **Type:**
Project # **11143.00** **EX2A**

LIGHT FIXTURE CUT SHEET Note: This document is for information only. Refer to specifications for all catalog numbers, lamps, finishes, etc.

AT64/AT74 6" - 4" / 7" - 4" Round Tapered Aluminum Poles

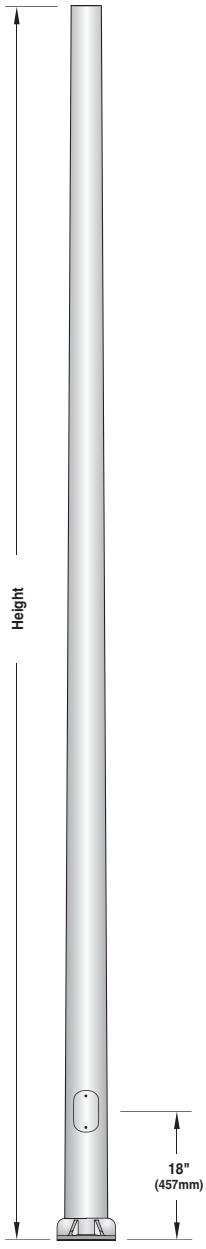
selux

Project: _____

Type: _____ **Qty:** _____

Ordering Format: _____ – _____ – _____ – _____ – _____ – _____

Series Height Finish Option Option Option



Pole Series	Height	Wall Thickness	EPA Information (ft²)					Finish	Options
			70 mph	80 mph	90 mph	100 mph	110 mph		
AT64	12 12 ft.	0.156	20.0	20.0	16.3	13.1	10.7	**WH** White **BK** Black **BZ** Bronze **SV** Silver **SP** Specify Premium Color	**BC9** Optional base cover for AT64 poles only **BC10** Optional base cover for AT74 poles only **REC** GFCI Receptacle **REC2** GFCI Receptacle with weather-proof in-use cover **T30** Supplied with Ø3" Tenon, 4" high **T35** Supplied with Ø3 1/2" Tenon, 4 1/2" high For PC or PCT refer to fixture spec sheets (where applicable). For other options please consult factory.
AT64	14 14 ft.	0.156	20.0	17.7	13.7	10.9	8.9		
AT64	16 16 ft.	0.156	19.0	14.1	10.8	8.6	7.0		
AT64	18 18 ft.	0.156	15.7	11.5	8.7	6.9	5.5		
AT64	20 20 ft.	0.156	13.5	9.6	7.1	5.6	4.4		
AT64	23 23 ft.	0.156	10.0	6.8	4.8	3.7	2.8		
AT74	18 18 ft.	0.156	20.0	17.7	13.7	10.9	8.8		
AT74	20 20 ft.	0.156	20.0	14.9	11.4	9.0	7.3		
AT74	23 23 ft.	0.156	15.8	11.4	8.5	6.6	5.3		
AT74	24 24 ft.	0.156	14.8	10.5	7.8	6.0	4.7		
AT74	25 25 ft.	0.156	13.4	9.5	7.0	5.4	4.2		

Other heights available, consult factory. EPA Calculations allow for 1.3 Gust Factor

Standard Specifications

Pole Shaft - Pole shaft is spun from seamless 6063 alloy aluminum which is heat treated to a T6 temper.

Anchor Base - Anchor base is cast from 356 alloy aluminum which is heat treated to a T6 temper. The anchor base casting and shaft are joined by a continuous circumferential weld at the outside top and inside bottom of the anchor base.

Access Hole - The opening measures 3" x 5" (76 x 127mm) for 6" Dia. poles 4" x 6" (102 x 152mm) for 7" Dia. poles, with a cast 356 aluminum tempered to a T6 condition reinforced frame. Frame is supplied with integral ground lug connection located inside pole. Flush fitting cover is supplied with tamper resistant fasteners.

Anchor Bolts - Pole is supplied with four steel hot dip galvanized anchor bolts, 3/4" x 17" for 6" poles and 1" x 36" for 7" poles, each with two nuts, two flat washers and one lock washer.

Nut Cover - Poles come standard with cast aluminum nut covers.

Exterior Luminaire Finish - Selux utilizes a high quality Polyester Powder Coating. All Selux luminaires and poles are finished in our Tiger Drylac certified facility and undergo a five stage intensive pretreatment process where product is thoroughly cleaned, phosphated and sealed. Selux powder coated products provide excellent salt and humidity resistance as well as ultra violet resistance for color retention. All products are tested in accordance with test specifications for coatings from ASTM and PCI.

Standard exterior colors are White (WH), Black (BK), Bronze (BZ), and Silver (SV). Selux premium colors (SP) are available, please specify from your Selux color selection guide. Hot Dip Galvanized finish (GV) on all steel parts also available.

All Poles are constructed per AASHTO standards for structural supports for highway signs, luminaires and traffic signals as published in 1994.

A consideration of field conditions such as (but not limited to) wind zone, height, vibration must be given by the designer/specifier for the appropriate application.

Performance of poles is dependent upon proper support/attachment of pole to adequate foundation design. Selux does not design or offer recommendations for foundations. EPA values assume that the bottom of the pole is at grade level.

Call Selux (1-800-SELUXCS) if there are any questions, or for any assistance in determining suitability with appropriate fixtures.

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TEL (845) 834-1400
FAX (845) 834-1401
www.selux.us
A64-74-0913-01 (ss-v3.1)

NRTL Listed (i.e. UL, CSA)

Union Made Affiliated with **IBEW** *Local 363*

Made in the USA

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Project: Ithaca Commons Repair and Upgrade **Date:** 12 December 2013 **Type:** EX2A

Project # 11143.00

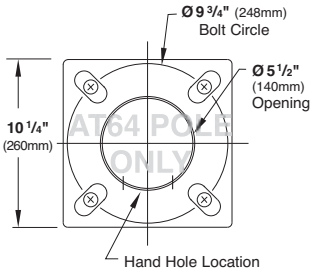
LIGHT FIXTURE CUT SHEET Note: This document is for information only. Refer to specifications for all catalog numbers, lamps, finishes, etc.

AT64/AT74 6"-4"/7"-4" Round Tapered Aluminum Poles

selux

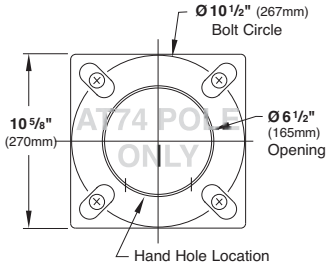
Bolt Circle (AT64)

Use caution when setting anchor bolts. Bolts must be vertically straight and centered on dimensions shown.



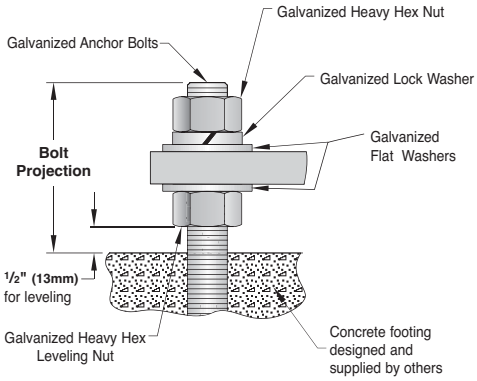
Bolt Circle (AT74)

Use caution when setting anchor bolts. Bolts must be vertically straight and centered on dimensions shown.



Note: Adequate drainage must be provided in concrete foundation.

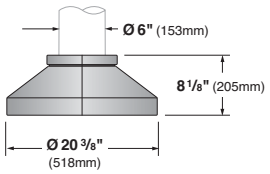
Anchor Bolt Detail



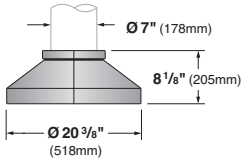
Additional Spec Information

Pole Series	Top Diameter	Bottom Diameter	Handhole Size	Base Size	Conduit Opening	Bolt Size	Bolt Circle	Bolt Projection
AT64	4"	6"	3" x 5"	10 1/4" x 10 1/4"	5 1/2"	3/4" x 17"	9 3/4"	3 1/2"
AT74	4"	7"	4" x 6"	10 5/8" x 10 5/8"	6 1/2"	1" x 36"	10 1/2"	4 1/8"

BC9 Optional Base Cover (AT64)
Die cast aluminum, two-piece field installable base cover.



BC10 Optional Base Cover (AT74) Die cast aluminum, two-piece field installable base cover.



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A64-74-0913-02 (ss-v3.1)

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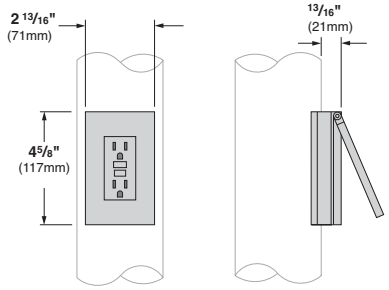
Project: **Ithaca Commons Repair and Upgrade** **Date:** **12 December 2013** **Type:**

Project # **11143.00** **EX2A**

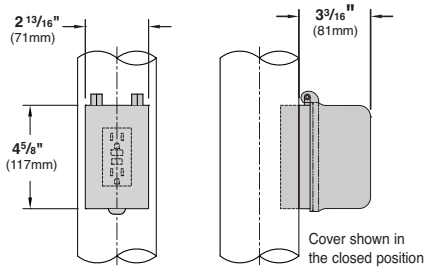
LIGHT FIXTURE CUT SHEET Note: This document is for information only. Refer to specifications for all catalog numbers, lamps, finishes, etc.

Optional Accessories

GFCI Receptacle with flat cover (REC) - GFCI duplex receptacle with cast base welded to pole and gasketed, provided with weather-proof, self-closing non-lockable cover; located 36" (915mm) from base of pole, inline with handhole. Receptacle is intended only for portable tools or other portable equipment to be connected to outlet only when attended by operating personnel. For use with 120v applications only, for other fixture voltages, please consult factory for wire segregation requirements.



GFCI Receptacle with in-use cover (REC2) - GFCI duplex receptacle with cast base welded to pole and gasketed, provided with weather-proof, self-closing lockable in-use cover; located 36" (915mm) from base of pole, inline with handhole. Receptacle is intended only for portable tools or other portable equipment to be connected to outlet only when attended by operating personnel. For use with 120v applications only, for other fixture voltages, please consult factory for wire segregation requirements.



*Physical size subject to change pending availability

Photo Cell (PC) - Twist lock photocell mounted to aluminum cap which attaches to pole top or can be remotely located. Can be oriented for optimum performance. *Refer to fixture spec sheet to determine if this option is applicable.*

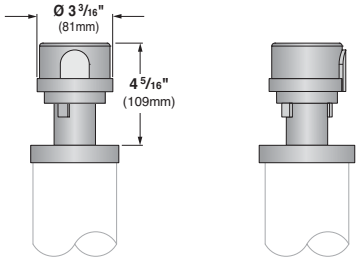
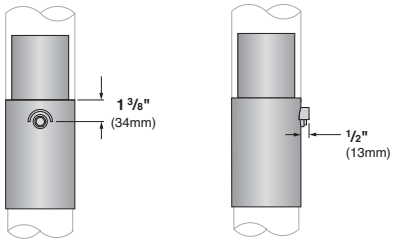


Photo Cell Tenon (PCT) - Button type photocell mounted in cast aluminum pole top tenon. Tenon has integral cast visor to prevent false start/stop cycle and can be oriented for optimum performance. *Refer to fixture spec sheet to determine if this option is applicable.*



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Date: _____ Customer: _____

Project: ITHACA COMMONS REPAIR AND UPGRADE - SURFACE IMPROVEMENT PACKAGE

Type: _____ Qty: _____

selux

Discera 600 LED

Order Code:

DSC6L	Series	DSC6L Discera 600 LED					
_____	Optics	R1 Type I Distribution	R2 Type II Distribution	R3 Type III Distribution	R4 Type IV Distribution	R5 Type V Distribution	
_____	Mounting	S1 Single Short Arm	S2 Double Short Arm@180°	L1 Single Long Arm	L2 Double Long Arm @180°	SW Short Arm Wall Mount	LW Long Arm Wall Mount
_____	Light Engine	4TL350 40W LED/ 46W System	4TL500 58W LED/ 64W System				
_____	CCT	30 3000K	45 4500K			for other CCT please consult factory	
_____	Power Cord Length	12	15	18	20	25	XX Add 2' if double mounting is used
_____	Finish	WH White	BK Black	BZ Bronze	SV Silver	SP Specify Premium Color	
_____	Voltage	120	208	240	277	347	480
_____	Options	DM Dimming (0-10V)	HLxx Hi-Lo Switching (please consult factory for settings)				

SM 3085A

Product Modifications

Please list modification requirements for review by factory:

Approvals

Date:

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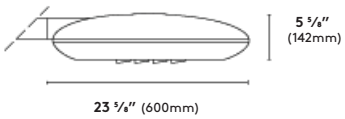
Project: **Ithaca Commons Repair and Upgrade** **Date:** **12 December 2013** **Type:**

Project # **11143.00** **EX2B**

LIGHT FIXTURE CUT SHEET Note: This document is for information only. Refer to specifications for all catalog numbers, lamps, finishes, etc.

selux

DSC6L



Net Weight (lbs.):

Specifications

1. Luminaire Cover - Made from high pressure die-cast, low copper aluminum alloy.

2. Tool-less latch - Two tool-less steel latches for easy access to lamp chamber and maintanence.

3. Mounting Arm - Welded steel with powder coat finish.

4. Fitter - Cast fitter for direct connection to standard short and long arms.

5. Gasketing - Silicone gasket provides seal at door and glass opening.

6. Glass Lens - Tempered, screened glass lens protects and helps seal optical chamber.

7. LED Light Engine - High efficacy LED light engine with 60,000 hour life until L70. Available with3000K or 4500K CCT and a CRI of 80. Protection class IP67.

8. Optics - (Not shown) High transmittance custom molded lenses create IES distribution types I, II, III, IV and V with IDA-Approved "Dark Sky Friendly" performance.

9. LED Driver - (Not shown) High power factor, High efficiency constant current LED driver. 120-277 VAC input. Protection class IP67. 347/480V with step down transformer.

10. Surge Protection - (Not shown) 3-Pole Surge protection device safeguards electrical components from indirect lighting strikes and surges up to (10kA and 10kV). RoHS compliant.

11. Access Door - Lower casting features tempered glass lens and a stainless steel hinge that attaches to upper casting on mounting arm side. Other side is secured with tool-less latches.

5 Year Limited LED Luminaire Warranty - Selux offers a 5 Year Limited Warranty to the original purchaser that the Discera 600 LED luminaire shall be free from defects in material and workmanship for up to five (5) years from date of shipment. This limited warranty covers the LED driver and LED array when installed and operated according to Selux instructions. Fixture suitable for ambient temperature of 40° C (104° F). For details and exclusions, see "Selux Terms and Condition of Sale."

Listings and Ratings: Luminaire and LED tested to IP65 and IESNA LM-79-08 standards. LED tested to LM-80 standards. Luminaire and LED tested at 25°C ambient temperature.

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Project: **Ithaca Commons Repair and Upgrade** **Date:** **12 December 2013** **Type:**
Project # **11143.00** **EX2B**

LIGHT FIXTURE CUT SHEET Note: This document is for information only. Refer to specifications for all catalog numbers, lamps, finishes, etc.

AT64/AT74 6" - 4" / 7" - 4" Round Tapered Aluminum Poles

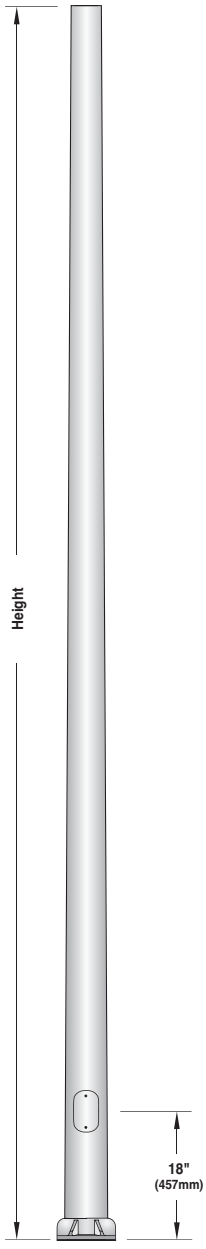
selux

Project: _____

Type: _____ **Qty:** _____

Ordering Format: _____ – _____ – _____ – _____ – _____ – _____

Series Height Finish Option Option Option



Pole Series	Height	Wall Thickness	EPA Information (ft²)					Finish	Options
			70 mph	80 mph	90 mph	100 mph	110 mph		
AT64	12 12 ft.	0.156	20.0	20.0	16.3	13.1	10.7	**WH** White **BK** Black **BZ** Bronze **SV** Silver **SP** Specify Premium Color	**BC9** Optional base cover for AT64 poles only **BC10** Optional base cover for AT74 poles only **REC** GFCI Receptacle **REC2** GFCI Receptacle with weather-proof in-use cover **T30** Supplied with Ø3" Tenon, 4" high **T35** Supplied with Ø3 1/2" Tenon, 4 1/2" high For PC or PCT refer to fixture spec sheets (where applicable). For other options please consult factory.
AT64	14 14 ft.	0.156	20.0	17.7	13.7	10.9	8.9		
AT64	16 16 ft.	0.156	19.0	14.1	10.8	8.6	7.0		
AT64	18 18 ft.	0.156	15.7	11.5	8.7	6.9	5.5		
AT64	20 20 ft.	0.156	13.5	9.6	7.1	5.6	4.4		
AT64	23 23 ft.	0.156	10.0	6.8	4.8	3.7	2.8		
AT74	18 18 ft.	0.156	20.0	17.7	13.7	10.9	8.8		
AT74	20 20 ft.	0.156	20.0	14.9	11.4	9.0	7.3		
AT74	23 23 ft.	0.156	15.8	11.4	8.5	6.6	5.3		
AT74	24 24 ft.	0.156	14.8	10.5	7.8	6.0	4.7		
AT74	25 25 ft.	0.156	13.4	9.5	7.0	5.4	4.2		

Other heights available, consult factory. EPA Calculations allow for 1.3 Gust Factor

Standard Specifications

Pole Shaft - Pole shaft is spun from seamless 6063 alloy aluminum which is heat treated to a T6 temper.

Anchor Base - Anchor base is cast from 356 alloy aluminum which is heat treated to a T6 temper. The anchor base casting and shaft are joined by a continuous circumferential weld at the outside top and inside bottom of the anchor base.

Access Hole - The opening measures 3" x 5" (76 x 127mm) for 6" Dia. poles 4" x 6" (102 x 152mm) for 7" Dia. poles, with a cast 356 aluminum tempered to a T6 condition reinforced frame. Frame is supplied with integral ground lug connection located inside pole. Flush fitting cover is supplied with tamper resistant fasteners.

Anchor Bolts - Pole is supplied with four steel hot dip galvanized anchor bolts, 3/4" x 17" for 6" poles and 1" x 36" for 7" poles, each with two nuts, two flat washers and one lock washer.

Nut Cover - Poles come standard with cast aluminum nut covers.

Exterior Luminaire Finish - Selux utilizes a high quality Polyester Powder Coating. All Selux luminaires and poles are finished in our Tiger Drylac certified facility and undergo a five stage intensive pretreatment process where product is thoroughly cleaned, phosphated and sealed. Selux powder coated products provide excellent salt and humidity resistance as well as ultra violet resistance for color retention. All products are tested in accordance with test specifications for coatings from ASTM and PCI.

Standard exterior colors are White (WH), Black (BK), Bronze (BZ), and Silver (SV). Selux premium colors (SP) are available, please specify from your Selux color selection guide. Hot Dip Galvanized finish (GV) on all steel parts also available.

All Poles are constructed per AASHTO standards for structural supports for highway signs, luminaires and traffic signals as published in 1994.

A consideration of field conditions such as (but not limited to) wind zone, height, vibration must be given by the designer/specifier for the appropriate application.

Performance of poles is dependent upon proper support/attachment of pole to adequate foundation design. Selux does not design or offer recommendations for foundations. EPA values assume that the bottom of the pole is at grade level.

Call Selux (1-800-SELUXCS) if there are any questions, or for any assistance in determining suitability with appropriate fixtures.

Selux Corp. © 2013
TEL (845) 834-1400
FAX (845) 834-1401
www.selux.us
A64-74-0913-01 (ss-v3.1)

NRTL Listed (i.e. UL, CSA)

Union Made Affiliated with **IBEW** *Local 363*

Made in the USA

In a continuing effort to offer the best product possible, we reserve the right to change, without notice, specifications or materials that in our opinion will not alter the function of the product. Specification sheets found at www.selux.us are the most recent versions and supercede all other printed or electronic versions.

Project: Ithaca Commons Repair and Upgrade **Date:** 12 December 2013 **Type:** EX2B

Project # 11143.00

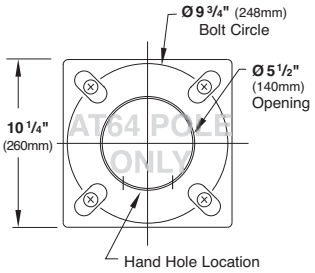
LIGHT FIXTURE CUT SHEET Note: This document is for information only. Refer to specifications for all catalog numbers, lamps, finishes, etc.

AT64/AT74 6"-4"/7"-4" Round Tapered Aluminum Poles

selux

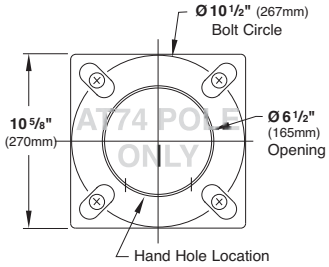
Bolt Circle (AT64)

Use caution when setting anchor bolts. Bolts must be vertically straight and centered on dimensions shown.



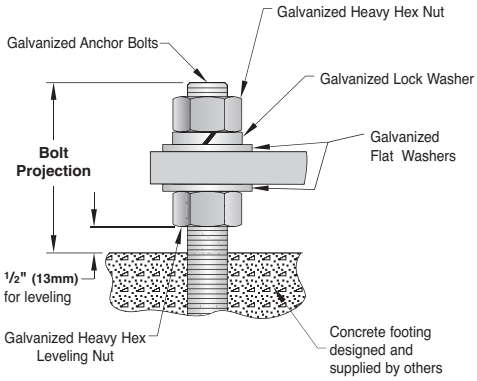
Bolt Circle (AT74)

Use caution when setting anchor bolts. Bolts must be vertically straight and centered on dimensions shown.



Note: Adequate drainage must be provided in concrete foundation.

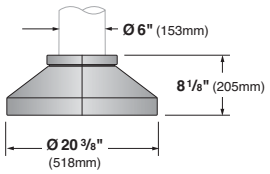
Anchor Bolt Detail



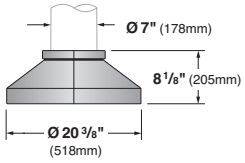
Additional Spec Information

Pole Series	Top Diameter	Bottom Diameter	Handhole Size	Base Size	Conduit Opening	Bolt Size	Bolt Circle	Bolt Projection
AT64	4"	6"	3" x 5"	10 1/4" x 10 1/4"	5 1/2"	3/4" x 17"	9 3/4"	3 1/2"
AT74	4"	7"	4" x 6"	10 5/8" x 10 5/8"	6 1/2"	1" x 36"	10 1/2"	4 1/8"

BC9 Optional Base Cover (AT64)
Die cast aluminum, two-piece field installable base cover.



BC10 Optional Base Cover (AT74) Die cast aluminum, two-piece field installable base cover.



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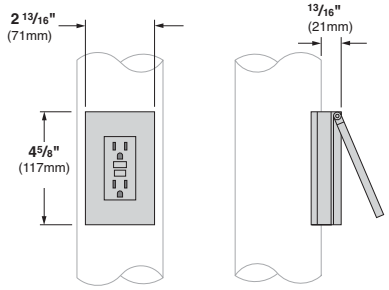
Project: **Ithaca Commons Repair and Upgrade** **Date:** **12 December 2013** **Type:** **EX2B**

Project # **11143.00**

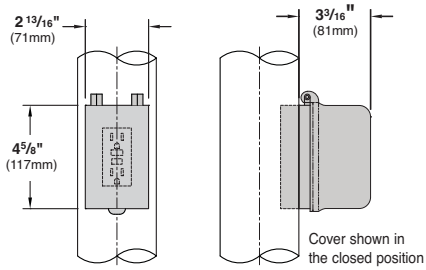
LIGHT FIXTURE CUT SHEET Note: This document is for information only. Refer to specifications for all catalog numbers, lamps, finishes, etc.

Optional Accessories

GFCI Receptacle with flat cover (REC) - GFCI duplex receptacle with cast base welded to pole and gasketed, provided with weather-proof, self-closing non-lockable cover; located 36" (915mm) from base of pole, inline with handhole. Receptacle is intended only for portable tools or other portable equipment to be connected to outlet only when attended by operating personnel. For use with 120v applications only, for other fixture voltages, please consult factory for wire segregation requirements.



GFCI Receptacle with in-use cover (REC2) - GFCI duplex receptacle with cast base welded to pole and gasketed, provided with weather-proof, self-closing lockable in-use cover; located 36" (915mm) from base of pole, inline with handhole. Receptacle is intended only for portable tools or other portable equipment to be connected to outlet only when attended by operating personnel. For use with 120v applications only, for other fixture voltages, please consult factory for wire segregation requirements.



*Physical size subject to change pending availability

Photo Cell (PC) - Twist lock photocell mounted to aluminum cap which attaches to pole top or can be remotely located. Can be oriented for optimum performance. *Refer to fixture spec sheet to determine if this option is applicable.*

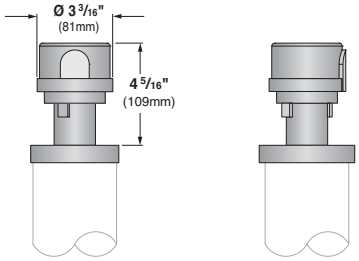
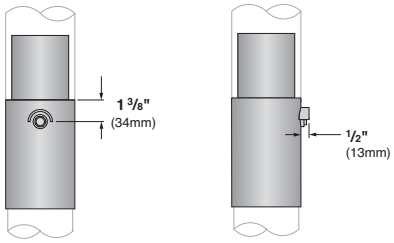


Photo Cell Tenon (PCT) - Button type photocell mounted in cast aluminum pole top tenon. Tenon has integral cast visor to prevent false start/stop cycle and can be oriented for optimum performance. *Refer to fixture spec sheet to determine if this option is applicable.*



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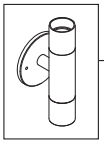

BK SSL SOLID STATE LIGHTING

the power of with adjust-e-lume™ TECHNOLOGY

EL DORADO™

PROJECT:	
TYPE:	
CATALOG NUMBER:	
SOURCE:	
NOTES:	

CATALOG NUMBER LOGIC

		ED	LED								
Example	-	ED	- LED	- e22/e22 UP/DOWN	- SP/SP UP/DOWN	- A7/A6 UP/DOWN	- BLW	- 12/12 UP/DOWN	- 11/11 UP/DOWN	-	B

Material
- **Blank** - Aluminum
- **B** - Brass
- **S** - Stainless Steel

Series
- **ED** - El Dorado Series™

Source
- **LED** - **'e'** Technology with Integral Driver

LED Type *Select Up and Down*

e36 - 8WLED/2.7K	**e23** - 8WLED/4K	**e25** - 8WLED/Green	**e27** - 8WLED/Amber
e22 - 8WLED/3K	**e24** - 8WLED/Red	**e26** - 8WLED/Blue	

Optics* *Select Up and Down*

NSP - Narrow Spot (Red Indicator)	**MFL** - Medium Flood (Yellow Indicator)
SP - Spot (Green Indicator)	**WFL** - Wide Flood (Blue Indicator)

Adjust-e-Lume™ Output Intensity** *(Choose factory setting)*

A9 (Standard), **A8, A7, A6, A5, A4, A3, A2, A1**

***Please see Adjust-e-Lume™ photometry to determine desired intensity.*

Finish

Aluminum Finish

Powder Coat Color	Satin	Wrinkle
Bronze	BZP	BZW
Black	BLP	BLW
White (Gloss)	WHP	WHW
Aluminum	SAP	—
Verde	—	VER

Brass Finish

Machined	MAC
Polished	POL
Mitique™	MIT

Stainless Finish

Machined	MAC
Polished	POL
Brushed	BRU *Interior use only.*

Premium Finish

ABP	Antique Brass Powder	CMG	Cascade Mountain Granite	RMG	Rocky Mountain Granite
AMG	Aleutian Mountain Granite	CRI	Cracked Ice	SDS	Sonoran Desert Sandstone
AQW	Antique White	CRM	Cream	SMG	Sierra Mountain Granite
BCM	Black Chrome	HUG	Hunter Green	TXF	Textured Forest
BGE	Beige	MDS	Mojave Desert Sandstone	WCP	Weathered Copper
BPP	Brown Patina Powder	NBP	Natural Brass Powder	WIR	Weathered Iron
CAP	Clear Anodized Powder	OCP	Old Copper	*Also available in RAL Finishes See submittal SUB-1439-00*	

Lens Type *Select Up and Down*
- **12** - Soft Focus Lens
- **13** - Rectilinear Lens

Shielding *Select Up and Down*
- **11** - Honeycomb Baffle

Cap Style
- **A** - 45°
- **B** - 90°
- **C** - Flush
- **D** - 45° Less weephole
- **E** - 90° Less weephole

LM79 DATA

BK No.	CCT (Typ.)	Input Watts (Typ.)	CRI (Typ.)
e36	2700K	8.4	90
e22	3100K	8.4	90
e23	4100K	8.4	75
e24	Red (627nm)	7.9	~
e25	Green (530nm)	8.4	~
e26	Blue (470nm)	8.4	~
e27	Amber (590nm)	7.9	~

L70 DATA

Minimum Rated Life (hrs.) 70% of initial lumens (L_{70})
50,000
50,000
50,000
50,000
50,000
50,000
50,000

*OPTICAL DATA

Beam Type	Angle	Visual Indicator
Narrow Spot	14°	Red Dot
Spot	18°	Green Dot
Medium Flood	25°	Yellow Dot
Wide Flood	36°	Blue Dot

B-K LIGHTING

40429 Brickyard Drive • Madera, CA 93636 • USA
559.438.5800 • FAX 559.438.5900
www.bklighting.com • info@bklighting.com

SUBMITTAL DATE	DRAWING NUMBER
12-13-11	SUB000943

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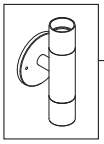


BKSSL SOLID STATE LIGHTING

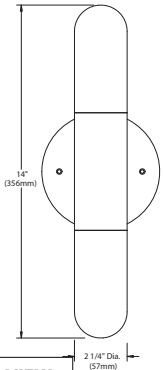
the power of with adjust-e-lume™ TECHNOLOGY

EL DORADO™

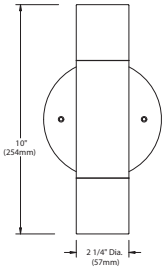
PROJECT:	
TYPE:	

FRONT VIEW

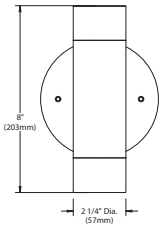
"A/D" CAP



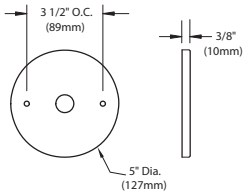
"B/E" CAP



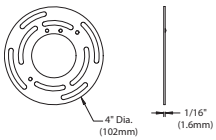
"C" CAP



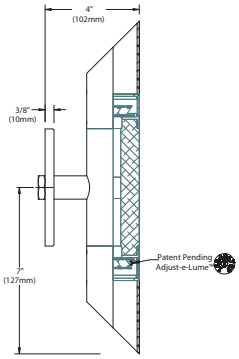
CANOPY DETAIL

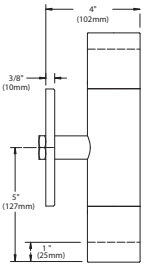


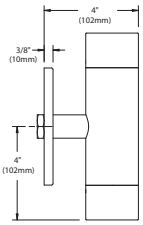
UNIVERSAL RING



SIDE VIEW

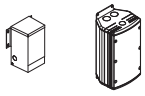






Accessories *(Configure separately)*

Remote options:



TR Series PMRM™

All dimensions indicated on this submittal are nominal.
Contact Technical Sales if you require more stringent specifications.

SPECIFICATIONS

GreenSource Initiative™
Metal and packaging components are made from recycled materials. Manufactured using renewable solar energy, produced onsite. Returnable to manufacturer at end of life to ensure cradle-to-cradle handling. Packaging contains no chlorofluorocarbons (CFC's). Use of this product may qualify for GreenSource efficacy and recycling rebate(s). Consult www.bklighting.com/greensource for program requirements.

Materials
Furnished in Copper-Free Aluminum (Type 6061-T6), Brass (Type 360) or Stainless Steel (Type 316).

Body
Fully machined from solid billet. Unibody design provides enclosed, water-proof wireway and integral heat sink for maximum component life. High temperature, silicone 'O' Ring provides water-tight seal.

Cap
Fully machined. Accommodates [1] lens or louver media. Choose from 45° cutoff ('A' or 'D'), 1" deep bezel with 90° cutoff ('B' or 'E'), or flush lens ('C') cap styles. 'A' and 'B' caps include weep-hole for water and debris drainage. 'D' and 'E' caps exclude weep-hole and are for interior use only. or louver media. Flush lens.

Lens
Shock resistant, tempered, glass lens is factory adhered to fixture cap and provides hermetically sealed optical compartment. Specify soft focus (#12) or rectilinear (#13) lens.

BKSSL™
Integrated solid state system with 'e' technology is scalable for field upgrade. Modular design with electrical quick disconnects permit field maintenance. High power, forward throw source complies with ANSI C78.377 binning requirements. Exceeds ENERGY STAR® lumen maintenance requirements. LM-80 certified components.

Integral non-dimming driver. Minimum 50,000 hour rated life at 70% of initial lumens (L70). BKSSL technology provides long life, significant energy reduction and exceptional thermal management.

Optics
Interchangeable OPTIKIT™ modules permit field changes to optical distribution. Color-coded for easy reference: Narrow Spot (NSP) = Red. Spot (SP) = Green. Medium Flood (MFL) = Yellow. Wide Flood = Blue.

Adjust-e-Lume™ (Pat. Pending)
Integral electronics allows dynamic lumen response at the individual fixture. Indexed (100% to 25% nom.) lumen output. Maintains output at desired level or may be changed as conditions require. Specify factory preset output intensity.

Installation
5" dia., machined canopy with stainless steel universal mounting ring permits mounting to 4" octagonal junction box (by others).

Transformer
For use with 12VAC BKSSL remote transformer.

Wiring
Teflon® coated, 18AWG, 600V, 250° C rated and certified to UL 1659 standard.

Hardware
Tamper-resistant, stainless steel hardware. Canopy mounting screws are additionally black oxide treated for additional corrosion resistance.

Finish
StarGuard® (Pat. Pend.), a RoHs compliant, 15 stage chromate-free process cleans and conversion coats aluminum components prior to application of Class 'A' TGIC polyester powder coating. Brass components are available in powder coat or handcrafted metal finish. Stainless steel components are available in handcrafted metal finish. (Brushed finish for interior use only).

Warranty
5 year limited warranty.

Certification and Listing
ITL tested to IESNA LM-79. Lighting Facts Registration per USDOE (www.lightingfacts.com). ETL Listed to ANSI/UL Standard 1838 and UL Subject 8750 and Certified to CAN/CSA Standard C22.2 No. 9. RoHs compliant. Suitable for indoor or outdoor use. Suitable for use in wet locations. IP66 Rated. Made in USA.

*Teflon is a registered trademark of DuPont Corporation.
*Energy Star is a registered trademark of the United States Environmental Protection Agency.

B-K LIGHTING	40429 Brickyard Drive • Madera, CA 93636 • USA 559.438.5800 • FAX 559.438.5900 www.bklighting.com • info@bklighting.com	SUBMITTAL DATE 12-13-11	DRAWING NUMBER SUB000943

Project: Ithaca Commons Repair and Upgrade **Date:** 12 December 2013 **Type:**
Project # 11143.00 **EX3**

LIGHT FIXTURE CUT SHEET Note: This document is for information only. Refer to specifications for all catalog numbers, lamps, finishes, etc.

adjust-e-lume™ TECHNOLOGY

Photometry for use with e22 **3K**

Select OptiKit™ for desired distribution

RED	Narrow Spot (NSP)
GREEN	Spot (SP)
YELLOW	Medium Flood (MFL)
BLUE	Wide Flood (WFL)

Set adjust-e-lume™ Dial to desired output

Narrow Spot

Distance from lamp	Adjust-e-Lume™ Setting 1	2	3	4	5	6	7	8	9
20'	2.4	2.9	4.9	6.1	7.3	8.8	9.1	9.3	9.3
16'	3.8	4.6	7.6	9.6	11.4	13.8	14.3	14.5	14.6
12'	6.7	8.2	13.5	17.0	20.3	24.5	25.4	25.7	25.9
8'	15.1	18.4	30.3	38.2	45.8	55.2	57.0	57.9	58.2
4'	60.3	73.6	121.3	152.8	183.1	220.9	228.2	231.6	232.8

4' 2' 0' 2' 4'

Note: If using No. 11 honeycomb baffle multiply footcandle values by .80

Spot

Distance from lamp	Adjust-e-Lume™ Setting 1	2	3	4	5	6	7	8	9
20'	1.6	2.1	3.1	4.1	4.9	6.0	6.1	6.2	6.3
16'	2.5	3.3	4.9	6.4	7.6	9.3	9.6	9.8	9.9
12'	4.5	5.9	8.7	11.4	13.5	16.6	17.0	17.3	17.5
8'	10.2	13.2	19.5	25.6	30.5	37.3	38.3	39.0	39.4
4'	40.6	52.7	78.1	102.3	121.9	149.1	153.1	156.0	157.8

8' 6' 4' 2' 0' 2' 4' 6' 8'

Note: If using No. 11 honeycomb baffle multiply footcandle values by .80

Medium Flood

Distance from lamp	Adjust-e-Lume™ Setting 1	2	3	4	5	6	7	8	9
20'	1.0	1.2	1.9	2.4	2.9	3.4	3.5	3.6	3.7
16'	1.5	1.8	2.9	3.8	4.6	5.3	5.4	5.7	5.8
12'	2.6	3.3	5.2	6.7	8.1	9.5	9.6	10.1	10.2
8'	6.0	7.4	11.8	15.0	18.3	21.3	21.6	22.8	23.0
4'	23.8	29.5	47.0	60.2	73.3	85.1	86.4	91.2	92.2

10' 8' 6' 4' 2' 0' 2' 4' 6' 8' 10'

Note: If using No. 11 honeycomb baffle multiply footcandle values by .80

Wide Flood

Distance from lamp	Adjust-e-Lume™ Setting 1	2	3	4	5	6	7	8	9
20'	0.4	0.5	0.9	1.1	1.3	1.6	1.7	1.7	1.7
16'	0.7	0.8	1.4	1.7	2.0	2.4	2.6	2.7	2.7
12'	1.2	1.5	2.5	3.0	3.5	4.3	4.7	4.7	4.7
8'	2.8	3.4	5.5	6.7	7.9	9.8	10.5	10.7	10.7
4'	11.1	13.4	22.2	26.8	31.7	39.0	41.9	42.6	42.7

14' 12' 10' 8' 6' 4' 2' 0' 2' 4' 6' 8' 10' 12' 14'

Note: If using No. 11 honeycomb baffle multiply footcandle values by .80

B-K LIGHTING

40429 Brickyard Drive • Madera, California 93636 • 559.438.5800
www.bklighting.com • www.adjust-e-lume.com • www.bkssl.com

Project: Ithaca Commons Repair and Upgrade **Date:** 12 December 2013 **Type:** EX3

Project # 11143.00

LIGHT FIXTURE CUT SHEET Note: This document is for information only. Refer to specifications for all catalog numbers, lamps, finishes, etc.

Mounting Base Detail

DRAWING FOR MOUNTING CONCEPT ONLY

Provide 12Volt A.C. Power from Remote Magnetic Transformer

EL CAPITAN "E" ON SMJ WITH RADIUS BASE

09/07/12	B-K LIGHTING, INC.	DRAWING NUMBER CUS-1205-32

ALL DIMENSIONS INDICATED ON THIS SUBMITTAL ARE NOMINAL. CONTACT TECHNICAL SALES IF YOU REQUIRE MORE STRINGENT DIMENSIONAL SPECIFICATIONS.

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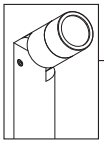
Project: **Ithaca Commons Repair and Upgrade** **Date:** **12 December 2013** **Type:**

Project # **11143.00** **EX3**

LIGHT FIXTURE CUT SHEET Note: This document is for information only. Refer to specifications for all catalog numbers, lamps, finishes, etc.



ArtiStar™

BK SOLID STATE LIGHTING

Integral Transformer

the power of with adjust-e-lume™ TECHNOLOGY

INTEGRAL ARTISTAR™

PROJECT:	
TYPE:	
CATALOG NUMBER:	
SOURCE:	
NOTES:	

CATALOG NUMBER LOGIC

			AR	LED	TR													
Example	**B**	-	**AR**	- **LED**	- **TR**	-	**e22**	-	**NSP**	-	**A9**	-	**MIT**	-	**12**	-	**11**	-	**A**	-	**12**	-	**120**	-	**PP**

Material
Blank - Aluminum **B** - Brass **S** - Stainless Steel

Series
AR - ArtiStar™

Source
LED - **'e'** Technology with Integral Driver

Housing
TR - Integral Transformer

LED Type
e36 - 8WLED/2.7K **e23** - 8WLED/4K **e25** - 8WLED/Green **e27** - 8WLED/Amber
e22 - 8WLED/3K **e24** - 8WLED/Red **e26** - 8WLED/Blue

Optics*
NSP - Narrow Spot (Red Indicator) **MFL** - Medium Flood (Yellow Indicator)
SP - Spot (Green Indicator) **WFL** - Wide Flood (Blue Indicator)

Adjust-e-Lume™ Output Intensity** *(Choose factory setting)*
A9 (Standard)**, A8, A7, A6, A5, A4, A3, A2, A1**
***Please see Adjust-e-Lume™ photometry to determine desired intensity.*

Finish

Aluminum Finish

Powder Coat Color	Satin	Wrinkle
Bronze	BZP	BZW
Black	BLP	BLW
White (Gloss)	WHP	WHW
Aluminum	SAP	—
Verde	—	VER

Brass Finish

Machined	MAC
Polished	POL
Mitique™	MIT

Stainless Finish

Machined	MAC
Polished	POL
Brushed	BRU *Interior use only.*

Premium Finish

ABP	Antique Brass Powder	CMG	Cascade Mountain Granite	RMG	Rocky Mountain Granite
AMG	Aleutian Mountain Granite	CRI	Cracked Ice	SDS	Sonoran Desert Sandstone
AQW	Antique White	CRM	Cream	SMG	Sierra Mountain Granite
BCM	Black Chrome	HUG	Hunter Green	TXF	Textured Forest
BGE	Beige	MDS	Mojave Desert Sandstone	WCP	Weathered Copper
BPP	Brown Patina Powder	NBP	Natural Brass Powder	WIR	Weathered Iron
CAP	Clear Anodized Powder	OCP	Old Copper	*Also available in RAL Finishes See submittal SUB-1439-00*	

Lens Type
12 - Soft Focus Lens **13** - Rectilinear Lens

Shielding
11 - Honeycomb Baffle

Cap Style
A - 45° **B** - 90° **C** - Flush **D** - 45° less Weep Hole *(Interior Use Only)* **E** - 90° less Weep Hole *(Interior Use Only)*

Base Height
6 - 6" with Anchor Base **12** - 12" with Anchor Base **18** - 18" with Anchor Base **24** - 24" with Anchor Base

Voltage
120 - 120 VAC Input **277** - 277 VAC Input

Option
PP - Power Pipe™ option with 18" Stake
SF - Stability Flange *(for use with Power Pipe™)*
WM - Wall or ceiling Mount with 5" dia. canopy**
*** Base height limited to 6" max. with brass and stainless steel fixtures*

LM79 DATA

BK No.	CCT (Typ.)	Input Watts (Typ.)	CRI (Typ.)
e36	2700K	8.4	90
e22	3100K	8.4	90
e23	4100K	8.4	75
e24	Red (627nm)	7.9	~
e25	Green (530nm)	8.4	~
e26	Blue (470nm)	8.4	~
e27	Amber (590nm)	7.9	~

L70 DATA

Minimum Rated Life (hrs.) 70% of initial lumens (L_{70})
50,000
50,000
50,000
50,000
50,000
50,000
50,000

*OPTICAL DATA

Beam Type	Angle	Visual Indicator
Narrow Spot	14°	Red Dot
Spot	18°	Green Dot
Medium Flood	25°	Yellow Dot
Wide Flood	36°	Blue Dot

B-K LIGHTING

40429 Brickyard Drive • Madera, CA 93636 • USA
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SUBMITTAL DATE 5-8-12

DRAWING NUMBER SUB001108

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ArtiStar™

BKSSL SOLID STATE LIGHTING

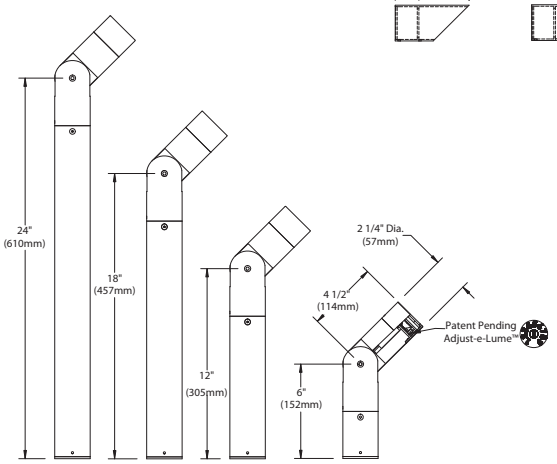
Integral Transformer

the power of with adjust-e-lume™ TECHNOLOGY

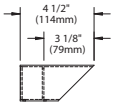
INTEGRAL ARTISTAR™

PROJECT:	
TYPE:	

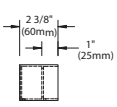
ANCHOR BASE STANDARD MOUNT



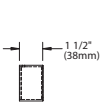
"A/D" CAP



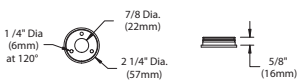
"B/E" CAP



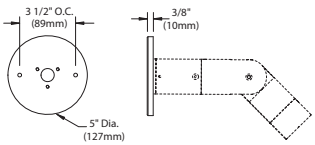
"C" CAP



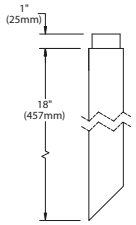
STANDARD BASE



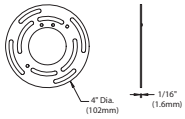
WALL MOUNT CANOPY



POWER PIPE



UNIVERSAL RING



All dimensions indicated on this submittal are nominal.
Contact Technical Sales if you require more stringent specifications.

SPECIFICATIONS

GreenSource Initiative™
Metal and packaging components are made from recycled materials. Manufactured using renewable solar energy, produced onsite. Returnable to manufacturer at end of life to ensure cradle-to-cradle handling. Packaging contains no chlorofluorocarbons (CFC's). Use of this product may qualify for GreenSource efficacy and recycling rebate(s). Consult www.bklighting.com/greensource for program requirements.

Materials
Furnished in Copper-Free Aluminum (Type 6061-T6), Brass (Type 360) or Stainless Steel (Type 304).

Body
Fully machined from solid billet. Unibody design provides enclosed, water-proof wireway and integral heat sink for maximum component life. Integral knuckle for maximum mechanical strength. High temperature, silicone 'O' Ring provides water-tight seal.

Knuckle
'Aim and Lock' knuckle is comprised of two components. The first is integral to the body and features an interior, machined taper. The second is machined from solid billet and features a second, reverse angle taper. The resultant mechanical taper-lock allows a full 180° vertical adjustment without the use of serrated teeth, which inherently limit aiming. High temperature, silicone 'O' Ring provides water-tight seal and compressive resistance to maintain fixture position. Design withstands 73 lb. static load prior to movement to ensure decades of optical alignment. Biaxial source control with 360° horizontal rotation in addition to vertical adjustment.

Cap
Fully machined. Accommodates [1] lens or louver media. Choose from 45° cutoff ('A' or 'D'), 1" deep bezel with 90° cutoff ('B' or 'E'), or flush lens ('C') cap styles. 'A' and 'B' caps include weep-hole for water and debris drainage. 'D' and 'E' caps exclude weep-hole and are for interior use only.

Lens
Shock resistant, tempered, glass lens is factory adhered to fixture cap and provides hermetically sealed optical compartment. Specify soft focus (#12) or rectilinear (#13) lens.

BKSSL™
Integrated solid state system with 'e' technology is scalable for field upgrade. Modular design with electrical quick disconnects permit field maintenance. High power, forward throw source complies with ANSI C78.377 binning requirements. Exceeds ENERGY STAR® lumen maintenance requirements. LM-80 certified components.

Integral non-dimming driver. Minimum 50,000 hour rated life at 70% of initial lumens (L70). BKSSL technology provides long life, significant energy reduction and exceptional thermal management.

Optics
Interchangeable OPTIKIT™ modules permit field changes to optical distribution. Color-coded for easy reference: Narrow Spot (NSP) = Red. Spot (SP) = Green. Medium Flood (MFL) = Yellow. Wide Flood = Blue.

Adjust-e-Lume™ (Pat. Pending)
Integral electronics allows dynamic lumen response at the individual fixture. Indexed (100% to 25% nom.) lumen output. Maintains output at desired level or may be changed as conditions require. Specify factory preset output intensity.

Installation
Available for installation in three distinct mounting conditions:

Anchor Base (Standard)
Machined anchor base with 7/8"dia. slip conduit hole and [3] 3/16" dia. anchor bolt holes (hardware by others).

Power Pipe™ (Optional)
Provides a clean transition from wiring system to fixture. Schedule 80, 18" PVC housing for direct burial into soil or concrete. Machined 2-1/4" dia. cap for fixture mounting. Stainless steel hardware. Optional 6" diameter, molded stability flange, which simplifies installation and projects into substrate to reinforce housing stability.

Wall Mount Canopy (Optional)
Optional 5" dia. machined canopy permits mounting to junction box (gasket by others). 6" maximum base height for canopy-mounted brass or stainless steel fixture.

Transformer
Integral, low voltage, magnetic transformer. 120, or 277VAC primary voltage, 50/60Hz. 12VAC secondary voltage.

Hardware
Tamper-resistant, stainless steel hardware. Knuckle vertical aiming screw is additionally black oxide treated for additional corrosion resistance.

Finish
StarGuard® (Pat. Pend.), a RoHs compliant, 15 stage chromate-free process cleans and conversion coats aluminum components prior to application of Class 'A' TGIC polyester powder coating. Brass components are available in powder coat or handcrafted metal finish. Stainless steel components are available in handcrafted metal finish. (Brushed finish for interior use only).

Warranty
5 year limited warranty.

Certification and Listing
ITL tested to IESNA LM-79. Lighting Facts Registration per USDOE (www.lightingfacts.com). ETL Listed to ANSI/UL Standard 1598 and UL Standard 8750. Certified to CAN/CSA Standard C22.2 No. 250. RoHs compliant. Suitable for indoor or outdoor use. Suitable for use in wet locations. Suitable for installation within 4' of the ground. IP66 Rated. Made in USA.

MADE IN THE USA lighting facts RoHS

*Delrin® is a registered trademark of DuPont Corporation.
Energy Star is a registered trademark of the United States Environmental Protection Agency.

B-K LIGHTING

40429 Brickyard Drive • Madera, CA 93636 • USA
559.438.5800 • FAX 559.438.5900
www.bklighting.com • info@bklighting.com

SUBMITTAL DATE	DRAWING NUMBER
5-8-12	SUB001108

Project: Ithaca Commons Repair and Upgrade **Date:** 12 December 2013 **Type:** EX4

Project # 11143.00

LIGHT FIXTURE CUT SHEET Note: This document is for information only. Refer to specifications for all catalog numbers, lamps, finishes, etc.

adjust-e-lume™ TECHNOLOGY

Photometry for use with e22 **3K**

Select OptiKit™ for desired distribution

RED	Narrow Spot (NSP)
GREEN	Spot (SP)
YELLOW	Medium Flood (MFL)
BLUE	Wide Flood (WFL)

Set adjust-e-lume™ Dial to desired output

Narrow Spot

Distance from lamp	Adjust-e-Lume™ Setting 1	2	3	4	5	6	7	8	9
20'	2.4	2.9	4.9	6.1	7.3	8.8	9.1	9.3	9.3
16'	3.8	4.6	7.6	9.6	11.4	13.8	14.3	14.5	14.6
12'	6.7	8.2	13.5	17.0	20.3	24.5	25.4	25.7	25.9
8'	15.1	18.4	30.3	38.2	45.8	55.2	57.0	57.9	58.2
4'	60.3	73.6	121.3	152.8	183.1	220.9	228.2	231.6	232.8

4' 2' 0' 2' 4'

Note: If using No. 11 honeycomb baffle multiply footcandle values by .80

Spot

Distance from lamp	Adjust-e-Lume™ Setting 1	2	3	4	5	6	7	8	9
20'	1.6	2.1	3.1	4.1	4.9	6.0	6.1	6.2	6.3
16'	2.5	3.3	4.9	6.4	7.6	9.3	9.6	9.8	9.9
12'	4.5	5.9	8.7	11.4	13.5	16.6	17.0	17.3	17.5
8'	10.2	13.2	19.5	25.6	30.5	37.3	38.3	39.0	39.4
4'	40.6	52.7	78.1	102.3	121.9	149.1	153.1	156.0	157.8

8' 6' 4' 2' 0' 2' 4' 6' 8'

Note: If using No. 11 honeycomb baffle multiply footcandle values by .80

Medium Flood

Distance from lamp	Adjust-e-Lume™ Setting 1	2	3	4	5	6	7	8	9
20'	1.0	1.2	1.9	2.4	2.9	3.4	3.5	3.6	3.7
16'	1.5	1.8	2.9	3.8	4.6	5.3	5.4	5.7	5.8
12'	2.6	3.3	5.2	6.7	8.1	9.5	9.6	10.1	10.2
8'	6.0	7.4	11.8	15.0	18.3	21.3	21.6	22.8	23.0
4'	23.8	29.5	47.0	60.2	73.3	85.1	86.4	91.2	92.2

10' 8' 6' 4' 2' 0' 2' 4' 6' 8' 10'

Note: If using No. 11 honeycomb baffle multiply footcandle values by .80

Wide Flood

Distance from lamp	Adjust-e-Lume™ Setting 1	2	3	4	5	6	7	8	9
20'	0.4	0.5	0.9	1.1	1.3	1.6	1.7	1.7	1.7
16'	0.7	0.8	1.4	1.7	2.0	2.4	2.6	2.7	2.7
12'	1.2	1.5	2.5	3.0	3.5	4.3	4.7	4.7	4.7
8'	2.8	3.4	5.5	6.7	7.9	9.8	10.5	10.7	10.7
4'	11.1	13.4	22.2	26.8	31.7	39.0	41.9	42.6	42.7

14' 12' 10' 8' 6' 4' 2' 0' 2' 4' 6' 8' 10' 12' 14'

Note: If using No. 11 honeycomb baffle multiply footcandle values by .80

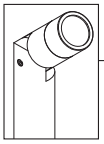
B-K LIGHTING

40429 Brickyard Drive • Madera, California 93636 • 559.438.5800
www.bklighting.com • www.adjust-e-lume.com • www.bkssl.com

Project: Ithaca Commons Repair and Upgrade **Date:** 12 December 2013 **Type:** EX4

Project # 11143.00

LIGHT FIXTURE CUT SHEET Note: This document is for information only. Refer to specifications for all catalog numbers, lamps, finishes, etc.



ArtiStar™ — Integral Transformer

the power of with adjust-e-lume™ TECHNOLOGY

INTEGRAL ARTISTAR™

PROJECT:	
TYPE:	
CATALOG NUMBER:	
SOURCE:	
NOTES:	

CATALOG NUMBER LOGIC

			AR	LED	TR													
Example	**B**	-	**AR**	- **LED**	- **TR**	- **e22**	- **NSP**	- **A9**	- **MIT**	- **12**	- **11**	- **A**	- **12**	- **120**	- **PP**			

Material
Blank - Aluminum **B** - Brass **S** - Stainless Steel

Series
AR - ArtiStar™

Source
LED - **'e'** Technology with Integral Driver

Housing
TR - Integral Transformer

LED Type
e36 - 8WLED/2.7K **e23** - 8WLED/4K **e25** - 8WLED/Green **e27** - 8WLED/Amber
e22 - 8WLED/3K **e24** - 8WLED/Red **e26** - 8WLED/Blue

Optics*
NSP - Narrow Spot (Red Indicator) **MFL** - Medium Flood (Yellow Indicator)
SP - Spot (Green Indicator) **WFL** - Wide Flood (Blue Indicator)

Adjust-e-Lume™ Output Intensity** *(Choose factory setting)*
A9 (Standard)**, A8, A7, A6, A5, A4, A3, A2, A1**
***Please see Adjust-e-Lume™ photometry to determine desired intensity.*

Finish

Aluminum Finish

Powder Coat Color	Satin	Wrinkle
Bronze	BZP	BZW
Black	BLP	BLW
White (Gloss)	WHP	WHW
Aluminum	SAP	—
Verde	—	VER

Brass Finish

Machined	MAC
Polished	POL
Mitique™	MIT

Stainless Finish

Machined	MAC
Polished	POL
Brushed	BRU *Interior use only.*

Premium Finish

ABP	Antique Brass Powder	CMG	Cascade Mountain Granite	RMG	Rocky Mountain Granite
AMG	Aleutian Mountain Granite	CRI	Cracked Ice	SDS	Sonoran Desert Sandstone
AQW	Antique White	CRM	Cream	SMG	Sierra Mountain Granite
BCM	Black Chrome	HUG	Hunter Green	TXF	Textured Forest
BGE	Beige	MDS	Mojave Desert Sandstone	WCP	Weathered Copper
BPP	Brown Patina Powder	NBP	Natural Brass Powder	WIR	Weathered Iron
CAP	Clear Anodized Powder	OCP	Old Copper	*Also available in RAL Finishes See submittal SUB-1439-00*	

Lens Type
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Shielding
11 - Honeycomb Baffle

Cap Style
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Base Height
6 - 6" with Anchor Base **12** - 12" with Anchor Base **18** - 18" with Anchor Base **24** - 24" with Anchor Base

Voltage
120 - 120 VAC Input **277** - 277 VAC Input

Option
PP - Power Pipe™ option with 18" Stake
SF - Stability Flange *(for use with Power Pipe™)*
WM - Wall or ceiling Mount with 5" dia. canopy**
*** Base height limited to 6" max. with brass and stainless steel fixtures*

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e23	4100K	8.4	75
e24	Red (627nm)	7.9	~
e25	Green (530nm)	8.4	~
e26	Blue (470nm)	8.4	~
e27	Amber (590nm)	7.9	~

L70 DATA

Minimum Rated Life (hrs.) 70% of initial lumens (L_{70})
50,000
50,000
50,000
50,000
50,000
50,000
50,000

*OPTICAL DATA

Beam Type	Angle	Visual Indicator
Narrow Spot	14°	Red Dot
Spot	18°	Green Dot
Medium Flood	25°	Yellow Dot
Wide Flood	36°	Blue Dot

B-K LIGHTING
40429 Brickyard Drive • Madera, CA 93636 • USA
559.438.5800 • FAX 559.438.5900
www.bklighting.com • info@bklighting.com

SUBMITTAL DATE 5-8-12

DRAWING NUMBER SUB001108

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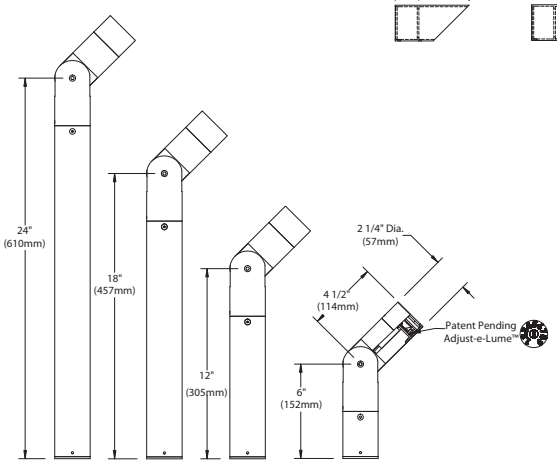
ArtiStar™
BKSSL SOLID STATE LIGHTING
Integral Transformer

the power of with adjust-e-lume™ TECHNOLOGY

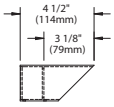
INTEGRAL ARTISTAR™

PROJECT:	
TYPE:	

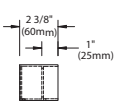
ANCHOR BASE STANDARD MOUNT



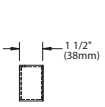
"A/D" CAP



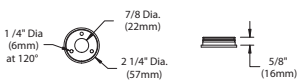
"B/E" CAP



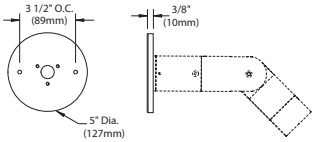
"C" CAP



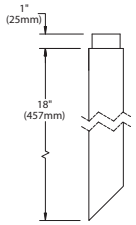
STANDARD BASE



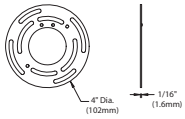
WALL MOUNT CANOPY



POWER PIPE



UNIVERSAL RING



All dimensions indicated on this submittal are nominal.
Contact Technical Sales if you require more stringent specifications.

SPECIFICATIONS

GreenSource Initiative™
Metal and packaging components are made from recycled materials. Manufactured using renewable solar energy, produced onsite. Returnable to manufacturer at end of life to ensure cradle-to-cradle handling. Packaging contains no chlorofluorocarbons (CFC's). Use of this product may qualify for GreenSource efficacy and recycling rebate(s). Consult www.bklighting.com/greensource for program requirements.

Materials
Furnished in Copper-Free Aluminum (Type 6061-T6), Brass (Type 360) or Stainless Steel (Type 304).

Body
Fully machined from solid billet. Unibody design provides enclosed, water-proof wireway and integral heat sink for maximum component life. Integral knuckle for maximum mechanical strength. High temperature, silicone 'O' Ring provides water-tight seal.

Knuckle
'Aim and Lock' knuckle is comprised of two components. The first is integral to the body and features an interior, machined taper. The second is machined from solid billet and features a second, reverse angle taper. The resultant mechanical taper-lock allows a full 180° vertical adjustment without the use of serrated teeth, which inherently limit aiming. High temperature, silicone 'O' Ring provides water-tight seal and compressive resistance to maintain fixture position. Design withstands 73 lb. static load prior to movement to ensure decades of optical alignment. Biaxial source control with 360° horizontal rotation in addition to vertical adjustment.

Cap
Fully machined. Accommodates [1] lens or louver media. Choose from 45° cutoff ('A' or 'D'), 1" deep bezel with 90° cutoff ('B' or 'E'), or flush lens ('C') cap styles. 'A' and 'B' caps include weep-hole for water and debris drainage. 'D' and 'E' caps exclude weep-hole and are for interior use only.

Lens
Shock resistant, tempered, glass lens is factory adhered to fixture cap and provides hermetically sealed optical compartment. Specify soft focus (#12) or rectilinear (#13) lens.

BKSSL™
Integrated solid state system with 'e' technology is scalable for field upgrade. Modular design with electrical quick disconnects permit field maintenance. High power, forward throw source complies with ANSI C78.377 binning requirements. Exceeds ENERGY STAR® lumen maintenance requirements. LM-80 certified components.

Integral non-dimming driver. Minimum 50,000 hour rated life at 70% of initial lumens (L70). BKSSL technology provides long life, significant energy reduction and exceptional thermal management.

Optics
Interchangeable OPTIKIT™ modules permit field changes to optical distribution. Color-coded for easy reference: Narrow Spot (NSP) = Red. Spot (SP) = Green. Medium Flood (MFL) = Yellow. Wide Flood = Blue.

Adjust-e-Lume™ (Pat. Pending)
Integral electronics allows dynamic lumen response at the individual fixture. Indexed (100% to 25% nom.) lumen output. Maintains output at desired level or may be changed as conditions require. Specify factory preset output intensity.

Installation
Available for installation in three distinct mounting conditions:

Anchor Base (Standard)
Machined anchor base with 7/8"dia. slip conduit hole and [3] 3/16" dia. anchor bolt holes (hardware by others).

Power Pipe™ (Optional)
Provides a clean transition from wiring system to fixture. Schedule 80, 18" PVC housing for direct burial into soil or concrete. Machined 2-1/4" dia. cap for fixture mounting. Stainless steel hardware. Optional 6" diameter, molded stability flange, which simplifies installation and projects into substrate to reinforce housing stability.

Wall Mount Canopy (Optional)
Optional 5" dia. machined canopy permits mounting to junction box (gasket by others). 6" maximum base height for canopy-mounted brass or stainless steel fixture.

Transformer
Integral, low voltage, magnetic transformer. 120, or 277VAC primary voltage, 50/60Hz. 12VAC secondary voltage.

Hardware
Tamper-resistant, stainless steel hardware. Knuckle vertical aiming screw is additionally black oxide treated for additional corrosion resistance.

Finish
StarGuard® (Pat. Pend.), a RoHs compliant, 15 stage chromate-free process cleans and conversion coats aluminum components prior to application of Class 'A' TGIC polyester powder coating. Brass components are available in powder coat or handcrafted metal finish. Stainless steel components are available in handcrafted metal finish. (Brushed finish for interior use only).

Warranty
5 year limited warranty.

Certification and Listing
ITL tested to IESNA LM-79. Lighting Facts Registration per USDOE (www.lightingfacts.com). ETL Listed to ANSI/UL Standard 1598 and UL Standard 8750. Certified to CAN/CSA Standard C22.2 No. 250. RoHs compliant. Suitable for indoor or outdoor use. Suitable for use in wet locations. Suitable for installation within 4' of the ground. IP66 Rated. Made in USA.

MADE IN THE USA lighting facts RoHS

*Teflon® is a registered trademark of DuPont Corporation.
Energy Star is a registered trademark of the United States Environmental Protection Agency.

B-K LIGHTING
40429 Brickyard Drive • Madera, CA 93636 • USA
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www.bklighting.com • info@bklighting.com

SUBMITTAL DATE	DRAWING NUMBER
5-8-12	SUB001108

Project: Ithaca Commons Repair and Upgrade **Date:** 12 December 2013 **Type:** EX4A

Project # 11143.00

LIGHT FIXTURE CUT SHEET Note: This document is for information only. Refer to specifications for all catalog numbers, lamps, finishes, etc.

adjust-e-lume™ TECHNOLOGY

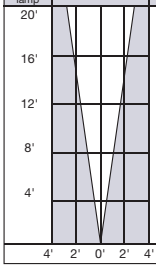
Photometry for use with e22 **3K**

Select OptiKit™ for desired distribution

RED	Narrow Spot (NSP)
GREEN	Spot (SP)
YELLOW	Medium Flood (MFL)
BLUE	Wide Flood (WFL)

Set adjust-e-lume™ Dial to desired output

Narrow Spot

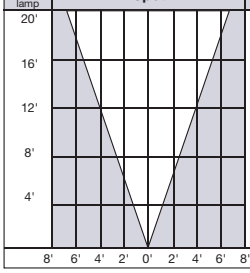


Distance from lamp	Adjust-e-Lume™ Setting 1	2	3	4	5	6	7	8	9
20'	2.4	2.9	4.9	6.1	7.3	8.8	9.1	9.3	9.3
16'	3.8	4.6	7.6	9.6	11.4	13.8	14.3	14.5	14.6
12'	6.7	8.2	13.5	17.0	20.3	24.5	25.4	25.7	25.9
8'	15.1	18.4	30.3	38.2	45.8	55.2	57.0	57.9	58.2
4'	60.3	73.6	121.3	152.8	183.1	220.9	228.2	231.6	232.8

4' 2' 0' 2' 4'

Note: If using No. 11 honeycomb baffle multiply footcandle values by .80

Spot

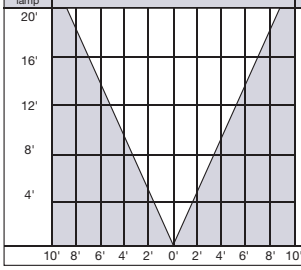


Distance from lamp	Adjust-e-Lume™ Setting 1	2	3	4	5	6	7	8	9
20'	1.6	2.1	3.1	4.1	4.9	6.0	6.1	6.2	6.3
16'	2.5	3.3	4.9	6.4	7.6	9.3	9.6	9.8	9.9
12'	4.5	5.9	8.7	11.4	13.5	16.6	17.0	17.3	17.5
8'	10.2	13.2	19.5	25.6	30.5	37.3	38.3	39.0	39.4
4'	40.6	52.7	78.1	102.3	121.9	149.1	153.1	156.0	157.8

8' 6' 4' 2' 0' 2' 4' 6' 8'

Note: If using No. 11 honeycomb baffle multiply footcandle values by .80

Medium Flood

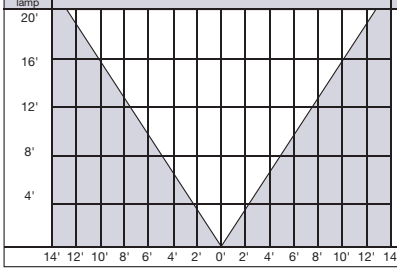


Distance from lamp	Adjust-e-Lume™ Setting 1	2	3	4	5	6	7	8	9
20'	1.0	1.2	1.9	2.4	2.9	3.4	3.5	3.6	3.7
16'	1.5	1.8	2.9	3.8	4.6	5.3	5.4	5.7	5.8
12'	2.6	3.3	5.2	6.7	8.1	9.5	9.6	10.1	10.2
8'	6.0	7.4	11.8	15.0	18.3	21.3	21.6	22.8	23.0
4'	23.8	29.5	47.0	60.2	73.3	85.1	86.4	91.2	92.2

10' 8' 6' 4' 2' 0' 2' 4' 6' 8' 10'

Note: If using No. 11 honeycomb baffle multiply footcandle values by .80

Wide Flood



Distance from lamp	Adjust-e-Lume™ Setting 1	2	3	4	5	6	7	8	9
20'	0.4	0.5	0.9	1.1	1.3	1.6	1.7	1.7	1.7
16'	0.7	0.8	1.4	1.7	2.0	2.4	2.6	2.7	2.7
12'	1.2	1.5	2.5	3.0	3.5	4.3	4.7	4.7	4.7
8'	2.8	3.4	5.5	6.7	7.9	9.8	10.5	10.7	10.7
4'	11.1	13.4	22.2	26.8	31.7	39.0	41.9	42.6	42.7

14' 12' 10' 8' 6' 4' 2' 0' 2' 4' 6' 8' 10' 12' 14'

Note: If using No. 11 honeycomb baffle multiply footcandle values by .80

B-K LIGHTING

40429 Brickyard Drive • Madera, California 93636 • 559.438.5800
www.bklighting.com • www.adjust-e-lume.com • www.bkssl.com

Project: Ithaca Commons Repair and Upgrade **Date:** 12 December 2013 **Type:**

Project # 11143.00 **EX4A**

LIGHT FIXTURE CUT SHEET Note: This document is for information only. Refer to specifications for all catalog numbers, lamps, finishes, etc.

NOT USED

HLB Lighting Design 233 Lewis Wharf Boston MA 02110 617 229 5190 voice 617-723-5190 fax www.HLBlighting.com

Recessed wall luminaire

Type:
BEGA Product:
Project:
Voltage:
Color:
Options:
Modified:

Housing: Constructed of die cast and extruded aluminum with integral wiring compartment. Mounting tabs provided.

Enclosure: One piece die cast aluminum faceplate, 1⁄8" thick. Clear tempered glass with translucent white ceramic coating. Faceplate is secured by two (2) socket head, stainless steel, captive screws threaded into stainless steel inserts in the housing casting. Continuous high temperature O-ring gasket for weather tight operation.

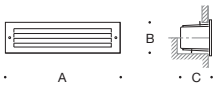
Electrical: 6.7 W LED luminaire, 8.5 total system watts, -30° C start temperature. Integral 120 V through 277 V electronic LED driver, 0 -10 V dimming. The LED and driver are mounted on a removable plate for easy replacement. Standard LED color temperature is 3000K (available in 4000K; add suffix K4). Through Wiring: Maximum four (4) No. 12 AWG conductors (plus ground) suitable for 75° C. Provided with 1/2" NPT threaded conduit entries.

Note: Due to the dynamic nature of LED technology, LED luminaire data on this sheet is subject to change at the discretion of BEGA-US. For the most current technical data, please refer to www.bega-us.com.

Finish: These luminaires are available in four standard BEGA colors: Black (BLK); White (WHT); Bronze (BRZ); Silver (SLV). To specify, add appropriate suffix to catalog number. Custom colors supplied on special order.

UL listed, suitable for wet locations and for installation within 3 feet of ground. Type non-IC. Protection class: IP64.

Luminaire Lumens: 10
Tested in accordance with LM-79-08



	Lamps	A	B	C
2196LED ADA	6.7 W LED	9½	2½	4¼

BEGA-US 1000 BEGA Way, Carpinteria, CA 93013 (805) 684-0533 FAX (805) 566-9474 www.bega-us.com
©copyright BEGA-US 2012 Updated 10/12

Project: **Ithaca Commons Repair and Upgrade** **Date:** **12 December 2013** **Type:**
Project # **11143.00** **EX6**

LIGHT FIXTURE CUT SHEET Note: This document is for information only. Refer to specifications for all catalog numbers, lamps, finishes, etc.

NOT USED

HLB Lighting Design 233 Lewis Wharf Boston MA 02110 617 229 5190 voice 617-723-5190 fax www.HLBlighting.com

NOT USED

HLB Lighting Design 233 Lewis Wharf Boston MA 02110 617 229 5190 voice 617-723-5190 fax www.HLBlighting.com

Date: _____ Customer: _____

Project: ITHACA COMMONS REPAIR AND UPGRADE - SURFACE IMPROVEMENT PACKAGE

Type: _____ Qty: _____

selux

Discera 600 LED

Order Code:

DSC6L	Series	DSC6L Discera 600 LED					
_____	Optics	R1 Type I Distribution	R2 Type II Distribution	R3 Type III Distribution	R4 Type IV Distribution	R5 Type V Distribution	
_____	Mounting	S1 Single Short Arm	S2 Double Short Arm@180°	L1 Single Long Arm	L2 Double Long Arm @180°	SW Short Arm Wall Mount	LW Long Arm Wall Mount
_____	Light Engine	4TL350 40W LED/ 46W System	4TL500 58W LED/ 64W System				
_____	CCT	30 3000K	45 4500K			for other CCT please consult factory	
_____	Power Cord Length	12	15	18	20	25	XX Add 2' if double mounting is used
_____	Finish	WH White	BK Black	BZ Bronze	SV Silver	SP Specify Premium Color	
_____	Voltage	120	208	240	277	347	480
_____	Options	DM Dimming (0-10V)	HLxx Hi-Lo Switching (please consult factory for settings)				

SM 3085A

Product Modifications

Please list modification requirements for review by factory:

Approvals

Date:

Selux Corporation © 2013, T 845-834-1400, 800-735-8927, F 845-834-1401, www.selux.us
In a continuing effort to offer the best product possible, we reserve the right to change, without notice, specifications or materials that in our opinion will not alter the function of the product. Specification sheets found at www.selux.us are the most recent versions and supercede all other printed or electronic versions.

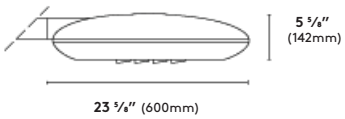
Project: **Ithaca Commons Repair and Upgrade** **Date:** **12 December 2013** **Type:**

Project # **11143.00** **EX8**

LIGHT FIXTURE CUT SHEET Note: This document is for information only. Refer to specifications for all catalog numbers, lamps, finishes, etc.

selux

DSC6L



Net Weight (lbs.):

Specifications

1. Luminaire Cover - Made from high pressure die-cast, low copper aluminum alloy.

2. Tool-less latch - Two tool-less steel latches for easy access to lamp chamber and maintanence.

3. Mounting Arm - Welded steel with powder coat finish.

4. Fitter - Cast fitter for direct connection to standard short and long arms.

5. Gasketing - Silicone gasket provides seal at door and glass opening.

6. Glass Lens - Tempered, screened glass lens protects and helps seal optical chamber.

7. LED Light Engine - High efficacy LED light engine with 60,000 hour life until L70. Available with3000K or 4500K CCT and a CRI of 80. Protection class IP67.

8. Optics - (Not shown) High transmittance custom molded lenses create IES distribution types I, II, III, IV and V with IDA-Approved "Dark Sky Friendly" performance.

9. LED Driver - (Not shown) High power factor, High efficiency constant current LED driver. 120-277 VAC input. Protection class IP67. 347/480V with step down transformer.

10. Surge Protection - (Not shown) 3-Pole Surge protection device safeguards electrical components from indirect lighting strikes and surges up to (10kA and 10kV). RoHS compliant.

11. Access Door - Lower casting features tempered glass lens and a stainless steel hinge that attaches to upper casting on mounting arm side. Other side is secured with tool-less latches.

5 Year Limited LED Luminaire Warranty - Selux offers a 5 Year Limited Warranty to the original purchaser that the Discera 600 LED luminaire shall be free from defects in material and workmanship for up to five (5) years from date of shipment. This limited warranty covers the LED driver and LED array when installed and operated according to Selux instructions. Fixture suitable for ambient temperature of 40° C (104° F). For details and exclusions, see "Selux Terms and Condition of Sale."

Listings and Ratings: Luminaire and LED tested to IP65 and IESNA LM-79-08 standards. LED tested to LM-80 standards. Luminaire and LED tested at 25°C ambient temperature.

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In a continuing effort to offer the best product possible, we reserve the right to change, without notice, specifications or materials that in our opinion will not alter the function of the product. Specification sheets found at www.selux.us are the most recent versions and supercede all other printed or electronic versions.

Project: **Ithaca Commons Repair and Upgrade** **Date:** **12 December 2013** **Type:**

Project # **11143.00** **EX8**

LIGHT FIXTURE CUT SHEET Note: This document is for information only. Refer to specifications for all catalog numbers, lamps, finishes, etc.

Ritorno® LED Retrofit Kit

selux

Project: _____

Type: _____ **Qty:** _____

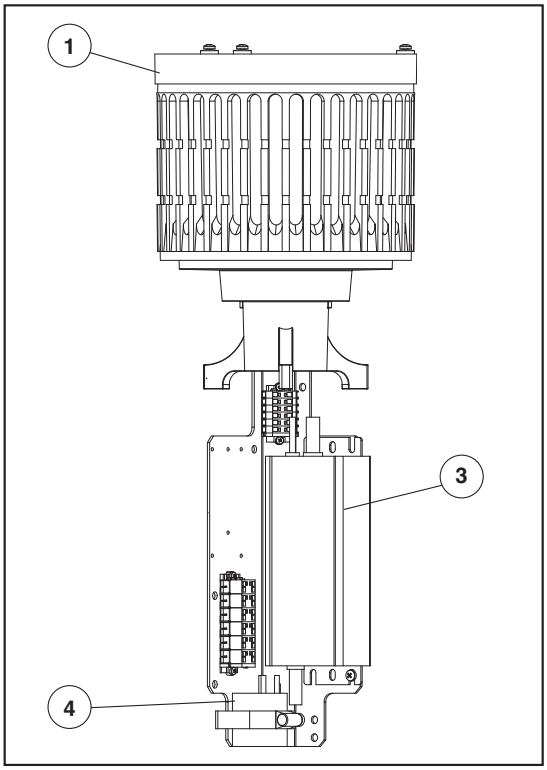
RLRK	–	_____	–	_____	–	_____	–	_____	–	_____	–	_____
Series		Mounting		Light Engine		CCT		Finish		Voltage		Options

Series	Mounting	Light Engine	CCT	Finish	Voltage	Options
RLRK Ritorno® LED Retrofit Kit	**RRA** **RRS** **RSA**	**L55** 55W	**3000** **3500** **4000**	**WH** White **BK** Black **BZ** Bronze **SV** Silver **SP** Specify Premium Color	**120** **208** **277** **347**[1] **480**[1]	**DM** Dimming (0-10V) **HL**[2] Hi-Lo Switching

[1] With internal stepdown transformer [2] Only 120/277

Delivered Lumens

RRA @4000K (2573 lm)
RRS @4000K (2424 lm)
RSA @4000K (2573 lm)



1. Ritorno LED Retrofit Kit (RLRK) - Ritorno LED Retrofit Kit is a completely sealed (IP65) LED cast housing assembly. The RLRK is designed to update existing pole and wall mounted Ritorno HID luminaires to LED. The RLRK can be used to easily update existing RRA, RRS, and RSA luminaires in the field. Please refer to installation/update instructions provided with retrofit kit. Replacement can match existing HID luminaires one for one, up to 100W.

2. LED Light Engine - (Not shown) High efficacy LED light engine with 60,000 hour+ life until L70. Available with 3000K, 3500K or 4000K CCT and a CRI of 80.

3. LED Driver - High power factor, High efficiency constant current LED driver. 120-277 VAC input. Protection class IP67.

4. Surge Protection - 3-Pole Surge protection device safeguards electrical components from indirect lighting strikes and surges up to (10kA and 10kV).

Exterior Luminaire Finish - Selux utilizes a high quality Polyester Powder Coating. All Selux luminaires and poles are finished in our Tiger Drylac certified facility and undergo a five stage intensive pretreatment process where product is thoroughly cleaned, phosphated and sealed. Selux powder coated products provide excellent salt and humidity resistance as well as ultra violet resistance for color retention. All products are tested in accordance with test specifications for coatings from ASTM and PCI.

Standard exterior colors are White (WH), Black (BK), Bronze (BZ), and Silver (SV). Selux premium colors (SP) are available, please specify from your Selux color selection guide.

5 Year Limited LED Luminaire Warranty - Selux offers a 5 Year Limited Warranty to the original purchaser that the Ritorno LED luminaire shall be free from defects in material and workmanship for up to five (5) years from date of shipment. This limited warranty covers the fixture, LED driver and LED light engine when installed and operated according to Selux instructions. Fixture suitable for ambient temperatures from -35° C (-31° F) up to 40° C (104° F). For details and exclusions, see "Selux Terms and Condition of Sale."

Listings and Ratings: Tested to IESNA LM-79-08 and LM-80 test standards at 25° C ambient temperature.

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TEL (845) 834-1400
FAX (845) 834-1401
www.selux.us
RLRK-0213-01 (ss-V1.2)

NRTL Listed (i.e. UL, CSA)

Union Made Affiliated with **IBEW** *Local 363*

IP65

In a continuing effort to offer the best product possible, we reserve the right to change, without notice, specifications or materials that in our opinion will not alter the function of the product. Specification sheets found at www.selux.us are the most recent versions and supercede all other printed or electronic versions.

Date: _____ Customer: _____

Project: ITHACA COMMONS REPAIR AND UPGRADE - SURFACE IMPROVEMENT PACKAGE

Type: _____ Qty: _____

selux

Discera 600 LED

Order Code:

DSC6L	Series	DSC6L Discera 600 LED					
_____	Optics	R1 Type I Distribution	R2 Type II Distribution	R3 Type III Distribution	R4 Type IV Distribution	R5 Type V Distribution	
_____	Mounting	S1 Single Short Arm	S2 Double Short Arm@180°	L1 Single Long Arm	L2 Double Long Arm @180°	SW Short Arm Wall Mount	LW Long Arm Wall Mount
_____	Light Engine	4TL350 40W LED/ 46W System	4TL500 58W LED/ 64W System				
_____	CCT	30 3000K	45 4500K			for other CCT please consult factory	
_____	Power Cord Length	12	15	18	20	25	XX Add 2' if double mounting is used
_____	Finish	WH White	BK Black	BZ Bronze	SV Silver	SP Specify Premium Color	
_____	Voltage	120	208	240	277	347	480
_____	Options	DM Dimming (0-10V)	HLxx Hi-Lo Switching (please consult factory for settings)				

SM 3085A

Product Modifications

Please list modification requirements for review by factory:

Approvals

Date:

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Project: **Ithaca Commons Repair and Upgrade** **Date:** **12 December 2013** **Type:**

Project # **11143.00** **EX10**

LIGHT FIXTURE CUT SHEET Note: This document is for information only. Refer to specifications for all catalog numbers, lamps, finishes, etc.

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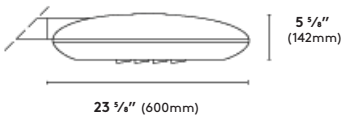
DSC6L



Net Weight (lbs.):

Specifications

1. Luminaire Cover - Made from high pressure die-cast, low copper aluminum alloy.

2. Tool-less latch - Two tool-less steel latches for easy access to lamp chamber and maintanence.

3. Mounting Arm - Welded steel with powder coat finish.

4. Fitter - Cast fitter for direct connection to standard short and long arms.

5. Gasketing - Silicone gasket provides seal at door and glass opening.

6. Glass Lens - Tempered, screened glass lens protects and helps seal optical chamber.

7. LED Light Engine - High efficacy LED light engine with 60,000 hour life until L70. Available with3000K or 4500K CCT and a CRI of 80. Protection class IP67.

8. Optics - (Not shown) High transmittance custom molded lenses create IES distribution types I, II, III, IV and V with IDA-Approved "Dark Sky Friendly" performance.

9. LED Driver - (Not shown) High power factor, High efficiency constant current LED driver. 120-277 VAC input. Protection class IP67. 347/480V with step down transformer.

10. Surge Protection - (Not shown) 3-Pole Surge protection device safeguards electrical components from indirect lighting strikes and surges up to (10kA and 10kV). RoHS compliant.

11. Access Door - Lower casting features tempered glass lens and a stainless steel hinge that attaches to upper casting on mounting arm side. Other side is secured with tool-less latches.

5 Year Limited LED Luminaire Warranty - Selux offers a 5 Year Limited Warranty to the original purchaser that the Discera 600 LED luminaire shall be free from defects in material and workmanship for up to five (5) years from date of shipment. This limited warranty covers the LED driver and LED array when installed and operated according to Selux instructions. Fixture suitable for ambient temperature of 40° C (104° F). For details and exclusions, see "Selux Terms and Condition of Sale."

Listings and Ratings: Luminaire and LED tested to IP65 and IESNA LM-79-08 standards. LED tested to LM-80 standards. Luminaire and LED tested at 25°C ambient temperature.

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Project: **Ithaca Commons Repair and Upgrade** **Date:** **12 December 2013** **Type:**
Project # **11143.00** **EX10**

LIGHT FIXTURE CUT SHEET Note: This document is for information only. Refer to specifications for all catalog numbers, lamps, finishes, etc.

AT64/AT74 6" - 4" / 7" - 4" Round Tapered Aluminum Poles

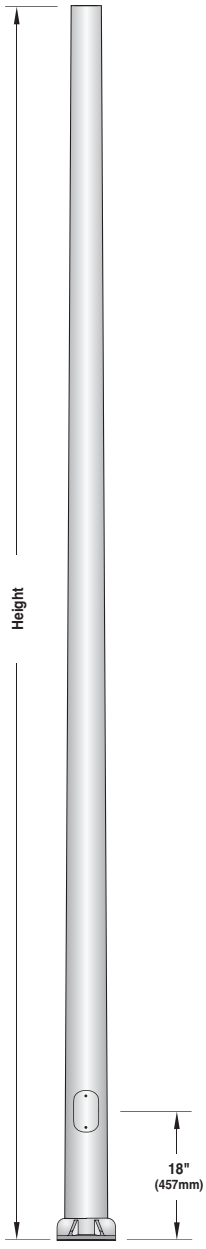
selux

Project: _____

Type: _____ **Qty:** _____

Ordering Format: _____ – _____ – _____ – _____ – _____ – _____

Series Height Finish Option Option Option



Pole Series	Height	Wall Thickness	EPA Information (ft²)					Finish	Options
			70 mph	80 mph	90 mph	100 mph	110 mph		
AT64	12 12 ft.	0.156	20.0	20.0	16.3	13.1	10.7	**WH** White **BK** Black **BZ** Bronze **SV** Silver **SP** Specify Premium Color	**BC9** Optional base cover for AT64 poles only **BC10** Optional base cover for AT74 poles only **REC** GFCI Receptacle **REC2** GFCI Receptacle with weather-proof in-use cover **T30** Supplied with Ø3" Tenon, 4" high **T35** Supplied with Ø3 1/2" Tenon, 4 1/2" high For PC or PCT refer to fixture spec sheets (where applicable). For other options please consult factory.
AT64	14 14 ft.	0.156	20.0	17.7	13.7	10.9	8.9		
AT64	16 16 ft.	0.156	19.0	14.1	10.8	8.6	7.0		
AT64	18 18 ft.	0.156	15.7	11.5	8.7	6.9	5.5		
AT64	20 20 ft.	0.156	13.5	9.6	7.1	5.6	4.4		
AT64	23 23 ft.	0.156	10.0	6.8	4.8	3.7	2.8		
AT74	18 18 ft.	0.156	20.0	17.7	13.7	10.9	8.8		
AT74	20 20 ft.	0.156	20.0	14.9	11.4	9.0	7.3		
AT74	23 23 ft.	0.156	15.8	11.4	8.5	6.6	5.3		
AT74	24 24 ft.	0.156	14.8	10.5	7.8	6.0	4.7		
AT74	25 25 ft.	0.156	13.4	9.5	7.0	5.4	4.2		

Other heights available, consult factory. EPA Calculations allow for 1.3 Gust Factor

Standard Specifications

Pole Shaft - Pole shaft is spun from seamless 6063 alloy aluminum which is heat treated to a T6 temper.

Anchor Base - Anchor base is cast from 356 alloy aluminum which is heat treated to a T6 temper. The anchor base casting and shaft are joined by a continuous circumferential weld at the outside top and inside bottom of the anchor base.

Access Hole - The opening measures 3" x 5" (76 x 127mm) for 6" Dia. poles 4" x 6" (102 x 152mm) for 7" Dia. poles, with a cast 356 aluminum tempered to a T6 condition reinforced frame. Frame is supplied with integral ground lug connection located inside pole. Flush fitting cover is supplied with tamper resistant fasteners.

Anchor Bolts - Pole is supplied with four steel hot dip galvanized anchor bolts, 3/4" x 17" for 6" poles and 1" x 36" for 7" poles, each with two nuts, two flat washers and one lock washer.

Nut Cover - Poles come standard with cast aluminum nut covers.

Exterior Luminaire Finish - Selux utilizes a high quality Polyester Powder Coating. All Selux luminaires and poles are finished in our Tiger Drylac certified facility and undergo a five stage intensive pretreatment process where product is thoroughly cleaned, phosphated and sealed. Selux powder coated products provide excellent salt and humidity resistance as well as ultra violet resistance for color retention. All products are tested in accordance with test specifications for coatings from ASTM and PCI.

Standard exterior colors are White (WH), Black (BK), Bronze (BZ), and Silver (SV). Selux premium colors (SP) are available, please specify from your Selux color selection guide. Hot Dip Galvanized finish (GV) on all steel parts also available.

All Poles are constructed per AASHTO standards for structural supports for highway signs, luminaires and traffic signals as published in 1994.

A consideration of field conditions such as (but not limited to) wind zone, height, vibration must be given by the designer/specifier for the appropriate application.

Performance of poles is dependent upon proper support/attachment of pole to adequate foundation design. Selux does not design or offer recommendations for foundations. EPA values assume that the bottom of the pole is at grade level.

Call Selux (1-800-SELUXCS) if there are any questions, or for any assistance in determining suitability with appropriate fixtures.

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NRTL Listed (i.e. UL, CSA)

Union Made Affiliated with **IBEW** *Local 363*

Made in the USA

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Project: Ithaca Commons Repair and Upgrade **Date:** 12 December 2013 **Type:**

Project # 11143.00 **EX10**

LIGHT FIXTURE CUT SHEET Note: This document is for information only. Refer to specifications for all catalog numbers, lamps, finishes, etc.

AT64/AT74 6"-4"/7"-4" Round Tapered Aluminum Poles

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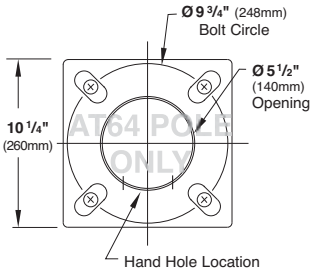
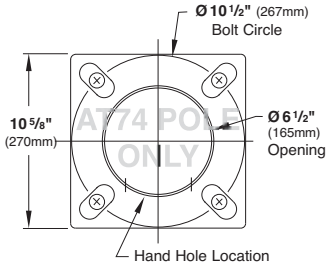
Bolt Circle (AT64)

Use caution when setting anchor bolts. Bolts must be vertically straight and centered on dimensions shown.



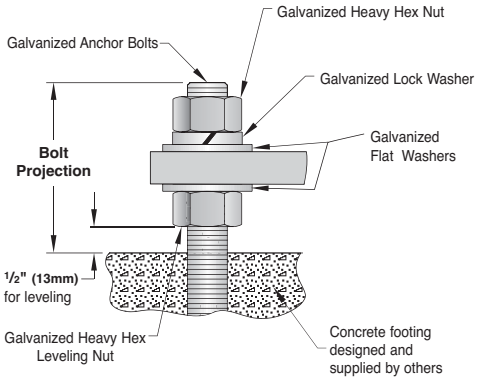
Bolt Circle (AT74)

Use caution when setting anchor bolts. Bolts must be vertically straight and centered on dimensions shown.



Note: Adequate drainage must be provided in concrete foundation.

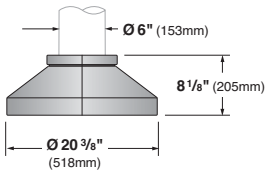
Anchor Bolt Detail



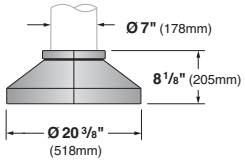
Additional Spec Information

Pole Series	Top Diameter	Bottom Diameter	Handhole Size	Base Size	Conduit Opening	Bolt Size	Bolt Circle	Bolt Projection
AT64	4"	6"	3" x 5"	10 1/4" x 10 1/4"	5 1/2"	3/4" x 17"	9 3/4"	3 1/2"
AT74	4"	7"	4" x 6"	10 5/8" x 10 5/8"	6 1/2"	1" x 36"	10 1/2"	4 1/8"

BC9 Optional Base Cover (AT64)
Die cast aluminum, two-piece field installable base cover.



BC10 Optional Base Cover (AT74) Die cast aluminum, two-piece field installable base cover.



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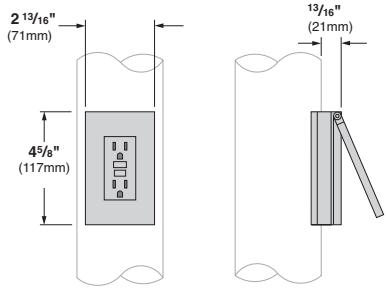
Project: **Ithaca Commons Repair and Upgrade** **Date:** **12 December 2013** **Type:**

Project # **11143.00** **EX10**

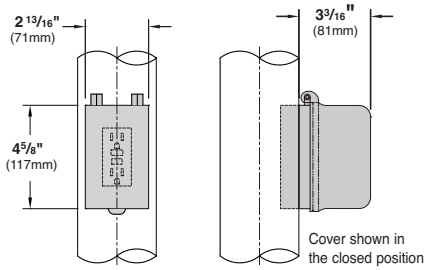
LIGHT FIXTURE CUT SHEET Note: This document is for information only. Refer to specifications for all catalog numbers, lamps, finishes, etc.

Optional Accessories

GFCI Receptacle with flat cover (REC) - GFCI duplex receptacle with cast base welded to pole and gasketed, provided with weather-proof, self-closing non-lockable cover; located 36" (915mm) from base of pole, inline with handhole. Receptacle is intended only for portable tools or other portable equipment to be connected to outlet only when attended by operating personnel. For use with 120v applications only, for other fixture voltages, please consult factory for wire segregation requirements.



GFCI Receptacle with in-use cover (REC2) - GFCI duplex receptacle with cast base welded to pole and gasketed, provided with weather-proof, self-closing lockable in-use cover; located 36" (915mm) from base of pole, inline with handhole. Receptacle is intended only for portable tools or other portable equipment to be connected to outlet only when attended by operating personnel. For use with 120v applications only, for other fixture voltages, please consult factory for wire segregation requirements.



*Physical size subject to change pending availability

Photo Cell (PC) - Twist lock photocell mounted to aluminum cap which attaches to pole top or can be remotely located. Can be oriented for optimum performance. *Refer to fixture spec sheet to determine if this option is applicable.*

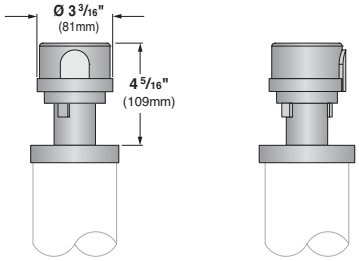
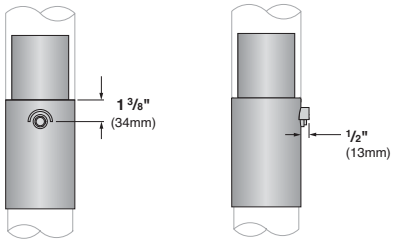


Photo Cell Tenon (PCT) - Button type photocell mounted in cast aluminum pole top tenon. Tenon has integral cast visor to prevent false start/stop cycle and can be oriented for optimum performance. *Refer to fixture spec sheet to determine if this option is applicable.*



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SECTION 312000

EARTH MOVING

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. Attention is directed to the PROCUREMENT AND CONTRACTING REQUIREMENTS and all Sections within DIVISION 01, GENERAL REQUIREMENTS, which are made a part of this Section of the Specifications.

1.02 SUMMARY

A. Section Includes:
1. Earth and rock excavation
2. Excavating and backfilling trenches for utilities and pits for buried utility structures.
3. Preparing subgrades, including excavation and backfill for, walks and pavements.
4. Excavation and removal of unsuitable bearing material.
5. Soils and backfill materials consolidation and compaction.
6. Furnishing and placing earth and granular materials.
7. Geotextiles and separation fabrics.
8. Removing from site excess and/or unsuitable fill
9. All other associated earthwork as necessary to perform the work under this Contract in conformance with the alignments, grades and detailed sections provided.

B. Related Sections:
1. Divisions 22, 26, and 33 Sections for installing underground facility utilities and buried utility structures.
2. Division 31 Section “Erosion and Sedimentation Control”

C. Special Requirements
1. Upon excavation, the subgrade shall be inspected by a qualified and independent testing representative obtained by the Owner. Subgrade shall be approved by the Owner’s representative before any new construction begins. Results of the tests must be reviewed and approved by the Architect/Engineer.
2. All excavation, fill or backfill placement, and utility construction shall be performed in the dry. The contractor shall be prepared to dewater as necessary. Subsurfaces shall be kept free of water, subjected to minimum amount of construction traffic, exposed no longer than necessary, and not permitted to freeze.
3. On-site soils shall not be reused.
4. Excavation of the highly weathered bedrock (likely encountered in the upper 1 to 2 feet of the rock surface) with conventional high capacity earth moving equipment (i.e. D8 or larger caterpillar type bulldozers equipped with rippers or high capacity backhoes, such as Cat 235) is unlikely to present significant difficulty.
5. Work for Unit Pavers shall be completed in accordance with Section 32 "Unit Paving".

1.03 DEFINITIONS

A. Backfill: Aggregate or earthen material or controlled low-strength material used to fill excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.

2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

C. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

D. Embankment Foundation: Surface area upon which an embankment or fill is constructed.

E. Excavation: Removal of material encountered to subgrade elevations, lines, and dimensions required and the subsequent disposal of materials removed.

1. Additional Excavation: When excavation has reached required subgrade elevations, notify the Owner's Designated Representative, who will make an inspection of the conditions. If Architect/Engineer determines that bearing materials at required subgrade elevations are unsuitable, continue excavation until suitable bearing materials are encountered and replace excavated material as directed by Architect/Engineer.

2. Unauthorized Excavation: Consists of removal of materials beyond required subgrade elevations or dimensions without specific direction of the Architect/Engineer or Owner's Designated Representative. Unauthorized excavation, as well as remedial work directed by the Architect/Engineer or Owner's Designated Representative, shall be at Contractor's expense. Fill of unauthorized excavations shall be as follows:

a. Under footings or foundation bases, fill of unauthorized excavations under footing or foundation bases shall be accomplished by extending lean concrete or well-graded crushed aggregate fill to bring elevations to proper position, when acceptable to Architect/Engineer.

b. In locations other than those above, backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by the Owner's Designated Representative.

3. Unclassified Excavation: Unclassified excavation shall consist of the excavation and disposal of all materials or obstructions, of any description, encountered during construction, unless otherwise specified.

F. Fill: Aggregate and/or earthen soil materials used to raise existing grades.

G. Loam: Soil mixture consisting of the following proportions:

Sand	30 - 50%
Silt	30 - 50%
Clay	0 - 20%

H. Rock: Solid hard material located in ledges, bedded deposits and unstratified masses, and all natural conglomerate deposits so firmly cemented as to present all the characteristics of solid rock, which must be removed by blasting or pneumatic hammers. Rock does not include shale, slate, soft sandstone, hardpan, masonry or concrete rubble, boulders less than 2 cubic yards, such other rock material which is decomposed, stratified, weathered or shattered, or any material capable of being removed by a well maintained Caterpillar 225 power shovel, or equivalent.

I. Structure Soil: A manufactured pavement subbase course that performs as a planting medium to support tree growth.

J. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, utility structures, pole bases, or other man-made stationary features constructed above or below the ground surface.

K. Subbase Course: Aggregate layer placed between the subgrade and asphalt pavement course, or directly under concrete pavement, hardscape or stabilized topsoil area.

L. Subgrade or Subgrade Surface: Uppermost undisturbed surface of an excavation or the top surface of a compacted fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

M. Suitable Material: A material whose composition is satisfactory for use in embankment, backfill, or fill construction. Determinations of whether a specific material is suitable for a specific application shall be made by the Owner's Designated Representative or Architect/Engineer.

N. Topsoil: Refer to Division 32 Section "Planting Soils".

O. Unstable Material: (if encountered) Unstable material shall mean debris and all wet, soft, or loose material, which does not provide sufficient bearing capacity to satisfactorily support pipes, structures or other work placed thereon.

P. Unsuitable Material: Unsuitable material shall mean excavated material, which in the opinion of the Owner's Designated Representative or Architect/Engineer, does not meet specification requirements for backfilling, embankment, or filling purposes and includes unstable material.

1. Unsuitable material includes materials containing humus, spongy material, roots, stumps, muck, peat, and any other objectionable material. This material shall be disposed of in an approved off-site spoil area.
2. The Owner's Designated Representative or Architect/Engineer shall be the sole judge of what constitutes unsuitable material.

Q. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.04 SUBMITTALS

A. Product Data: For each type of the following manufactured products required:

1. Geotextiles.
2. Low-strength material, including design mixture.
3. Warning tapes.

B. SAMPLES

1. 12-inch-by-12-inch sample of each type of geotextile specified.

C. Material Test Reports: Contractor shall submit test results for laboratory gradation, moisture content (Proctor Tests), and maximum density tests certified by an approved testing laboratory or other requirements on the various imported soil and granular items, from each approved material source, prior to their use on the project:

1. Classification according to ASTM D 2487.
2. Laboratory compaction curve according to ASTM D 1557.

D. Provide material certifications for imported materials.

E. Submit list indicating locations where various soil earthen and granular materials will be utilized.

F. List of compaction plans of proposed compaction equipment and description.

G. Details of proposed sheeting, if required, shall be submitted by the Contractor to the Architect/Engineer for review and no sheeting shall be installed without written acceptance from the Architect/Engineer. Sheeting design shall be stamped by NYS licensed professional engineer.

H. Submit Qualification Data: For qualified independent testing agency.

I. Pre-excavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earth moving operations. Submit before earth moving begins.

1.05 QUALITY ASSURANCE

A. Pre-excavation Conference: Contractor shall conduct a conference at the project site to comply with requirements in Division 1 Section “Project Meetings.”

B. All finished grades shall be as shown on the Drawings or as specified by the Architect/Engineer. Contractor shall verify that survey benchmark and intended elevations for the work are as indicated. Contractor shall verify existing site conditions.

C. Contractor's independent testing agency shall be approved by the Architect/Engineer.

D. Erosion control measures in accordance with Division 31 Section “Erosion and Sediment Control,” shall be followed.

E. When placing fill and backfill, all compaction and soil moisture requirements as delineated in this specification shall be followed. Lift thickness, and the compactive capabilities of the equipment used, shall be continually monitored by the Contractor to obtain the compaction efforts required.

F. Provide on-site at least one person who shall supervise the soil compaction operations, and who shall be thoroughly familiar with the various types of compaction equipment, proper compacting techniques and methods, and soils behavior, and who shall direct the compaction operations.

G. It is the responsibility of the Contractor to select, furnish and properly maintain equipment, which will compact the fill uniformly to the required density.

H. The Architect/Engineer will be the sole judge of the conformance of materials, workmanship, and compaction with the requirements of the Contract Documents.

I. Work referencing NYSDOT (New York State Department of Transportation) shall be in compliance with the New York State Department of Transportation Standard Specifications (NYSS) dated January 2, 2002 (and any subsequent revisions).

1.06 COMPACTION TESTING AND REPORTS

A. Owner will engage and pay for a qualified and independent testing and inspecting agency to complete field compaction density testing for all soils and granular materials utilized in the Work. All materials not meeting proper compaction requirements shall be removed and replaced. Costs to the Owner for additional testing of replacement materials shall be the responsibility of the Contractor.

B. The Owner reserves the right to request testing of all Contractor imported materials to verify conformance with approved materials. All soils and granular materials not meeting the proper gradation requirements nor previously approved laboratory maximum density tests as submitted by the Contractor shall be removed. Costs to the Owner for testing of materials, which are found not in conformance with approved materials, shall be the responsibility of the Contractor.

C. Laboratory test reports:
   1. As a minimum, the laboratory maximum density testing reports shall contain the following:
      a. Laboratory's name.
      b. Date, time, and specific location from which sample was taken and name of person who collected the sample.
      c. Moisture - Density Curve plotted on graph paper to as large a scale as is practical with all points used to derive the curve being clearly visible.
      d. Designation of the test method used.
      e. The optimum density and moisture content.
      f. A description of the sample.
      g. The date the test was performed and the person who performed the test.
      h. The project name, identification, and contractor's name.
      i. The signature of a responsible officer of the testing laboratory certifying to the information contained in the report.

1.07 PROJECT CONDITIONS

A. When work is in public rights-of-way, the Contractor shall make necessary arrangement for permits, as required, at no extra cost to the Owner.

B. The Contractor shall be required to ascertain the complete extent of all permits required governing dewatering operations, and shall be bound by their conditions and provisions.

C. Provide and maintain emergency ingress/egress to the site at all times. Provide and maintain pedestrian and vehicle access to all buildings.

D. If trench widths and depths are exceeded, concrete cradles or other special installation procedures may be required and shall be provided where directed by Architect/Engineer. All additional costs, including the cost of redesigns, shall be borne by Contractor.

E. Moisten or dry backfill materials to the proper moisture content as determined in accordance with ASTM D1557, Method C in order to obtain proper compaction.

F. Utilities shown on the Contract Drawings are based on the best information available and exact locations are not guaranteed. The Contractor shall verify existing utilities with the proper authorities.

G. Notify Dig Safely New York (UFPO) prior to commencing any excavation. Locate and identify existing underground and overhead services and utilities within contract limit work areas. Provide adequate means of protection of utilities and services, which are not designated to be removed. Repair utilities damaged during site work operations at Contractor’s expense.

H. The Contractor alone shall be responsible to locate all utilities and services outside the public rights-of-way. The Contractor shall complete test pits as needed to confirm underground utilities and services. The cost of all test pits shall be included in the price bid. Provide adequate means of protection of utilities and services, which are not designated to be removed. Repair utilities damaged during site work operations at Contractor’s expense.

I. Minimize interference with adjoining roads, streets, walks, parking areas and other adjacent occupied or used facilities during earth moving operations. Refer to Division 32 Section "Maintenance and Protection of Traffic" for traffic maintenance information.

J. Locate, protect, and maintain benchmarks, monuments, control points, and project engineering reference points. Reestablish disturbed or destroyed items at Contractor's expense.

K. The control of dust, noise, erosion, and sediment originating from construction operations is considered a critical responsibility of the Contractor. The Owner's Designated Representative will be the final judge of the adequacy of the Contractor's dust, noise, erosion, and sedimentation control. Work may be suspended by the Owner's Designated Representative until adequate dust, noise, erosion, and sedimentation control is attained.

L. Protect structures, utilities, sidewalks, pavements, buildings, and other services or facilities on site and adjacent to the site from damage caused by earth moving operations or other work in support of Contractor operations. Cost of repair and restoration of damaged items shall be at Contractor's expense.

M. The Contractor shall take precautions to protect from harm the work of other contractors on site and existing facilities. The Contractor shall be responsible for all damage or injury done to pipes, structures, utilities, pavement, buildings, property or person as a result of work performed to complete this contract. The Contractor at his own expense shall repair or replace such property or item to the satisfaction of the property owner, utility owner, public agency having jurisdiction, Architect/Engineer and Owner's Designated Representative.

N. When it is necessary to haul materials over the streets or pavements, the Contractor shall provide suitable tight vehicles so as to prevent deposits on the streets or pavements. In all cases, where any materials are dropped from the vehicles, the Contractor shall clean up the same as often as directed and keep the crosswalks, streets, pavements and drainage ways clean and free from dirt, mud, stone, and other hauled materials.

O. Contractor shall be responsible for cleaning private and public; roads, parking areas or walkways, of any material carried onto these roads or pavements by trucks or other equipment completing work in support of this project. Associated costs shall be included in price bid.

P. The following practices are prohibited within tree- and/or plant-protection zones:
   1. Storage of or stockpiling of construction materials, debris, or excavated material.
   2. Parking vehicles or equipment.
   3. Foot traffic.
   4. Erection of sheds or structures.
   5. Impoundment of water.
   6. Excavation or other digging unless otherwise indicated.
   7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
   8. Do not direct vehicle or equipment exhaust towards protection zones.
   9. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.
   10. Do not store materials potentially harmful to tree roots. Potentially harmful materials include, but are not limited to petroleum products, cement, lime, paints, detergents, acids and cleaning agents.

Q. The Owner and Architect/Engineer do not guarantee that all required excavation can be executed by use of machinery. In some cases, it may be necessary to revise proposed alignments, which may preclude the use of machinery. In this event, the Contractor shall be required to perform this work by

any method at the same price(s) bid in the Proposal, with no additional compensation due to the inability to use machinery.

R. The existing ground elevations as shown on the Drawings are believed to be reasonably correct. The Contractor shall satisfy himself, however, by actual examination of the sites of the work, as to the existing elevations and the amount of work required under this section. No claim shall be made by the Contractor for additional compensation for conditions other than that shown.

S. The Contractor shall remove any waste material or other debris that has accumulated as a result of the work of this section and dispose in conformance with applicable legal requirements and in a manner acceptable to the Owner's Designated Representative or Architect/Engineer.

T. Soil reports and boring logs: Refer to Section 020010 for project specific Geotechnical information.

1.08 TRIAL EXCAVATIONS

A. Contractor shall construct test pit excavations to determine the locations of underground utilities or structures as shown on the plans and/or as ordered by the Owner's Designated Representative or Architect/Engineer. Underground utilities and/or structures shall be located and tied off for future stake out. The test pit shall be properly backfilled and compacted. Surface restoration shall be performed as required and as ordered by the Owner's Designated Representative or Architect/Engineer.

1.09 STORAGE AND HANDLING

A. Stockpiling of earth spoil on the site shall be done in a manner which will not hinder the progress of the work; cause any nuisance; or cause spillage or tracking of materials from the transporting vehicle onto public or private roadways, parking areas, sidewalks or pavements, or cause an inconvenience to adjacent property owners or tenants, general public, other contractors, or business operations.

B. Obstruction of roads, driveways, parking areas, sidewalks, or interference with drainage along curbs, gutters, ditches, or drainage channels with stored material is not permitted.

C. Imported planting soil shall be stockpiled on-site. The stockpile shall be well-shaped and graded in order to shed water and to avoid contamination by other granular or earth materials temporarily stockpiled on-site. Provide erosion control (silt fence) around stockpiles.

1.010 SCHEDULING

A. If required to complete the work properly, the Contractor shall obtain grading releases from property owners near trenching or other grading operations at least ten (10) days before commencement of the work.

B. Do not commence site earth moving operations until temporary erosion- and sedimentation-control and tree- and plant-protection measures are in place.

C. Allow time to rework, screen and moisture condition imported soils for placement.

D. Except by permission of the Architect/Engineer, not more than 200 feet of trench shall be opened at any one time. Not more than 100 feet of trench may be opened in advance of the completed pipe laying operations; and not more than one street crossing may be obstructed by the same trench at any one time.

E. Schedule the work to allow ample time for laboratory tests and to permit the collecting of samples and the performing of field density tests during the backfilling and compaction operations.

F. All subgrades shall be approved by Architect/Engineer or Owner's Designated Representative before pipes, structures, and facilities are installed or concrete is placed. Results of the tests must be reviewed and approved by the Architect/Engineer.

G. Do not backfill against concrete elements until bearing surfaces have reached design strength or are properly braced and backfilling operations are approved.

H. Compaction shall not take place in freezing weather or when materials to be compacted are frozen, too wet or moist, or too dry.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

A. **Common Earth:** (for use under nonpaved areas located at least 5-feet outside building/structure limits only) - Sand, loam, gravel, or similar materials free from debris, frozen materials, organic materials, or other deleterious material, and containing some rock fragments, stones, and pebbles, not exceeding 4 inches in their largest dimension and meeting the following requirements:

1. Plasticity index of not more than 30 - ASTM D424.
2. Minimum laboratory dry weight at optimum moisture content of 110 pounds per cubic foot.

Provide imported Common Earth fill materials as required to complete the work. Contractor shall obtain rights and pay all cost for imported materials.

Proposed Common Earth fill (imported) material shall be inspected, tested, and laboratory report issued prior to use in the work.

B. **Select Earth:** Sand, gravel, and similar material which shall be free from silt, clay, loam, organic material, roots, debris, waste, frozen material, or other deleterious materials, and shall only contain small amounts (less than 10 percent) of stone, pebbles, or lumps over one inch in greatest dimension, but none over 2 inches in greatest dimension.

Imported select earth materials shall meet requirements of the NYSDOT Standard Specification Section 203-2.02C except that no material shall exceed 2-inches in their largest dimension.

C. **Imported Planting Soil:** Imported planting soil shall meet the requirements of Division 32, Section "Planting Soil" at no additional cost to the Owner. The material shall be stockpiled, tested and approved by Owner's Designated Representative prior to use on the project. Obtain planting soil from naturally well-drained sites where topsoil occurs at least 4-inches deep; do not obtain from bogs or marshes.

D. Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

E. Acceptance of all types of soil materials shall be based on the above requirements, and the Owner's Designated Representative or Architect/Engineer shall make final acceptance. Such acceptance or rejection of materials is binding upon the Contractor.

2.02 GRANULAR MATERIALS

A. **Cushion Sand:** The material shall meet the requirements of NYSDOT Standard Specification Section 703-06, Cushion Sand.

B. **Bedding Sand:** Sand shall consist of clean, hard, durable, uncoated particles, free from lumps of clay and all deleterious substances. When dry, the sand shall meet the following gradation requirements:

Sieve Size	Percent Passing by Weight
1/4 inch	100
No. 50	0-35
No. 100	0-10

The sand may be determined to be unacceptable if it contains loam or silt in excess of 10 percent of the total volume.

C. **Crushed Stone:** Material shall be clean, sound, crushed stone of uniform quality. It shall be a 50-50 mixture of NYSDOT primary size designation #1 and #2 stone as per NYSDOT Standard Specifications, Section 703-02, material designation 703-0201.

Sieve Size	Percent Passing by Weight
1-1/2 inch	100
1 inch	95-100
½ inch	45-57.5
¼ inch	0 – 7.5

D. **Subbase Material (Crusher Run):** Shall meet the requirements of NYSDOT Standard Specification Section 304-2, material designation 733.0404 – Subbase Course, Type 4.

E. **Engineered Fill (run-of-bank gravel):** Material consisting of hard, durable particles and shall meet the requirements of NYSDOT Standard Specification Section 304-2.02, Type 4. Maximum particle size 2-inches, less than 40% by weight passing the No. 40 sieve and less than 10% by weight passing the No. 200 Sieve.

F. **Select Granular Fill:** The material shall meet the requirements of NYSDOT Standard Specification Section 203-2.02C, for Select Granular Fill.

G. **Underdrain Filter Material:** Shall meet the requirements of NYSDOT Standard Specification Section 605-2.02, Type II Underdrain Filter Material.

H. **Pea Gravel:** Shall be screened, washed gravel meeting the gradation requirements of NYSDOT primary size designation #1A stone as per NYSDOT Standard Specifications, Section 703-02.

I. **Light and Medium Stone Fill:** The material shall meet the requirements of NYSDOT Standard Specification Section 620-2.02 for light and medium stone fill.

J. **Structural Soil:** CU Soil™ is a proprietary material patented by Cornell University. (US Patent #5,849,069). Only licensed producers are allowed to supply this material, meeting the specifications described in this text. For a list of licensed CU Soil™ producers' call AMEREQ, Inc. @ 1-800-832-8788.

K. Acceptance of all types of fill shall be based on the above requirements, and the Architect/Engineer shall make final acceptance. Such acceptance or rejection of materials is binding upon the Contractor

2.03 LOW STRENGTH MATERIALS

A. **Controlled Low Strength Material (CLSM):** Self compacting, flowable concrete material shall conform to ACI 229R with a compressive strength of 400 psi or as otherwise indicated on the plans or specifications.

B. **Controlled Density Fill (CDF):** "K-Krete" or approved equivalent with a compressive strength of 50 to 100 psi.

2.04 GEOTEXTILES

A. **Pavement Stabilization Geotextile Fabric:** The geotextile fabric for pavement stabilization shall be Mirafi 500X as manufactured by Mirafi, AMOCO 2002, Synthetic Industries 200ST or approved equal. The geotextile fabric shall be woven fabric of only continuous chain polymeric filaments or yarns of polyester. The fabric shall be inert to commonly encountered chemicals, hydrocarbons, mildew, and rot resistant. The fabric shall be UV stabilized.

Fabric Properties – Mirafi 500x	Acceptable Value	Test Method
Grab Tensile Strength, kN (lbs)	0.9 (200)	ASTM D4632
Elongation at Failure, % MD/ CD	15/ 10	ASTM D4632
Mullen Burst Strength, kPa (psi)	2756 (400)	ASTM D3786
Trapezoidal Tear Strength, kN (lbs)	0.33 (75)	ASTM D4533
Puncture Strength, kN (lbs)	0.40 (90)	ASTM D4833
Apparent Opening Size (AOS)	50	US Std. Sieve
	0.30 mm	ASTM D4751
Permittivity, sec^{-1}	0.05	ASTM D4491
Flow Rate, $l/min/m^2$ (gal/min/sf)	200 (5.0)	ASTM D4491
UV Resistance after 500 hrs, % strength	70	ASTM D4355

B. **Non-woven Filter Fabric**: The geotextile fabric for drainage shall be Mirafi 140N as manufactured by Mirafi, US Fabrics 120 NW, Skaps GT142 or approved equal. Nonwoven geotextile, specifically manufactured as a drainage geotextile; made from polyolefins, polyesters, or polyamides; and with the following minimum properties determined according to ASTM D 4759 and referenced standard test methods:

Grab Tensile Strength: 110 lbf (490 N); ASTM D 4632.
Tear Strength: 40 lbf (178 N); ASTM D 4533.
Puncture Resistance: 50 lbf (222 N); ASTM D 4833.
Water Flow Rate: 150 gpm per sq. ft. (100 L/s per sq. m); ASTM D 4491.
Apparent Opening Size: No. 50; ASTM D 4751.

2.05 ACCESSORIES

A. **Warning Tape:** Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility in bold readable lettering; colored as follows:

1. Red: Electric.
2. Yellow: Gas, oil, steam, and dangerous materials.

3. Orange: Telephone and other communications.

B. **Detectable Warning Tape:** Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility in bold readable lettering, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30-inches deep; colored as follows: (Detectable warning tape shall be a minimum of 12-inches wide for utilities where Drawings indicate tape shall be buried greater than 30-inches.)

1. Red: Electric.
2. Yellow: oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

C. **Tracer Wire*:*** Wire shall be 10 AWG stainless steel tracer wire. The wire shall be extended into tracer wire boxes with adequate excess wire to extend 3 feet above grade.

D. **Tracer Wire Boxes:** Tracer wire boxes in lawn areas shall be 4-inch shaft cathodic protection test boxes Model P445 DT Test as manufactured by Bingham & Taylor or approved equal. Provide cast iron rim and pentagon nut lid. Lid shall be blank with no lettering. Body of box shall be ABS plastic.
1. Box shall be 3-foot in length with standard base.
2. Provide each box with a terminal block containing four terminals.
3. The box shall not transmit shock or stress to the tracer wires and shall be plumb with the box cover flush with the surface of the finished grade.

2.06 COMPACTION

A. Utilize the proper compaction methods and equipment to suit the soils and conditions encountered. Mechanical, vibratory, pneumatic tampers or other method as approved by the Architect/Engineer shall be required.

B. Provide water in sufficient quantity as needed to assure compaction.

2.07 DEWATERING, DUST AND NOISE CONTROL

A. Provide all equipment and materials necessary to perform dewatering and dust control operations in a safe and satisfactory manner. Conform to the New York State Standards and Specifications for Erosion and Sediment Control, and Division 31 Section “Erosion and Sediment Control” for proper operations.

B. Standing water and/or saturated, unstable soil conditions will not be tolerated in areas to receive foundations, utilities, or asphalt or concrete pavements.

C. Provide noise suppression enclosures, if required and as determined by the Architect/Engineer. Enclosures, if required shall meet minimum requirements of 3/8-inch plywood enclosure lined with 2-inch rigid insulation.

PART 3 - EXECUTION

3.01 PREPARATION

A. Protect and maintain erosion and sedimentation controls during earth moving operations per division 312500.

B. Before placing subsequent materials remove temporary protection installed to protect subgrades and foundation soils from freezing temperatures and frost.

C. Prior to start of work, the Contractor's surveyor shall verify that all boundaries of temporary and permanent easements and property lines are clearly marked in the field so that the work will not violate these boundaries.

D. The Contractor and his surveyor shall verify the locations and character of structures, underground lines, and subsurface conditions and verify that the described work will not adversely affect them.

E. The Contractor's Surveyor shall verify that grade stakes have been properly and accurately set.

F. The Contractor shall be responsible for providing all necessary fill materials.

3.02 METHODS OF CONTROL FOR EXCAVATIONS AND GRADING

A. The Contractor shall employ at the site a licensed surveyor responsible for the proper layout of utilities, structures, and drainage. He shall maintain adequate stakeout control for inspection of the work and to accurately complete construction.

B. The alignment and depth of subgrades of all pipe trenches shall be determined by overhead grade lines or laser at Contractor's option, installed and maintained by his surveyor.

C. Rock excavation is anticipated at various locations. Removal limits shall be completed in accordance with Section below. No backfill shall begin until adequate time has been given to the Owner’s Designated Representative or Architect/Engineer for inspection and to verify the limits of removal are in accordance with the contract documents.

D. In the event that rock is encountered, the Contractor will take cross sections of the rock uncovered. No removal shall begin until adequate time has been given the Owner’s Designated Representative or Architect/Engineer for inspection and to verify the measurement of rock material.

3.03 EXPLOSIVES

A. Explosives shall not be utilized for this project.

3.04 EARTH MOVING, GENERAL

A. The work shall be performed by methods acceptable to the Owner’s Designated Representative or Architect/Engineer.

B. Excavation shall include the satisfactory removal and disposal of all materials encountered, regardless of the nature of the materials, or the manner in which they were excavated, except materials classified as rock excavation.

C. Excavate to subgrade elevations. Do not excavate rock until it has been classified and cross sectioned.

D. All pipe lines or existing structures encountered during the excavation operation and designated to remain shall be properly supported/protected to prevent damage.

E. Erosion and sedimentation control measures meeting the requirements of Division 31 Section "Erosion and Sediment Control" shall be used around all earthen material stockpiles.

F. Provide and maintain adequate temporary crossovers for pedestrian and vehicular traffic, including temporary gravel drives, steel plates, guardrails, lamps, flags; remove same when necessity for such protection ceases. All traffic maintenance shall be done in a manner satisfactory to the Owner's Designated Representative or Architect/Engineer.

G. Provide and maintain suitable temporary crossings over open trenches where necessary to maintain access for other Contractors, the Architect/Engineer or general public (if applicable).

H. The Contractor shall have available a supply of steel plates with minimum dimensions of 4 feet x 8 feet x 1 inch, or thicker, as required by jurisdictional authorities and to maintain emergency access and egress to the site. The plates shall be used to bridge open trenches crossing roadways, or driveways as directed by the Architect/Engineer. When used, they shall be secured against the possibility of shifting or dropping into the excavation. During winter months, these plates shall not be left in the roadway or driveway overnight unless specifically required by the Architect/Engineer.

I. When excavating in or adjacent to the traveled portion of highways, driveways, or parking areas take whatever measures are necessary to protect the road/drive/parking surfaces from becoming undermined.

J. Contractor shall be responsible to protect trees and associated root systems of trees indicated to remain on the proposed documents.

K. All traffic maintenance shall be done in a manner satisfactory to the Architect/Engineer and/or according to provisions outlined by the FHWA.

3.05 SOIL STABILIZATION

A. Sloped sides of excavations shall comply with local codes, ordinances, and requirements of agencies having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated. Maintain sides and slopes of excavations in safe condition until completion of backfilling and/or filling.

B. Shoring and Bracing: Provide materials for shoring and bracing, such as sheet piling, uprights, stringers, and cross braces, etc. in good serviceable condition. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Extend shoring and bracing as excavation progresses.

C. Daily inspections of excavations shall be made by an authorized competent representative of the Contractor performing the excavation work.

3.06 DRAINAGE/DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

1. Surface and ground water shall be intercepted and removed before entering excavations. All necessary measures shall be taken. Earth dikes, ditches or other devices, if required, shall be constructed to prevent such flows.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

2. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades and foundations.

3. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.

C. The Contractor shall at all times provide and maintain proper and satisfactory means and devices (i.e. ditches, temporary pipes, pumps, and/or other temporary construction) for the removal of all water entering the excavations. Water shall be removed as fast as it may collect, in such manner that shall not interfere with the execution of the work or in the proper placing of pipe, structures or other work.

D. The Contractor shall make his own determination as to required dewatering operations necessary to complete the work. Contractor shall have available at all times sufficient equipment, machinery, piping, and appurtenances for pumping water to keep excavations free from water during construction.

E. Where the presence of fine grained subsurface materials and high groundwater table may cause the upward flow of water into the excavation with a resulting quick or unstable condition, the Contractor shall install and operate a well point system to prevent the upward flow of water during construction.

F. All water removed from the trenches or excavations by pumping, bailing, siphoning, well-points, or other means shall be disposed of in such a manner so as to avoid damage to the work, work of other Contractors, surface and ground water, persons or property. Unless otherwise permitted by the Architect/Engineer, groundwater encountered within the limits of excavation shall be depressed to an elevation not less than 12 inches below the bottom thereof before pipe laying, concreting or masonry is started, and shall be so maintained until concrete and joint material have attained adequate strength.

G. The Contractor shall not discharge water from dewatering operations directly into any line or intermittent stream, channel, wetlands or surface water. The Contractor shall not discharge water from dewatering operations directly into the storm or sanitary sewer system without prior approval of the Architect/Engineer. If the quality of the trench water is not better than or equal to that of the receiving stream, the Contractor shall perform all work necessary to improve the quality of the removed water in accordance with all requirements of the agencies having jurisdiction. This work shall include, but not be limited to, filtration, settling, and screenings meeting the requirements of the New York State Standards and Specifications for Erosion and Sediment Control to reduce the amount of sediment contained in the water to allowable levels, as acceptable to the Architect/Engineer, prior to disposal.

H. All costs to ensure proper drainage, dewatering and discharge from dewatering operations shall be at the Contractor’s expense.

I. The Contractor shall be responsible for repairing, at his own expense, any ruts, gullies, sloughage, slides, and cleaning or repairing any catch basins or storm drainage lines which display signs of silt build-up during the course of construction until the contract is complete.

J. Provide adequate protection from the effects of possible uplift due to storm or groundwater where buoyancy might lift installed work or cause joint or structure failure during construction.

K. Protect the interior of installed work from the entering and accumulation of liquids, ice, and snow. Immediately remove and dispose any accumulation, which may occur.

L. Adjust, repair, replace, or clean all work, surfaces, and property, which may have been damaged as a result of any dewatering operation.

3.07 EARTH FILL

A. Unless otherwise specified, shown on the Contract Drawings, or directed by the Owner's Designated Representative or Architect/Engineer, trench and utility backfill material and earth fill located 5 feet outside pavement, building or structure limits shall be Select Earth. Earth fill to subgrade is not permitted under or within 5 feet of buildings, structures or pavements.

B. Import Select Earth fill material from off-site. The Contractor shall obtain all permits necessary to furnish off-site borrow.

3.08 SOIL CONDITIONING

A. Provide all wetting, drying, mixing and screening equipment and materials necessary to condition soils to optimum moisture for compaction and required gradation.

B. Allow time to rework, screen and moisture condition soils for placement.

C. Suitable imported materials shall include granular materials meeting NYSDOT Item 304.14 in areas under and within 5 feet of structures or buildings; granular materials meeting NYSDOT Item 304.12 in areas under and within 5 feet of pavements and utility structures; and, Select Earth in all other areas.

D. Moisture Control: Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
   1. Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade or layer of soil material. Apply water in minimum quantity as necessary to prevent free water from appearing on surface during or subsequent to compaction operations.

E. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to permit compaction to specified density.

F. Stockpile or spread soil material that has been removed because it is too wet to permit compaction. Assist drying by discing, harrowing, or pulverizing until moisture content is reduced to a satisfactory value.

3.09 MANNER OF EXECUTION

A. The excavated material shall be stored so that it will cause a minimum of inconvenience to public travel, active facility, adjacent owners or tenants and other contractors or subcontractors. Excavated material shall not be stored in the roadway, parking areas or sidewalks at any time.

B. Conduct operations in a manner which will keep the work free of standing and flowing water and dispose the water so as not to damage or create a nuisance to the work, the public, surface, groundwater, and adjacent properties.

C. The accumulation of liquids, ice and snow in excavation, trenches, areas to be graded, and adjacent areas during construction is not permitted.

D. Keep graded surfaces well drained, but avoid erosion. Do not place earth or granular fill on wet grade, in water, or over frost, ice or snow. Excavations shall be maintained free of water.

E. Pipe trenching, building foundations, and structural undercuts: Under normal conditions, the excavation shall be vertical open cut from the ground surface. Tunneling beneath trees and certain surface structures may be required.

F. Bottom of excavations shall be finish graded by hand methods to receive bedding. The stone bedding shall be placed, compacted, and trimmed by hand to ensure the grade as necessary or as detailed.

G. Trench sheeting and bracing shall be placed as required to meet local, state and federal safety regulations.

H. The Architect/Engineer reserves the right to order sheathing and bracing left in place where removal may create damage or impair integrity of the work.

The right of the Architect/Engineer to order sheathing and bracing left in place shall not be construed as creating any obligation on his part to issue such orders. His failure to exercise his right to do so shall not relieve the Contractor of any liability for damages to persons or property occurring from or upon the work of constructing the sewer, water main, or appurtenances occasioned by negligence or otherwise, growing out of a failure on the part of the Contractor to leave in place in the trench sufficient sheathing and bracing to prevent the caving or moving of the ground, or disturbance of the completed work or any of the subsurface structures.

I. As required, the Contractor may add sufficient water during compaction to assure a complete consolidation of the material. This work shall be at no additional cost to the Owner. Where, in the opinion of the Owner's Designated Representative or Architect/Engineer, adequate consolidation is not being obtained, additional density tests may be ordered at the expense of the Contractor.

J. The Contractor shall make up any settlement of trenches or embankments with suitable material and stabilize at no additional cost to the Owner. This work shall be performed promptly and as directed by the Owner's Designated Representative

3.10 GRADING

A. General: Excavate, transport, place, compact and uniformly grade areas within the project limit (including excavated and filled sections and adjacent transition areas) to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
3. The degree of finish shall be that is ordinarily obtainable from either a blade, grader or scraper operations.
4. Subgrade surfaces shall drain, be compacted, and well graded.

B. Temporary Ditches, Swales: Install temporary or permanent diversion ditches and/or temporary pumps and take other steps as may be required to effectively eliminate potential water damage in accordance with the Division 31 Section "Erosion and Sediment Control" or instructions received from the Architect/Engineer.

C. The Contractor shall be responsible to subtract from finished grades shown on the plans the depths indicated on the Contract Drawings to ensure that the proper subgrade elevations are

established. Any questions regarding subgrade elevations shall be answered by the Architect/Engineer. The Architect/Engineer's decision shall mandate.

D. Site Rough Grading:

1. Unauthorized Excavation: Do not perform excavation work for any purposes other than those indicated on the Contract Drawings, unless so directed by the Architect/Engineer.
2. Slope grades to direct water away from buildings and to prevent ponding.
3. Finish subgrades to required elevations within the following tolerances:
   a. Turf, Planted Areas or Unpaved Areas: Plus or minus 1 inch.
   b. Walks: Plus or minus 1/2 inch.
   c. Pavements and slabs: Plus or minus 1/2 inch.

E. Grading under and within 10 feet of Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

F. Slopes: All swales shall be finished to drain readily. Unless otherwise indicated on the Contract Drawings, the surface of the subgrade in areas to receive lawns shall have a minimum slope of 2% unless otherwise agreed upon by the Architect/Engineer. All areas shall have positive drainage.

Round tops and bottoms of all slopes and drainage swales. Adjust slopes at intersections of cuts and fills and warp to flow into each other or into the natural ground surface without noticeable break. Establish earth at tops and bottoms of rock ledges in accordance with instructions received from the Architect/Engineers and in a manner that will prevent erosion.

G. Following stripping, the subgrade shall be compacted sufficiently to develop required compaction to a depth of at least 12 inches. Within building, pavement and retaining wall limits, no fill shall be placed until the subgrade has been proofrolled and approved by the Architect/Engineer. If subgrade ruts, waves or quakes during proofrolling, recompact or replace the unacceptable areas and proofroll again. Repeat process until satisfactory results are obtained as approved by the Architect/Engineer.

H. The Contractor shall dispose of excess excavated material in accordance with Part 3-Disposal.

3.11 EXCAVATIONS BELOW SUBGRADE

A. In case earth materials encountered at subgrades are unsuitable, the Contractor shall immediately notify the Architect/Engineer and shall excavate from the limiting subgrades shown or specified, to such new lines and grades, as will be ordered. Excavation below subgrade shall be done only upon express orders of the Owner’s Designated Representative or Architect/Engineer.

B. At subgrade in pavement areas any loose, soft, wet, frozen, organic, or otherwise unsuitable material shall be removed.

C. Whenever excavations are carried beyond or below the lines and grade shown on the Plans, or as given or directed by the Owner’s Designated Representative or Architect/Engineer, all such over-excavation shall be backfilled with special backfill such as: engineered fill; concrete or other materials as directed by the Owner’s Designated Representative or Architect/Engineer.

1. Fill over-excavations under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Whether over-excavation was directed by the Owner’s Designated Representative or Architect/Engineer or unauthorized, backfill shall be 2,500 psi concrete.
2. Fill authorized or unauthorized over-excavations below other construction, pipe, or conduit as directed by Owner’s Designated Representative.
3. In pavement areas fill over-excavations with Engineered Fill.

D. Special backfill materials ordered by the Architect/Engineer as a result of unauthorized over-excavation by the Contractor without prior approval shall be provided by the Contractor at no additional cost to the Owner.

E. Payment for authorized over-excavation and subsequent backfill materials shall be on a unit price basis agreed between the Owner and the Contractor prior to the required work.

F. All material which slides, fails, or caves into the established limits of excavations due to any cause whatsoever, shall be removed and disposed of at the Contractor's own expense and no extra compensation shall be paid the Contractor for any materials ordered for backfilling the void areas left by the slide, fall, or cave-in. It is the Contractor's responsibility to make all excavations safe for ongoing construction.

3.12 UNSTABLE SOILS REMOVAL METHODS

A. Methods of Removal: Prior to the start of excavation operations, divert water away from work area and create dry conditions. Through the use of dragline, clamshell, or other necessary equipment, excavate and legally dispose of all unacceptable material.

B. Precautionary Measures: Divert the run-off of mud and water during the course of removal of wet and unstable material to avoid adversely effecting adjacent construction or site improvement operations. Barricade, rope off, or otherwise protect workmen, active facility, and the public from open excavations, waterholes, and other hazards resulting from the work of this operation.

C. Damage: The Contractor shall correct any damage to structures, foundations, site improvement work or adjacent property resulting from the work of this operation.

D. Degree of Removal Required: Remove all unstable material to the point of sound stable earth or as directed by the Architect/Engineer.

3.13 ROCK EXCAVATION

A. Degree of Removal required: Rock, if encountered shall be removed to minimum depths as follows:

1. In Building Areas

   a. 2-foot outside of concrete work for which forms are required, except footings.

   b. 1-foot outside perimeter or concrete forms of footings.

   c. Outside dimensions of concrete work where no forms or exterior waterproofing treatments are required.

   d. Under slabs on grade: to subgrade or 8-inches below bottom of concrete slab whichever is greater.

2. Under Areas to Receive Pavement - To the surface of the respective subgrade for such areas. Boulders or isolated pockets of rock shall be removed to 12-inches below the pavement subgrade and the resultant excavation backfilled with pavement subbase-course material.

3. Under Lawn and Planted Areas - To 24-inches below finished grade. Boulders or protruding rock outcropping where in the manner determined by the Architect/Engineer may be left undisturbed, provided a directive to this effect is transmitted to the Contractor.

4. In pipe trenches for pipes 18-inch diameter and smaller: 6-inches below bottom of pipe and 2-feet wider than outside diameter of pipe, one (1) foot each side of pipe, but not less than 3-foot minimum trench width.

5. In pipe trenches for pipes larger than 18-inch diameter refer to Contract Drawing details for

additional rock removal requirements.

6. For underground utility structures (e.g. manholes, power/communication vaults etc). 6-inches below bottom of structure and one (1) foot each side of structure.

7. In all other cases to 6-inches below subgrade.

B. No blasting is allowed.

C. No separate or additional payment will be made for rock excavation. All work shall be included in the price bid for the project.

3.14 EXCAVATION FOR STRUCTURES

A. Excavations for structures and facilities shall be of sufficient size to give suitable room for proper construction procedures and no larger, or as shown on the Contract Drawings.

B. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. Extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections. Provide clearance sufficient for formwork. Banks and sides shall be at angle of repose of recline or sheathed, sheeted, shored and braced as required for safety, and conforming to all applicable laws, rules, regulations and codes. Remove shoring prior to backfilling.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades and remove loose materials and debris from excavation so that all footings rest on solid rock or approved undisturbed bearing soil, to leave solid base to receive other work.
2. If unsuitable bearing soil is encountered at depth indicated on Contract Drawings for foundation, the Contractor shall notify the Architect/Engineer and shall not proceed further until direction is given.
3. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.

C. Excavations at Edges of Tree- and Plant-Protection Zones:

1. Excavate by hand to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Cut and protect roots according to requirements in Division 31 Section “Site Clearing”, Part 3 -Tree and Plant Protection.

D. Ensure that movement of equipment in excavation does not cause working or pumping of underlying soil, which is not to be excavated. Should equipment cause the soil to work or pump, use other methods of excavation to maintain the design bearing capacity of the soil.

3.15 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.16 EXCAVATION FOR UTILITY TRENCHES

A. General

1. Trenches shall be excavated as shown on the Contract Drawings.
2. Before any trenching operation starts, the line of work shall be cleared and all existing underground pipe lines and structures located. Test pits shall be opened where necessary to properly establish the location.
3. When trenches crossing other pipe lines occur, machine excavation shall stop at least 2 feet away from the location of any pipe. The pipe line shall than be uncovered by manual excavation before proceeding with machine work.
4. Trenches shall be kept free of water by pumping or providing well points.
5. Trench sheeting and bracing shall be placed as required to meet local, state and federal safety regulations.
6. All pipe lines encountered during the trenching operation shall be properly supported to prevent damage.

B. Excavate trenches to indicated gradients, lines, depths, and elevations.

C. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated.

1. Clearance: 12 inches minimum each side of pipe or conduit or as indicated on the various utility trenching and bedding details on the Contract Drawings.

D. **Trench Bottoms**: (Where bedding course is required [e.g. facility water main, storm and sanitary sewers; and, pipes or conduits constructed under footings or foundations])

1. For pipes and conduits 18-inches or smaller in nominal diameter, excavate trenches minimum of 6-inches deeper, than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.
2. For pipes 21- to 36-inches in nominal diameter excavate trenches minimum of 9-inches deeper, than bottom of pipe and conduit elevations to allow for bedding course.
3. Excavate trenches in rock or other unyielding bearing material to depths indicated above depending on pipe or conduit size to allow for bedding course. Refer to Part 3 – Rock Excavation.

E. **Trenches in Tree- and Plant-Protection Zones**:

1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.
3. Cut and protect roots according to requirements in Division 31 Section “Site Clearing”, Part 3-Tree and Plant Protection.

3.17 SUBGRADE INSPECTION

A. Notify Owner’s Designated Representative when excavations have reached required subgrade.

B. Proof-roll subgrade below the building slabs and pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 10 tons to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Proof-rolling shall be witnessed by the Architect/Engineer or his designated representative.
2. Completely proof-roll subgrade in one direction. Limit vehicle speed to 3 mph.
3. Excavate any loose, wet, frozen, or soft spots; unsatisfactory soils; and areas of excessive pumping or rutting, as determined by Architect/Engineer and replace with compacted backfill or fill as directed. Refer to Part 3- Excavations Below Subgrade.
4. If subgrade ruts, waves or quakes during proof rolling, recompact or replace unacceptable area and proof roll again.
5. Repeat process until suitable results are obtained as approved by the Architect/Engineer or his designated representative

C. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect/Engineer and/or Owner's Designated Representative, without additional compensation.

3.18 BACKFILL

A. All excavations shall be backfilled to the original surface of the ground or to the lines and grades as shown on the Contract Drawings or as otherwise specified, or directed. Backfilling shall be done with suitable excavated materials as shown on the Contract Drawings or approved by the Architect/Engineer, and satisfactorily compacted.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

C. Place and compact backfill in excavations promptly, as work permits but not before completing the following:

1. Acceptance of construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
2. Inspection, testing, approval, and recording of locations and inverts for underground utilities has been performed and documented.
3. Removal of concrete formwork.
4. Removal of temporary shoring and bracing, and sheeting and backfilling of voids with satisfactory materials.
5. Removal of trash and debris from excavation.
6. Permanent or temporary horizontal bracing is in place on horizontally supported walls.

D. Excavated material considered by the Owner's Designated Representative or Architect/Engineer to be unsuitable for backfilling shall not be used, and shall be disposed in accordance with Part 3- Disposal of Excess and Waste Materials.

3.19 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Trenches under Footings: Backfill and compact trenches excavated under footings and within 18-inches of bottom of footings with 1000 psi CLSM to elevation of bottom of footings plus 3 inches.

1. Backfill trenches with 1000 psi CLSM where trench excavations pass horizontally within 18-inches of column or wall footings and that are carried below bottom of such footings or that pass under wall footings. Place CLSM to level of bottom of adjacent footing plus 3 inches.

D. Backfill voids with satisfactory soil while removing shoring and bracing.

E. Place and compact initial backfill as shown on details.

1. For soil and granular initial backfill: Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

2. For Controlled Low-Strength Material: Where CLSM indicated, place initial backfill of controlled low-strength material to a height of 12 inches over the pipe or conduit. Coordinate backfilling with utilities testing.

F. Place and compact final backfill to final subgrade elevation.

G. Install warning tape/detectable warning tape at elevations as shown on the Contract Drawings. Where not shown on the Contract Drawings install warning tape, centered and 12 inches above utility.

H. All pipes shall be protected from lateral displacement and possible damage resulting from backfill operations through, impact or unbalanced loading, by maintaining the pipe adequately embedded as detailed on the Plans. Except where detailed or due to subsoil conditions that require the use of concrete cradle encasement, all pipe embedment shall be placed so as to insure adequate lateral and vertical stability of the installed pipe during pipe jointing and backfill operations. A sufficient amount of the specified pipe backfill material to hold the pipe in rigid alignment shall be uniformly deposited and thoroughly compacted below, on each side, as well as above each pipe laid in accordance with the limits as shown on the Contract Drawings.

I. Pipe initial backfill shall be granular material or as indicated on the Contract Drawings. Pipe initial backfill materials placed any point below an elevation of 12 inches above the top of the pipe barrel shall be placed and compacted in layers not to exceed 12 inch lifts and shall be done simultaneously and uniformly on both sides of the pipe to the limits as shown on the Contract Drawings. All such materials shall be graded in the trench with hand tools in such a manner that they will be placed uniformly alongside the pipe. Each layer shall be thoroughly compacted to prevent settlement.

J. Trench final backfill when placed under pavements, utilities, buildings and other structures shall be Engineered Fill, Subbase Material or as indicated on the Contract Drawings and shall extend from the top of pipe initial backfill material to the bottom of the subbase. These materials shall be compacted in layers not to exceed 8 inch lifts. Each layer shall be thoroughly compacted to prevent settlement. In confined areas such as overexcavated areas, the fill should be placed in horizontal lifts not to exceed 6 inches loose thickness and compacted using a manually operated compactor.

K. Trench final backfill outside of pavements, utilities, buildings, and other structures shall consist of common earth backfill or as otherwise shown on the Contract Drawings and shall extend from the top of pipe initial backfill material to the bottom of the topsoil. These backfill materials shall be

compacted in layers not to exceed 10-inch lifts after compaction. Each layer shall be thoroughly compacted to prevent settlement.

L. Where trenches are constructed in, near, or across roadway ditches or other watercourses, the backfill shall be protected from surface erosion.

M. Trucks or other heavy equipment shall not be operated over pipelines until a minimum of 24 inches of backfill above the crown of the pipe has been placed and properly compacted.

N. Where pedestrian, bicycle or vehicle traffic is impacted; all trenches within paved areas shall be immediately restored to existing grade with temporary subbase material and/or pavement to allow traffic flow to continue until final restoration is complete.

O. Trench backfill for waterway crossings, if any, shall include 18 inches of medium stone fill rock lining meeting the requirements of this Section.

P. Do not backfill trenches until tests and inspections have been made and backfilling is authorized by the Architect/Engineer. Use care in backfilling to avoid damage or displacement of pipe systems.

3.20 BACKFILLING OR PLACING FILL AROUND STRUCTURES

A. Location of Fill Types: (Where not otherwise shown on the Contract Drawings)

Type 1 (Select Earth Fill) - In all areas outside of building area to within 6" of finished grade, except at asphalt, concrete or brick pavements; curbing; concrete slabs; or graveled areas; where it is to be brought to an elevation appropriate to allow all subbase, asphalt, concrete or brick materials to be placed to grade as shown on the Contract Drawings.

Type 2 (Engineered Fill) - In all fill areas within the building up to the subgrade limits.

Type 3 (Subbase NYSDOT 304-2, Type 2) – Subbase under slabs. Depth as indicated on the Contract Drawings.

B. Backfilling around structures shall not be commenced until directed by the Owner’s Designated Representative.

C. Prior to backfilling, a minimum of seven (7) days cure time shall elapse from the placing of cast-in-place concrete. The Contractor shall comply with any special requirements noted on the Contract Drawings. In no case shall backfill materials be allowed to fall directly on a structure or to damage the structure or its protective coatings.

D. Backfill around structures shall be deposited in horizontal layers not more than 6- to 8-inches in thickness and shall be compacted by tamping to prevent settlement. Backfill shall be no more than 4 inches thick when hand-operated equipment is used. Backfill shall be brought up evenly on all sides of structures so as not to subject the structure to unequal loadings. Do not backfill against unsupported walls or structures.

E. Evenly distribute stones in fill, none over 3-inch diameter within top 12-inches of subgrade. Remove rocks and compact each layer of fill before applying next layer. Slope to prevent ponding of water and to provide positive drainage away from building(s) and roadways. Dewater as required to prevent water from setting in excavated and graded areas. No backfilling will be allowed in areas full of water.

F. At all times the Contractor shall maintain and operate proper and adequate surface and subsurface drainage methods to the satisfaction of the Owner’s Designated Representative in order to keep the construction site dry and in such condition that placement and compaction of fill

may proceed unhindered by saturation of the area. During construction, the surface of the fill area shall be left in such condition that precipitation and/or surface water will run off.

G. Place underslab base material (Type 3 Fill as noted above) after all underslab mechanical lines, electrical conduits, etc. have been installed. Protect lines, etc. as required.

H. When a compacted course is indicated to be 6" thick or less, place material in a single layer. When indicated to be more than 6" thick, place material in equal layers, except no single layer more than 6" or less than 3" in thickness when compacted

3.21 EMBANKMENT CONSTRUCTION (if required)

A. Prior to the placement of materials in fill sections, remove all debris and other deleterious material and stabilize all existing surfaces.

B. Ground surfaces sloped steeper than 1 vertical on 4 horizontal shall be plowed, scarified, stepped, or broken up to permit bonding of the embankment with the existing surface.

C. Prior to placement of fill, the embankment foundation shall be thoroughly inspected by the Architect/Engineer. The embankment foundation shall be proof rolled by a roller or loaded ten wheeler (not less than 10-tons) to the satisfaction of the Architect/Engineer. Proofrolling shall be witnessed by the Architect/Engineer or his designated representative. Any loose, soft, wet, frozen, organic, or otherwise unsuitable material shall be removed and replaced with Engineered Fill. If embankment foundation ruts, waves or quakes during proof rolling, recompact or replace unacceptable area and proof roll again. Repeat process until suitable results are obtained as approved by the Architect/Engineer or his designated representative.

D. Uniformly place and spread fill in successive horizontal layers not more than 8-inches in compacted depth for material compacted by heavy compaction equipment, and not more than 4-inches in loose depth for materials compacted by hand operated tampers. Complete compaction to proper density and complete compaction testing prior to placing additional backfill material.

E. The embankment shall be constructed with suitable imported material. The Architect/Engineer shall be the sole judge of what constitutes suitable and unsuitable material.

3.22 SUBSURFACE DRAINAGE

A. Subdrainage Pipe: Specified in Division 33 Section "Subdrainage."

B. Subsurface Drain: Place subsurface drainage geotextile around perimeter of subdrainage trench. Place a 6-inch course of filter material on subsurface drainage geotextile to support subdrainage pipe. Encase subdrainage pipe in a minimum of 12 inches of filter material, placed in compacted layers 6 inches thick, and wrap in subsurface drainage geotextile, overlapping sides and ends at least 6 inches.

1. Compact each filter material layer to 85 percent of maximum density with a minimum of two passes of a plate-type vibratory compactor.

C. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches of final subgrade, in compacted layers 6 inches thick. Overlay drainage backfill with one layer of subsurface drainage geotextile, overlapping sides and ends at least 6 inches.

1. Compact each filter material layer to 85 percent of maximum density with a minimum of two passes of a plate-type vibratory compactor.

2. Place and compact impervious fill over drainage backfill in 6-inch thick compacted layers to final subgrade.

3.23 PREPARATION OF PAVEMENT SUBGRADES

A. Shape the entire subgrade to the required line, grade, and cross slope. Remove any protruding stones larger in diameter than 5 inches and fill the resulting depressions with Subbase Material.

B. Proof-roll the subgrade in accordance with Part 3 Subgrade Inspection. Proofrolling shall be witnessed by the Architect/Engineer or his designated representative. Any loose, soft, wet, frozen, organic, or otherwise unsuitable material shall be removed and replaced with Engineered Fill. If subgrade surface ruts, waves or quakes during proof rolling, recompact or replace unacceptable area and proof roll again. Repeat process until suitable results are obtained as approved by the Architect/Engineer or his designated representative.

C. Roll the subgrade surface with a roller weighing not less than 10 tons and achieve the required compaction densities. If during construction, the Contractor allows the subgrade to become wet and rutted, Contractor shall re-shape, aerate, and recompact subgrade, as required. Compact the entire width of the area to receive pavement and shoulders. Where subgrade failures occur due to rolling, thoroughly roll and compact these areas until no further consolidation is apparent.

D. When pavements cannot be placed immediately after the preparation of the subgrade, the entire, subgrade area shall be restricted to construction traffic until subbase materials can be placed.

E. After rolling, the finished subgrade shall not vary from the established grade and cross slope by more than the tolerance indicated in Part 3-Grading.

F. Do not disturb the finished subgrade by traffic or other operations and protect and maintain in a satisfactory condition until the overlaying granular materials are placed.

G. Any deteriorated subgrade areas that occur during construction are to be removed and repaired by Contractor prior to placement of subbase at no additional cost to Owner.

3.24 STABILIZATION FABRIC

A. The stabilization fabric shall be placed over subgrade only after the subgrade has been reviewed and limits for fabric established by the Architect/Engineer.

B. The fabric shall be unrolled over the designated subgrade area with a 24-inch overlap at fabric ends and allowing 18-inch overlap on sides. Prior to placement of subbase materials the fabric shall be pulled tight leaving no waves in the fabric.

C. Subbase materials shall be placed on the fabric in such a manner that equipment does not come in contact with the fabric, the fabric remains in tension and no damage to the filter cloth from equipment or subbase materials occurs. All fabric placed shall be covered with fill the same day.

D. Fabric, which becomes damaged prior to covering, shall be removed over its full width and replaced with new fabric, overlapping as stated above.

E. Maintain a minimum of 8 inches loose thickness of aggregate above stabilization fabric subject to traffic.

3.25 SUBBASE COURSES UNDER PAVEMENTS AND WALKS

A. The Contractor shall notify the Architect/Engineer at least three days before any subbase material is scheduled to be placed.

B. Place subbase course on subgrades free of mud, frost, snow, or ice.

C. Subbase shall be placed to the thickness and limits as shown on the Contract Drawings.

D. On prepared subgrade, place subbase course under pavements and walks as follows:

1. Install separation or stabilization geotextile (where required) on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
2. Shape subbase course to required crown elevations and cross-slope grades.
3. Place subbase course 6 inches or less in compacted thickness in a single layer.
4. Place subbase course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
5. Each course shall be compacted with a vibratory compactor capable of producing a minimum dynamic vibration force of 27,000 pounds.
6. Compact subbase course at optimum moisture content to required grades, lines, cross sections, and thickness. Meet compaction requirements in accordance with this specification.

E. Compaction for driveways or roadways shall proceed in the longitudinal direction to traffic flow and be performed in accordance with NYSS Section 304. Compaction for parking areas shall commence on one side of an area and gradually proceed to the opposite side. When rolling has been completed in one direction, the rolling shall commence in a direction 90 degrees from the first rolling. Bus loops, if any shall be considered as a driveway and shall only be rolled longitudinally.

F. After completion of rolling, no traffic shall be permitted over the compacted course and no hauling other than necessary for bringing material for next course will be allowed. Each compacted course shall be tested with a straight edge 16 feet in length and any depressions greater than 1/4 inch in depth shall be re-graded until the depressions are corrected. The finished surface shall be smooth compact and dry.

G. All voids in the top subbase course shall be removed by re-grading and compacting to the satisfaction of the Architect/Engineer.

H. Thickness tests and compaction tests shall be conducted on the subbase courses. The Contractor shall hand dig holes, not less than 3" in diameter through the subbase, at locations designated by the Architect/Engineer. The Architect/Engineer shall measure the thickness and if any deficiencies are found, they shall be corrected. These tests may be conducted on an average of one test every 200 feet.

3.26 COMPACTION OF SOIL (EARTH & GRANULAR) BACKFILLS AND FILLS

A. Performance:

1. Compaction densities shown are percentages of the maximum density obtainable at optimum moisture content as determined by ASTM D1557, Method C.

2. Uniformly spread each layer. Moisten or dry each layer of material to achieve optimum moisture content. Unless otherwise specified or directed by Architect/Engineer, compact each layer of material to the following required densities:

Location	Percentage of Modified Proctor Test Density
Under concrete slab, foundations, and footings	95%*

Backfill at Structures	95%
Undercut Backfill	95%
General Fill adjacent to and outside of Buildings	93%
Structural Engineered Fill at Bldgs	95%
Embankments	95%
Pavement Areas (asphalt and concrete and brick)	95%
Impervious Barriers	95%
Trench Backfill Under Traffic Areas (Including side-walks) Non-Traffic areas	 95% 92%
Other Landscaped Areas	92%
*100% for granular material if specified	

B. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 6 inches in loose depth for material compacted by hand-operated tampers.

C. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

3.27 FIELD QUALITY CONTROL AND TESTING

A. Contractor shall provide free access to Work and shall provide assistance and cooperation with appointed testing firm during testing. Coordinate operations to allow ample time for the required sampling and testing.

B. Soil density and optimum moisture content tests for each source of imported material shall be conducted by the Contractor's independent, Architect/Engineer approved laboratory and shall be re-tested upon each significant change of material. Costs shall be included in the price bid.

C. Samples from each source of material shall be made available to the Architect/Engineer for approval and testing purposes one week prior to its use.

D. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

E. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to sample materials, perform tests, and submit test reports during soils and granular material placement. Field density and moisture testing shall conform to the requirements of ASTM D1556 (sand core) or D2922 and ASTM D3017 (nuclear density). Soils shall be described in accordance with ASTM D2488, Visual-Manual Procedure.

F. The following tests **may** be performed:

1. Perform a laboratory maximum density test for each type of Contractor imported soil or granular material proposed for use to verify Contractor submitted information. Determine optimum moisture content in accordance with ASTM D1557, Method C.

G. Architect/Engineer will designate the time, date, and exact location of all field compaction density tests. Field density tests may be ordered by the Architect/Engineer at his discretion and at a minimum in accordance with the following average frequencies per lift:

1. General: One test for each type of fill and at each change in material or supplier.
2. Backfill for Foundations, Retaining Walls and Utility Trenches: At least one test for each layer of compacted fill and base material at intervals of approximately 50 feet along structure walls (foundation or retaining) and utility trench backfill on alternating lifts.
3. Embankments, Pavement Areas (asphalt, concrete, brick): At least one test on each 2,000 sq. ft. or less of mass fill placed under roadways, pavements (asphalt, stone or concrete) and sidewalks but not less than three tests for each partial lift.
4. Under Structures, Foundations, Slabs, Retaining Walls and Footings: At least one test on each 2,000 sq. ft. or less of mass fill placed under structures, foundations, floor slabs, retaining walls and footings with at least three tests for each partial lift.
5. Under Building Pads: Perform at least one test of subgrade for every 2,000 sq. ft. of building pad, but in no case fewer than three tests of subgrade. In addition, for each layer of compacted fill or backfill, if any, perform one field test for every 1,000 sq. ft. of overlaying building slab, but in no case fewer than three tests per lift. Compaction tests for areas under building slabs shall be completed not more than 24-hours prior to placement of concrete.
6. Landscaped Areas: One test per 300 cubic yards of compacted fill or backfill but not less than two per lift.

H. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

I. Compacted soils not meeting compaction densities shall be re-excavated, re-compacted, and re-tested until all requirements are met. All costs of re-testing shall be borne by the Contractor.

J. Materials not meeting gradation requirements shall be removed from the project site and replaced with appropriate materials. All costs of re-testing shall be borne by the Contractor.

3.28 DISPOSAL OF EXCESS AND WASTE MATERIALS

A. Remove waste materials, including unacceptable/unsuitable excavated material, trash, and debris, and legally dispose off-site.

B. Remove excess excavated material and other materials not specified to be stored, or reused. Dispose off-site at a disposal site approved for the materials.

C. Burning or burial of excess or waste materials at the site is not permitted. Such materials shall be disposed of off-site in conformance with applicable local, state and federal legal requirements.

D. Excess excavated materials may temporarily be stockpiled on-site at a location approved by the Owner's Designated Representative.

E. All costs related to stockpiling, rehandling, transporting, removing and disposal of excess (including suitable and unsuitable) and waste materials shall be paid by the Contractor. Costs shall be included in the price bid.

3.29 MAINTENANCE AND PROTECTION OF WORK

A. Protecting Graded Areas: Protect newly graded areas from traffic and erosion. Keep free of trash and debris. Protect subgrades and foundation soils from freezing temperatures and frosts when atmospheric temperature is lower than 35 degrees F.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Owner's Designated Representative; reshape and recompact.

C. Settling: Where settling is measurable or observable at excavated areas during construction, remove finished surface (pavement, lawn, or other finish areas), add backfill material, compact, and replace/reconstruct surface treatment.

1. Restore appearance, quality, and condition of finished surface to match adjacent work, and eliminate evidence of restoration to greatest extent possible, at the Contractor's expense.

D. Any backfill or fill materials that settle and/or erode during the general project warranty period shall be repaired by the Contractor upon receipt of written notice from the Owner's Designated Representative, at no expense to the Owner.

1. Remove finished surface (pavement, lawn, or other finish areas), add backfill material, compact, and replace/reconstruct surface treatment.
2. Restore appearance, quality, and condition of finished surface to match adjacent work, and eliminate evidence of restoration to greatest extent possible, at the Contractor's expense.

E. Replace or repair any pipe, structure, or other work, which has been displaced or damaged during construction and general project warranty period at no expense to Owner.

F. Repair to proper grade any settlement of slab, pavement, utility structure, lawn, etc. adversely affected by settlement within general project warranty period at no expense to Owner.

PART 4 – METHOD OF MEASUREMENT (None)

PART 5 – BASIS OF PAYMENT

A. Cost of work for this section shall be included in the price bid for related items. No separate payment.

END OF SECTION

SECTION 312300

SITE EXCAVATING, BACKFILLING, AND COMPACTING

PART 1 GENERAL

1.00 GENERAL PROVISIONS

A. Attention is directed to the PROCUREMENT AND CONTRACTING REQUIREMENTS and all Sections within DIVISION 01, GENERAL REQUIREMENTS, which are made a part of this Section of the Specifications.

1.01 WORK INCLUDED

A. Provide all equipment and materials, and do all work necessary for site excavating, backfilling, and compacting, as indicated on the Drawings and as specified.

B. The work of this section shall include, but is not necessarily limited to the following:

1. Site excavation, filling, and grading.
2. Excavation and backfill for site structures and utilities.
3. Preparation of subgrade for slabs, pavements, and landscaping.
4. Sheeting, bracing, and support of excavations as necessary.
5. Drainage and dewatering as necessary to perform work in the dry.
6. Placement and compaction of fills.

1.02 RELATED WORK

A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:

1. Section 033001, CAST-IN-PLACE CONCRETE – SITEWORK.
2. Section 329115, STRUCTURAL SOIL.
3. Section 329300, PLANTS, Furnishing and installing plants.
4. Section 329313, PLANTING SOILS.
5. Aggregate base courses beneath paving is included under the applicable paving specification section.

1.03 REFERENCES

A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.

1. American Society for Testing and Materials (ASTM):

D 422	Particle - Size Analysis of Soils

D 1556	Density of Soil In Place by the Sand-Cone Method
D 1557	Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3))
D 2487	Classification of Soils for Engineering Purposes
D 3017	Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
D 4318	Liquid Limit, Plastic Limit, and Plasticity Index of Soils

2. Associated General Contractors of America, Inc.(AGC):

Manual	Manual of Accident Prevention in Construction

3. New York State Department of Transportation (NYSDOT):

Specifications	Standard Specifications-Construction and Materials

1.04 EXISTING CONDITIONS

A. The Contractor shall become thoroughly familiar with the site, consult records and drawings of adjacent structures and of existing utilities and their connections, and note all conditions which may influence the work of this Section.

B. By submitting a bid, the Contractor affirms that he has carefully examined the site and all conditions affecting work under this Section including work which has been let for construction under previous bid packages. No claim for additional costs will be allowed because of lack of full knowledge of existing conditions.

C. The Contractor may, at his own expense, conduct additional subsurface testing as required for his own information.

1.05 INFORMATION NOT GUARANTEED

A. Information on the Drawings and in the Specifications relating to subsurface conditions, natural phenomena, and existing utilities and structures is from the best sources presently available. Such information is furnished only for the information and convenience of the Contractor, and the accuracy or completeness of this information is not guaranteed.

B. Plans, surveys, measurements, and dimensions under which the work is to be performed are believed to be correct, but the Contractor shall have examined them for himself during the bidding period, as no additional compensation will be made for errors and inaccuracies that may be found therein.

C. A geotechnical report, entitled Utility Installation Recommendation Report, Ithaca Commons Rehabilitation, Ithaca, New York, dated 07/31/12 has been prepared by CME Associates, Inc. for use by the Architect in the design of the Project. This report is included as Apppendix A at the end of this Project Manual.

1.06 QUALITY CONTROL

A. The Owner reserves the right to retain a Geotechnical Consultant, at the Owner's expense, to perform on-site observation and testing in accordance with Section 014000, QUALITY REQUIREMENTS.

B. Contractor shall select and pay for an independent testing agency to perform on-site observation and testing during the following phases of the construction operations. The services of the Geotechnical Consultant and/or Soils Engineer shall include, but not be limited to the following:

1. Observation during placement and compaction of fills.
2. Laboratory testing and analysis of fill and bedding materials specified, as required.
3. Observe construction and perform water content, gradation, and compaction tests at a frequency and at locations determined by the Geotechnical Consultant. The results of these tests will be submitted to the Architect, copy to the Contractor, on a timely basis so that the Contractor can take such action as is required to remedy indicated deficiencies. During the course of construction, the Geotechnical Consultant will advise the Architect in writing with copy to Contractor if, at any time, in his opinion, the work is not in substantial conformity with the Contract Documents.
4. Observation of fills following interruptions by rains or other inclement weather.

C. Contractor shall perform field density tests in accordance with ASTM D 1556 or D 3017.

1. Make at least one field density test of the subgrade for every 2000 sq. ft. of paved area, but in no case less than three tests.
2. In each compacted fill layer, make one field density test for every 2000 sq. ft. of overlaying paved areas, but in no case less than three tests.

D. The Geotechnical Consultant's presence does not include supervision or direction of the actual work by the Contractor, his employees, or agents. Neither the presence of the Geotechnical Consultant, nor any observations and testing performed by him shall excuse the Contractor from defects discovered in his work.

E. The Owner reserves the right to modify or waive Geotechnical Consultant services.

F. Testing of soils shall be in accordance with the following:

Property	ASTM Test Method
Particle-Size Analysis	D 422
Liquid Limit	D 4318
Plasticity Index	D 4318

1. Off-site materials: One soil test shall be performed for every 2000 cy of material imported, or more frequent if the material varies from previous samples.

1.07 SUBMITTALS

A. Source of any off-site material shall be identified and the results of material tests shall be submiited for Architect review and apprroval prior to delivering any material on-site.

B. A 10 lb. sample of each off-site material proposed for use, and of any on-site material when so requested by the Architect or Geotechnical Consultant, shall be submitted for approval.

1. Samples shall be delivered to office of the Architect or Geotechnical Consultant, as directed.
2. Samples required in connection with compaction tests will be taken and transported by the Geotechnical Consultant.

C. Proposed methods and materials to be employed for dewatering shall be submitted for approval.

1.08 PROTECTION OF EXISTING STRUCTURES AND UTILITIES

A. The work shall be executed in such manner as to prevent any damage to adjacent property and any other property and existing improvements such as, but not limited to: streets, curbs, paving, utility lines and structures, monuments, bench marks and other public and private property. Protect existing structures and foundations from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. In case of any damage or injury caused in the performance of the work, the Contractor shall, at his own expense, make good such damage or injury to the satisfaction of, and without cost to the Owner. Existing roads, sidewalks, and curbs damaged during the project work shall be repaired or replaced to their original condition at the completion of operations. The Contractor shall replace, at his own cost, existing bench marks, monuments, and other reference points which are disturbed or destroyed.

C. Buried structures, utility lines, etc., including those which project less than 18 in. above grade, which are subject to damage from construction equipment shall be clearly marked to indicate the hazard. Markers shall indicate limits of danger areas, by means which will be clearly visible to operators of trucks and other construction equipment, and shall be maintained at all times until completion of Project.

1.09 DRAINAGE AND DEWATERING

A. The Contractor shall provide, at his own expense, adequate pumping and drainage facilities to keep excavated areas sufficiently dry from groundwater and/or surface runoff so as not to adversely affect construction procedures or cause excessive disturbance of underlying natural ground or excavation bottom.

B. The Contractor shall grade and ditch the site as necessary to direct surface runoff away from open excavations and subgrade surfaces. Positive drainage (minimum 1.0% slope) shall be maintained at all times.

C. Water from trenches and excavations shall be disposed of in such a manner as will not cause injury to public health nor to public or private property, nor to existing work, nor to the work completed or in progress, nor to the surface of roads, walks, and streets, nor cause any interference with the use of the same by the public. Methods of disposal of pumped effluent shall not cause erosion or siltation, and shall conform to requirements of Section 312500, EROSION AND SEDIMENT CONTROLS.

D. Under no circumstances place fills, pour concrete, or install piping and appurtenances in excavations containing free water.

E. There shall be sufficient pumping equipment, in good working order, available at all times to remove water.

F. Where, in the opinion of the Geotechnical Consultant, pumping of excavations is not effective in maintaining a dry firm subgrade, other dewatering methods acceptable to the Geotechnical Consultant, shall be employed. This may include the use of well points or deep well dewatering.

1.10 FROST PROTECTION

A. Do not excavate to full indicated depth when freezing temperatures may be expected, unless footings or slabs can be poured immediately after the excavation has been completed. Protect the excavation from frost if placing of concrete is delayed.

B. Completed foundations which have not been backfilled shall be protected from freezing by temporary additional earth cover, insulating blankets, heaters, or other methods acceptable to the Architect.

C. Frozen material shall not be placed as fill or backfill.

1.11 SHORING AND SHEETING

A. Provide shoring, sheeting and/or bracing at excavations, as required, to prevent collapse of earth at side of excavations.

B. Comply with federal, state, and local regulations, or in the absence of such regulations, comply with the requirements contained in the AGC Manual.

C. Remove sheeting and shoring and the like, as backfilling operations progress, taking all necessary precautions to prevent collapse of excavation sides.

1.12 DEFINITIONS

A. Subgrade - shall be that portion of the soil or rock which remains after stripping of topsoil, excavation, and prior to filling or placement of roadway base course.

B. Embankment - shall be defined as any area on the site to raise grades to proposed subgrade elevations. Embankments are placed in layers to a predetermined elevation and cross section.

C. Structural Backfill - shall be the designated material as indicated on the Drawings to attain the proposed grades abutting or adjacent to site structures.

D. Utility Trench Backfill - is the area bounded by the proposed finished subgrade and the cover material over the respective pipe or conduit. This material shall conform with applicable requirements for embankment or structural backfill depending on the area or zone into which the utility is installed.

E. Satisfactory On-site Borrow is defined as inorganic soil material, with maximum particle size less than 4 inches, which exhibits a well-defined Moisture Density Relationship Curve and which conforms to Unified Soil Classification System (USCS) Classes GW, GM, GC, GP, SW, SM, SP SC and SC-SM.

F. Unsatisfactory Materials include Ex-situ Rock Muck and USCS Classes ML, CL, CH, MH, OH, OL, PT and Miscellaneous Fill, Organic Matter, Cobbles and Boulders, and any on-site borrow which cannot be (practically) moisture adjusted to within 2% to 3% of Optimum Moisture Content.

G. Topsoil - The upper layer of the soil profile which is supporting the growth of vegetation as evidenced by the existence therein of numerous roots and other organic matter.

H. Soil - all earth materials, organic or inorganic, which have resulted from natural processes such as weathering, decay, and chemical action of in situ rock or the deposition of unconsolidated material.

I. Rock (Ledge) - shall be defined as sound and solid mass, layer, or ledge of mineral matter in place of such hardness and texture that it:

1. Mechanical Definition of Rock:

   Cannot be effectively loosened or broken down by ripping in a single pass with a late model tractor-mounted hydraulic ripper equipped with one digging point of standard manufacturer's design adequately sized for use with and propelled by a crawler type tractor rated between 210-and 240-net flywheel horsepower, operating in low gear, or

2. Manual Definition of Rock:

   In areas where the use of the ripper described above is impracticable, rock defined as sound material of such hardness and texture that it cannot be loosened or broken by a 6 lb. drifting pick. The drifting pick shall have a handle not less than 34 in. in length.

1.13 COORDINATION

A. Prior to start of earthwork the Contractor shall arrange an on-site meeting with the Architect for the purpose of establishing Contractor's schedule of operations and scheduling inspection procedures and requirements.

B. As construction proceeds, the Contractor shall be responsible for notifying the Architect prior to start of earthwork operations requiring inspection and/or testing.

C. The Contractor shall be responsible for obtaining test samples of soil materials proposed to be used and transporting them to the site sufficiently in advance of time planned for use of these materials for testing of materials to be completed. Use of these proposed materials by the Contractor prior to testing and approval or rejection, shall be at the Contractor's risk.

1.14 PROTECTION OF EXISTING LANDSCAPE

A. The Contractor shall exercise care to preserve the natural landscape and shall conduct his construction operations so as to prevent any unnecessary destruction, scarring, or defacing of the natural surroundings in the vicinity of the Work.

1. Except where clearing is required for permanent works, for approved construction roads, and for excavation operations, the costal dune and all trees, native shrubbery, and vegetation shall be preserved and shall be protected from damage which may be caused by the Contractor's construction operations and equipment. Existing trees to remain shall be suitably protected from damage with fencing or other means acceptable to the Architect.

2. Movement of crews and equipment within the right-of-way and over routes provided for access to the work shall be performed in a manner to prevent damage to property. Where unnecessary destruction, scarring, damage, or defacing may occur as a result of the Contractor's operations the same shall be repaired, replanted, reseeded, or otherwise corrected at the Contractor's expense.

B. Where indicated on the Drawings and as directed by the Architect, disturbed areas shall be temporary seeded in accordance with Section 312500, EROSION AND SEDIMENT CONTROLS.

PART 2 PRODUCTS

2.01 SOURCE OF MATERIALS

A. Material shall be obtained from required on-site excavations, to the extent that suitable material is available, and from offsite sources, to the extent that suitable material is not available from on-site excavations.

1. No recycled material derived from asphalt or concrete pavements, brick or concrete building materials, glass or other similar building materials shall be permitted as fill or backfill on the site unless specifically approved in writing by the Owner.

2.02 FILL AND BACKFILL MATERIALS

A. On-site material for use in compacted backfill shall be natural, inorganic, granular soil, taken from areas of excavation after stripping of topsoil and removal of unsuitable material.

B. Material containing organic matter, topsoil, organic silt, peat, or soft or frost-susceptible soil is unsuitable for any of the following uses:

Backfill beneath site structures
Backfill beneath pavement and within 5 ft. of subgrade

Bearing strata material
Bedding

C. Select Granular Fill or Satisfactory On-site Borrow may be used as Fill and Backfill below pavement subgrade elevation. Subbase Course below pavements, slabs and sidewalks shall consist of NYSDOT Type 4 or Type 2 Subbase Course Material.

D. Pipe Bedding Material shall be specified by the Project Civil Engineer.

E. Select Granular Fill shall be a high quality natural or manufactured mineral aggregate product, which has been approved for use after review of all required prequalification test submittals.

F. The minimum requirements for a prequalification submittal shall include the following test results which are not more than 60 days old:

1. Sieve Analysis – ASTM D422
2. Moisture Density Relationship Modified Effort – ASTM D1557
3. Plasticity Index – ASTM D4318
4. Soundness Test – ASTM C88

G. Select Granular Fill material shall be well-graded sand and gravel, approved recycled product or crushed rock product which is capable of being compacted to the required density at the proper moisture content and which is 98% free of deleterious materials, trash, roots, debris, frozen material and organic or other foreign matter.

H. Select Granular Fill material shall be accepted on the basis of gradation and a well-defined Moisture-Density Relationship Curve. Select Granular Fill to be placed within 2'-0" of final exterior grade shall be subject to Soundness requirements. Soundness shall be less than 30% loss based on a four-cycle magnesium sulfate soundness test. Plasticity Index of that portion of fill material passing the No. 40 mesh sieve shall not exceed 5.0. Gradation shall be as given below:

Sieve Size	% Passing by Weight
2 in.	100
1/4 in.	25-60
No. 40	5-40
No. 200	0-10

2.03 SLEEVES

A. Sleeves for installing future pipe or wiring shall be Schedule 40 PVC pipe, minimum 4 in. diameter unless otherwise noted.

1. Sleeve locations for future conduit shall be coordinated with the Owner and Architect.

PART 3 EXECUTION

3.01 SUBGRADE INSPECTION

A. Notify Architect when excavations have reached required subgrade.

B. When excavations have reached required subgrade, Contractor shall have subgrades surveyed to determine if subgrade elevations will allow for the indicated depth of proposed materials to be placed on them.

1. If Architect determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material to achieve required subgrade elevation, as directed.
2. If survey indicates that subgrade elevations are too high, continue excavation and reconstruct subgrades to required elevation as directed, without additional compensation.
3. If survey indicates that subgrade elevations are too low, add compacted backfill or fill material to achieve required subgrade elevation as directed, without additional compensation.

C. All subgrade to receive site features such as asphalt pavement, concrete sidewalk, slabs etc. shall be examined and approved by Geotechnical Consultant, prior to placement of any Fill.

1. The subgrade under pavements and sidewalks shall be proofrolled using a 5-ton smooth drum roller making at least 3 passes on vibratory mode. This requirement may be modified or relaxed depending on presence of surrounding adjacent structures, utilities and buildings.Proofrolling shall not damage any of these elements. Geotechnical Consultant will delineate any unstable or non-uniform response areas that will require remediation. Remediation will likely include undercutting to firm ground and backfilling with Select Granular Fill.
2. Sand and Gravel subgrade prepared as outlined above and approved by a Geotechnical Consultant is expected to exhibit a Modulus of Subgrade Reaction of 200 pci.

D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.02 EXCAVATION

A. Sheeting, shoring, bracing, pumping, bailing, and other incidental work necessary to make and maintain excavations and keep them free from water at all times during placing of concrete, utility lines, and fill and backfill materials, shall be performed or supplied as required. Fill and backfill shall be placed in dry or dewatered areas only.

1. Groundwater fluctuations should be expected at this site depending on the time of the year construction takes place. Also, perched groundwater conditions should be expected within project excavation depths. All excavations shall be maintained in-the-dry until satisfactorily backfilled. Contractor shall provide a satisfactory dewatering system to lower and maintain water level to at least 2 feet below planned deepest excavation.

B. Sheeting shall be installed where required to maintain safe and workable conditions in excavations. Sheeting, including necessary wales and struts, shall be selected and designed by the Contractor. Use of sheeting shall equal or exceed minimum required for safety and/or conformance to law.

C. Structures, pipes, pavement, earth, and other property liable to damage from excavation operations shall be braced, underpinned, and supported as required to prevent damage and movement.

D. As excavation approaches underground utilities and structures, excavation shall be done by hand tools. Such manual excavation is incidental to normal excavation and no special payment will be made.

E. Excavation shall include satisfactory disposal of excavated material not employed as backfill or fill materials.

1. Excavation material, other than topsoil, which is not required for or is unsuitable for backfill or fill materials, shall be legally disposed of off-site.

F. Excavation for pipe and other items shall be carried far enough below underside of item to accommodate bedding material.

G. Excavations which extend below indicated or specified levels ("over-excavation"), shall be filled to those levels with compacted Structural Backfill Material if within the areas of structures and Granular Fill for areas beyond the structures limits.

H. If bearing surface of subgrade which is to receive fill, structure, concrete, or other construction becomes softened, disturbed, or unstable, unsuitable material shall be removed down to a firm bearing surface and replaced with suitable material. Subgrade shall then be protected from further disturbance until construction item is placed.

I. Excavations shall not be wider than required to set, brace, and remove forms for concrete, install structures, piping, or perform other necessary work. Width of trench at 12 in. above top of pipe or conduit shall not be greater than the sum of outside diameter of the pipe or the conduit plus 2 ft. (pipe O.D. + 2 ft.). Sides of trench above this level shall be sloping, at an angle 30 degrees or less from vertical, from this level to grade. In materials where sloping walls are not stable, trench walls shall be sheeted.

J. Rock, if encountered, shall be removed by mechanical means only. Blasting shall only be permitted with wrtitten approval by Owner and Architect, and shall be done in strict accordance with applicable laws and ordinances. Explosives shall be stored on-site only when blasting is in progress. When the need for explosives has passed, they shall be removed from the site.

1. Surfaces of rock foundation shall be sufficiently rough to bond well with the masonry and embankments to be built and, if required, shall be cut to rough benches or steps.
2. Before masonry is built upon rock, the rock shall be freed from all vegetation, dirt, clay, shale, excessively cracked rock, water, ice, and other objectionable substances. Picking, wedging, streams of water under high pressure, stream jets, and other effective means shall be used to clean exposed rock.
3. Except as otherwise indicated on the Drawings, rock shall be excavated to a depth 6 in. or more below bottom of structures.

K. Below-ground Demolition

1. Underground items, not indicated on the Drawings, which impede construction of new work indicated, shall be abandoned, demolished, and/or removed only with the approval of the Architect.

L. Proofroll areas to support pavements with a 35 ton rubber tired roller in four passes in two perpendicular directions. Undercut to level of stable soils in unstable areas. Perform work in presence of Geotechnical Consultant.

3.03 FILLING AND BACKFILLING

A. Filling shall be done in any area only after the Geotechnical Consultant has reviewed subgrade.

B. All filling and backfilling for this project shall be accomplished in a workmanlike manner according to good industry practice. All filling and backfilling should be installed in a quality controlled manner with prequalified materials, with quality assurance structural tests and inspections conducted at regular intervals according to the BCNYS Chapters 17 and 18, and consistent with the following methodology.

1. The area to receive fill should be properly prepared, proofrolled, inspected and approved prior to placement of fill.
2. Fill material shall be placed on the approved subgrade in a manner to minimize segregation. The fill should be placed in nearly horizontal lifts commencing at the lowest fill area elevation and proceeding with each lift upward and outward from the lower lift.
3. The moisture content of the material shall be adjusted prior to application of compaction such that it is within 2% of the Optimum Moisture Content.
4. The compacted lift thickness and minimum in-place field density shall conform to the requirements of Table 1.

Table 1: Structural Fill Compaction and Lift Thickness Recommendations

Minimum In-Place Density*	Range of Compacted Lift Thickness (inches)	Fill Area Description
95%	8 to 12	Subbase Course under pavement, slabs and sidewalks, mass fill within open trenches resulting from removal of existing
95%	8 to 12	Confined areas, and utility trench backfill

*As determined using ASTM D1557, Modified Proctor.

5. When the test results indicate that insufficient compaction has been obtained in any layer, the Contractor shall take action to modify or alter the moisture content of the soil, to provide additional compaction or otherwise to increase the in-place soil density. If the Contractor cannot obtain satisfactory compaction due to material properties, the Contractor shall remove the unsatisfactory material and replace with new material.
6. Materials which are frozen or which are contaminated with mud, debris, organics or other deleterious materials shall be removed and replaced with uncontaminated specified material.
7. No fill shall be placed over an area or lift of fill that has not been tested and achieved satisfactory results.

I. Compaction of backfill in excavation shall be to a density not less than that required of the surrounding area fill.

J. Equipment and methods employed to achieve specified compaction shall be subject to the approval of the Architect and Geotechnical Consultant, and equipment shall be replaced and methods revised as directed until specified compaction is obtained.

K. Compaction of each lift shall be completed before compaction of the next lift is started.

L. Backfill adjacent to wall, conduit, pipe, and similar item, and in other areas where wheeled equipment cannot safely be employed, shall be placed in 4 in. thick layers, to the specified compaction, using mechanical tampers.

3.04 MOISTURE CONTROL

A. Variation of moisture content in fill and backfill materials shall be limited to Optimum Moisture (-1% to +3%). Moisture content shall be as uniformly distributed as practicable within each lift, and shall be adjusted as necessary to obtain the specified compaction.

B. Material which does not contain sufficient moisture to be compacted to the specified densities shall be moisture conditioned by sprinkling, disking, windrowing, or other method approved by the Geotechnical Consultant.

1. Material conditioned by sprinkling shall have water added before compaction. Uniformly apply water to surface of subgrade or layer of soil material to obtain sufficient moisture content. The Contractor shall maintain sufficient hoses and/or water distributing equipment at the site for this purpose.

C. Material containing excess moisture shall be dried to required Optimum Moisture Content before it is placed and compacted. Excessively moist soils shall be removed and replaced or shall be scarified by use of plows, discs, or other approved methods, and air-dried to meet the above requirements.

D. Materials which are within the moisture requirements specified above, but which display pronounced elasticity or deformation under the action of earthmoving and compaction equipment, shall be reduced to Optimum Moisture Content, or below, to secure stability.

E. In the event of sudden downpours or other inclement weather, exposed subgrades and fills which, in the opinion of the Geotechnical Consultant, become inundated or excessively moistened shall have excess water removed and soil dried as specified above.

3.05 DUST CONTROL

A. Contractor shall be responsible for dust control during all construction operations. During the progress of the work, the Contractor shall conduct his operations and maintain the area of his activities including sweeping and sprinkling of streets as necessary, so as to minimize the creation and dispersion of dust. If the Architect decides that it is necessary to use calcium chloride for more effective dust control, the Contractor shall furnish and spread calcium chloride as directed. Methods and materials for dust control shall be as approved by the Architect.

1. Throughout the construction period the Contractor shall carry on an active program for the control of fugitive dust within all site construction zones, or areas disturbed as a result of construction. Control methods shall include the following: Apply calcium chloride at a uniform rate of one and one-half (1 ½) pounds per square yard in areas subject to blowing. For emergency control of dust apply water to affected areas. The source of supply and the method of application for water are the responsibility of the Contractor.
2. The frequency and methods of application for fugitive dust control shall be as directed by the Architect with concurrence by the Owner.

3.06 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.

3.07 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION

SECTION 312500

EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. Attention is directed to the PROCUREMENT AND CONTRACTING REQUIREMENTS and all Sections within DIVISION 01, GENERAL REQUIREMENTS, which are made a part of this Section of the Specifications.

1.02 SUMMARY

A. Work covered in this section includes the control of erosion, siltation, and sedimentation.

B. Comply with the NYSDEC SPDES General Permit for Stormwater Discharges from Construction Activity (GP-0-10-001) and the Storm Water Pollution Prevention Plan (SWPPP) established for the project.

C. Comply with Chapter 282 of the City of Ithaca Code for Stormwater Management and Erosion and Sediment Control.

D. Work consists of temporary and permanent control measures as shown on the plans or as ordered by the Architect/Engineer and/or the Qualified Inspector during the life of the contract to control soil erosion, siltation, sedimentation and prevent water pollution through use of berms, dikes, dams, sediment basins, fiber mats, netting, gravel, mulches, grasses, slope drains and other erosion control devices or methods.

E. Plans show the suggested minimum measures required. Areas of erosion and sedimentation control measures defined on the plans are not all-inclusive. Use erosion and sedimentation control techniques in all areas of construction where disturbance to existing conditions occur.

F. Place all appropriate erosion and sediment control measures a minimum of five (5) business days before commencement of construction that requires such measures.

G. Complete installation and repair of erosion control measures, as instructed by the Qualified Inspector, within 24 hours of being notified.

H. Protect all storm and sanitary sewers, ditches, swales, etc from siltation and sedimentation resulting from work completed under this contract.

1.03 SUBMITTALS

A. Prior to the start of construction, submit erosion and sediment control sequence schedule based on intended sequencing for review and approval by Architect/Engineer.

B. Submit actual erosion control measures and excavation dewatering discharge plan based on intended sequencing for review and approval by Architect/Engineer prior to start of construction. Define the maximum disturbed areas per project phase and show required cuts and fills. Refer to Part 3 - Schedule of Work for additional data to be submitted.

1.04 QUALITY ASSURANCE

A. Complete work in accordance with New York State Standards and Specifications for Erosion and Sediment Control.

B. Provide at least one person who will be present at all times during erosion control operations and who is thoroughly familiar with the types of materials being installed and the best methods for their installation and who will direct all work performed under this section.
   a. In accordance with General Permit (GP-0-10-001), the Contractor shall provide a qualified individual who has received minimum 4-hours training in Erosion and Sediment Control endorsed by the New York State Department of Environmental Conservation (NYSDEC).

C. Provide material from manufacturers and vendors that are reputable, qualified firms that regularly engaged in producing the required types of materials.

D. Use construction methods/techniques, which limit exposed earthen areas and minimize the effect of earth disturbance activities on soil erosion. Do not disturb more than five (5) acres of soil at any one time without prior written approval from the NYSDEC.

E. Direct all sediment-laden water to an appropriate sediment control device prior to off-site discharge.

F. Maintain all erosion and sediment control measures in good working condition and in accordance with the Contract Documents. Inspect erosion and sediment control measures, weekly and after each runoff event.

1.05 AUTHORITY OF WORK

A. The Architect/Engineer and/or Owner’s Designated Representative may limit the area of clearing and grubbing, excavation, borrow, embankment and/or utility operations in progress, commensurate with the Contractor’s capability and progress in keeping the finish grading, mulching, seeding, and other such permanent or temporary control measures current in accordance with the accepted schedule.

B. The Architect/Engineer and/or Owner’s Designated Representative has the authority to limit the surface area of erodible earth material exposed by clearing and grubbing, the surface area of erodible earth material exposed by excavation, borrow, and fill operations, and to direct the Contractor to provide immediate permanent or temporary pollution control measures to minimize damage to adjacent property and contamination of adjacent streams or other watercourses, lakes, ponds or other areas of water impoundment.

C. In addition, agencies having jurisdiction over waterway crossings or site erosion control, such as the Corps of Engineers and the NYSDEC, have the authority to make observations at the

site to evaluate the construction practices with regard to the approved permits. Deviation from the requirements of the approved permits will require the approval of the Architect/Engineer, and any agencies having jurisdiction.

1.06 PROJECT REQUIREMENTS

A. Avoid and prevent any erosion and silting of rivers, streams, ponds, impoundments, drainage ditches, and swales.

B. Protect and maintain all areas disturbed by the work, such that erosion is adequately controlled and silt and sediments are not allowed to flow into or onto: any watercourse; adjacent properties; roadways, parking areas, walkways or other pavements; or, storm or sanitary sewers.

C. Sequence work in a manner that keeps exposed, unprotected surface areas of any earth material that is subject to erosion by wind or water, to a minimum.

D. Keep exposure of uncompleted cut slopes, embankments, trench excavations, and site graded areas as short as possible. Initiate seeding and other erosion control measures on each segment as soon as possible. Provide temporary and/or permanent stabilization measures within 14 days in areas where soil disturbance activities have ceased.

E. If construction is halted for any length of time, shape all excavated and graded areas to intercept and divert runoff to points where minimal erosion will occur. Provide and maintain temporary erosion and sediment control measures, such as berms, dikes, slope drains, silt stops, and sedimentation basins, until permanent drainage facilities and erosion control features have been completed and are operative.

F. Handle and treat fine material placed or exposed during the work to minimize the possibility of it reaching surface waters. Use diversion channels, dikes, sediment traps, or any other effective control measures.

G. Provide silt stops wherever erosion control measures is not fully capable of controlling erosion, such as in drainage channels and where slopes may exist. Before water is allowed to flow in any ditch, swale, or channel, install permanent erosion control measures in the waterway so the waterway is protected from erosion.

H. Devote particular attention to all (existing and new) drainage facilities, keeping them operational at all times. Inspect and repair siltation controls. Provide inlet protection at existing and new drainage structures.

I. Take precaution in the use of construction equipment to minimize erosion. Do not leave wheel tracks where erosion might begin. Prevent direct discharge from dewatering pumps and surface runoff from the construction sites to storm sewers, culverts, streams or ditches. Intercept and direct surface runoff to siltation ponds before discharging to natural drainage channels. Construct sump pits to dewater trench and other excavations.

J. Remove siltation deposits in storm sewers, surface waters, streams or wetlands resulting from the discharge of water from the project site to restore profiles and conditions that exist prior to the commencement of the work.

K. Keep access routes and parking areas used for the work clean of debris and other obstructions resulting from the work.

L. Keep traveled ways free of foreign objects such as spilled earth, rock, timber, and other items that may fall from transporting vehicles. Immediately remove materials spilled or dropped from the undercarriage of any carrying vehicle used in the Contractor's hauling operations along or across any public or private traveled way.

M. Do not disturb lands and waters outside the limits of construction, except as found necessary and approved by the Architect/Engineer.

N. The requirements of this section also apply to project-related construction activities away from the project site, such as at borrow pits, off-site storage areas, and haul and work roads.

O. Mulching must follow the seeding operation by not more than 24 hours.

P. Should any protective measures employed indicate any deficiencies or erosion taking place, immediately provide additional materials or use different techniques to correct the situation and to prevent additional erosion.

Q. Provide erosion control measures until the permanent measures have been sufficiently established and are capable of controlling erosion on their own.

R. Comply with all federal, state, and local laws, ordinances, rules, and regulations.

PART 2 - PRODUCTS AND MATERIALS

2.01 GENERAL

A. Provide materials conforming to the design plans or specifications outlined in the New York State Standards and Specifications for Erosion and Sediment Control (Blue Book).

B. All materials are subject to the approval of the Architect/Engineer and must be clean and free of noxious weeds and deleterious materials.

C. Provide grass that is a quick growing species suitable to the geographical area as specified in the Contract Documents.

D. Provide standards commercial grade fertilizer and soil conditioners acceptable to the Architect/Engineer.

E. Trench plug materials must consist of native soil installed within "sandbags."

2.02 HAY AND STRAW MULCH (if required)

A. General: Provide hay and straw mulches free from swamp grass, weeds, twigs, debris, and other deleterious material, and free from rot, mold, primary noxious weed seeds, and rough or woody materials. Mulches containing mature seed of species which would volunteer and be detrimental to

the permanent seeding, or would result in overseeding, or would produce growth which is aesthetically unpleasing, is not permitted.

B. Hay Mulch: Properly aired native hay, Sudan grass hay, broomsedge hay, legume hay, or similar hay or grass mowings. When air-dried in the loose state, the contents of the representative bale may not have more than fifteen (15) percent of the resulting air-dry weight of the bale. Apply at the rate of 2 to 3 tons/acre, or at 1.5 tons/acre when a net or a mulch stabilizer is used with the mulch.

C. Straw Mulch: Threshed plant residue of oats, wheat, barley, rye, or rice from which grain has been removed. Apply at the rate of 2 to 3 tons/acre or at 1.5 tons/acre when a net or a mulch stabilizer is used with the mulch.

D. Mulch Stabilizers: "Curasol" applied at the rate of 40 gallons/acre, Dow "Mulch Binder" applied at the rate of 45 gallons/acre, or asphalt binder, AASHTO M140, Type SS-1 or RS-1 as applicable, applied at the rate of 400 gallons/acre.

E. Temporary Type Mulch Nets: Paper yard, approximately 0.05" in diameter, woven in to a net with approximate openings of 7/8" by 1/2" and weighing about 0.20 lbs./sy.

F. Permanent Type Mulch Nets: "Vexar" or "Erosion-Net" plastic or nylon mesh netting with approximate openings of 3/8" by 3/4".

2.03 MATTING/BLANKETS (if required)

A. Nomenclature: The various materials under this paragraph are sometimes referred to as "matting" and "blankets". These words are interchangeably used throughout this section, but the meanings are the same.

B. Jute Matting: Undyed and unbleached jute yarn woven into a uniform open, plain weave mesh, furnished in rolled strips conforming to the following physical requirements:

Width : 48", ±1"
: 78 warp ends per width of cloth
: 41 weft ends per yard
Weight: 1.22-1.80 lbs./LY, ±5%

C. Excelsior Matting: Uniform web of interlocking wood excelsior fibers with a backing of mulchnet fabric on one side only. Provide either twisted paper chord or cotton cord woven mulchnet. Furnish excelsior matting in rolled strips to the following physical requirements:

Width : 36", 1"
Weight: 0.80 lbs./SY, 5%

D. Erosion Control Mulching Blanket: "Hold/Gro" by Gulf States Paper Corp.

E. Staples: No. 11 (or heavier) plain iron wire made from at least 12" lengths of wire bent to form "U" of 1" to 2" width. Use longer staples for loose soils or where otherwise required.

2.04 HYDROMULCHES (if required)

A. Do not use hydromulches where the slope of the ground surface exceeds 10 percent.

B. Provide wood fiber mulch with tackifier that meets NYSDOT material designations 713-11 and 713-12. Apply wood fibers at the rate of 500 lbs./acre and tackifier at the rate of 40-45 gallons/acre and in accordance with manufacturer's recommendations.

C. Paper mulch equal to "Spra-mulch" by Rumose Products Co., applied at the rate of 1,200 lbs./acre.

2.05 SEED AND SOD FOR EROSION CONTROL

A. Seed for temporary control: Blend - Mix Type 'A' Rate: 5 to 6 pounds per 1,000 SF

Common Names	Parts	Purity	Germination
Adelphi Kentucky Bluegrass	30%	90%	87%
Baron Kentucky Bluegrass	30%	90%	87%
Pennlawn Fescue	30%	90%	82%
Pleasure Perennial Ryegrass	10%	90%	90%

B. For permanent control: See Division 32 Section "Turf and Grasses"

2.06 SILT FENCES

A. Provide filter cloth as manufactured by Mirafi 100X, Stabilenka T104N, or Indian Valley 3611 Construction Grade and meets the following requirements:

1. Silt Fence Fabric:

Fabric Properties	Minimum Acceptable Value	Test Method
Grab Tensile Strength (lbs)	90	ASTM D1682
Elongation at Failure (%)	50	ASTM D1682
Mullen Burst Strength (lbs)	190	ASTM D3786
Puncture Strength (lbs)	40	ASTM D3786
Slurry Flow Rate (gal/min/sf)	0.3	
Equivalent Opening Size	40-80	US Std. Sieve SW-02215
Ultraviolet Radiation Stability (%)	90	ASTM G-26

B. Other materials are defined on the silt fence detail shown on the Contract Documents.

C. Pre-assembled silt fence, which is complete with U.V., stabilized filter fabric (minimum 36-inch) high-strength polypropylene netting and pre-attached hardwood stakes may be used. Use Silt-LOCK 36-100RX preassembled reinforced silt fence manufactured by JDR Enterprises, Inc., Mirafi Envirofence, or Belton Industries.

2.07 STABILIZED CONSTRUCTION ENTRANCE

A. Provide clean, sound, crushed stone of uniform quality. Use NYSDOT primary size designation #3, #4, or #4A stone as per NYSDOT Standard Specifications, Section 703-02, Material Designation 703-0201.

B. Provide Filter cloth for heavy duty haul roads, rough graded, as listed below. Acceptable materials are Trevira Spunbound 1135 or Mirafi 600X. The filter cloth must be woven fabric of only continuous chain polymeric filaments or yarns of polyester. The fabric must be inert to commonly encountered chemicals, hydrocarbons, mildew; rot resistant and conform to the fabric properties listed below:

Fabric Properties	Rough Graded	Test Method
Grab Tensile Strength (lbs)	220	ASTM D1682
Elongation at Failure (%)	60	ASTM D1682
Mullen Burst Strength (lbs)	430	ASTM D3786
Puncture Strength (lbs)	125	ASTM D751 modified
Equivalent Opening Size	40-80	US St Sieve CW-00215

2.08 CHECK DAMS (if required)

A. Light Stone Fill - Provide graded stone filling (light) material meeting the requirements of NYSDOT Standard Specification Section 620-2.02 for light and medium stone fill.

B. The gradation of materials furnished will be accepted or rejected based upon a visual examination of the material by the Owner's Representative.

C. Provide filter cloth that meets the same requirements as silt fence described in this section.

D. The purpose of check dams are to reduce erosion by restricting the velocity of flow in the swale/channel.

2.09 TEMPORARY SEDIMENT TRAP (if required)

A. Sideslopes must be 1:1 or flatter on cut slopes and 2 horizontal to 1 vertical or flatter on fill slopes.

B. Provide stone check dam or other pipe outlet with seepage collar.

C. Provide Mirafi 140N geotextile fabric as manufactured by Mirafi.

D. Construct and maintain outlets in a manner that sediment does not leave the trap and that erosion at or below the outlet does not occur.

E. The elevation of the top of any dike directing water to any sediment trap must be equal or exceed the maximum height of the outlet structure along the entire length of the trap.

2.10 INLET PROTECTION

A. Provide masonry or concrete block, stone-filled geotextile bags, and clean granular materials, as shown on the contract details.

2.11 SUMP PIT

A. Provide perforated 12 to 14 in. diameter corrugated or PVC vertical standpipe.

B. Provide NYSDOT No. 2 stone base material.

C. Provide filter cloth that meets the same requirements as silt fence described in this section.

PART 3 - EXECUTION

3.01 GENERAL

A. In the event of conflict between these specification requirements and pollution control laws, rules or regulations of other Federal, State, or local agencies, the more restrictive laws, rules or regulations apply.

B. Place appropriate erosion and sedimentation control measures including silt fences and temporary sediment traps prior to the excavation of ground vegetation of any segment of the project that requires such measures. Maintain all measures throughout construction until vegetation is established to the satisfaction of the Owner's Designated Representative.

C. Maintenance includes periodic removal and disposal of sediment, inspection and repair of damaged facilities, and replacement of any materials required to facilitate revegetation of disturbed areas.

D. Protect areas of temporary storage for spoil materials by silt fences as directed by the Architect/Engineer and/or Owner's Designated Representative.

E. Remove temporary measures such as silt fences and sediment traps at the end of construction when vegetation is established to the satisfaction of the Owner's Designated Representative. Do not remove erosion and sedimentation control measures without approval of the Architect/Engineer.

3.02 HAY AND STRAW MULCHING (if required)

A. Install hay or straw mulch immediately after each area has been properly prepared. When permanent seed or seed for erosion control is sown prior to placing the mulch, place mulch on seeded areas within 24 hours after seeding. Architect/Engineer may authorize the blowing of chopped mulch provided that 95 percent of the mulch fibers will be 6" or more in length and that it can be applied in a manner that there will be a minimum amount of matting that retards the growth of plants. Hay mulch should cover the ground enough to shade it, but the mulch should not be so thick that a person standing cannot see the ground through the mulch. Remove matted mulch or branches.

B. Where mild winds may blow the mulch, or when ground slopes exceed 15 percent, or when otherwise required to maintain the mulch firmly in place, apply a system of pegs and strings, a chemical stabilizer, or temporary type netting to the mulch. Unless otherwise directed, remove the strings and netting prior to the acceptance of the work.

C. Where high winds exist, or heavy rainstorms are likely, or where ground surfaces are steep, or where other conditions require, apply temporary type netting over the mulch and take necessary measures to keep the mulch firmly in place.

D. Unless otherwise specified, the use of permanent type netting is not permitted without the prior approval of the Architect/Engineer.

3.03 MATTING/BLANKETS - GENERAL (if required)

A. The use of mulch with matting is not permitted, however, a 4" to 6" overlap of mulch over the edge of matting is permissible.

B. Prepare surfaces of ditches and slopes to conform to the grades, contours and cross sections shown on the Drawings and finish to a smooth and even condition with all debris, roots, stone, and lumps raked out and removed. Loosen the soil surface to permit bedding of the matting. Unless otherwise noted, seed prior to the placement of the matting.

C. Unroll matting parallel to the direction of flow of water and loosely drape, without folds or stretching, so that continuous ground contact is maintained.

D. The ditches and swales, and on slopes, each upslope and each downslope end of each piece of matting shall be placed in a 6" trench, stapled at 12" on center, backfilled, and tamped. Similarly, bury edges of matting along the edges of catch basins and other structures. Architect/Engineer may require that any other edge, exposed to more than normal flow of water, be buried in a similar fashion.

E. Tightly secure matting to the soil by staples driven approximately vertically into the ground, flush with the surface of the matting. In driving the staples, take care not to form depressions or bulges in the surface of the matting.

F. Decrease the specified spacing of staples when varying factors, such as the season of the year or the amount of water encountered or anticipated, requires additional anchoring.

G. Refer to the following paragraphs for additional requirements on the placement and stapling of matting.

3.04 JUTE MATTING (if required)

A. Where strips are laid parallel or meet, as in a tee, they must overlap at least 4". Overlap ends at least 6" shingle fashion.

B. Space check slots, built at right angles to the direction of flow of water, so that one check slot or one end occurs within each 50 feet of length of slope. Construct check slots by placing a tight fold

of matting at least six (6) inches vertically into the ground. These shall be tamped the same as the upslope ends.

C. Press jute matting onto the ground with a light lawn roller or other satisfactory means.

D. On slopes flatter than 1:4, place staples not more than 3 feet apart in three rows, for each strip, with one row along each edge and one row alternately spaced down the center. On grades 1:4 or steeper, place staples in the same three rows, but spaced 2 feet. On lapping edges, double the number of staples, with the spacing halved. Ends of matting and all required check slots shall have staples placed every foot. Matting placed adjacent to boulders or other obstructions shall be stapled with no spaces between the staples.

E. Spread additional seed over jute matting, particularly those locations disturbed by the building of slots.

3.05 EXCELSIOR MATTING (if required)

A. Where strips of excelsior matting are laid end to end, butt the adjoining ends.

B. When adjoining rolls of excelsior matting are laid parallel to one another, butt the matting snugly.

C. On slopes flatter than 1:4, place staples not more than 3 feet apart in three rows, for each strip, with one row along each edge and one row alternately spaced down the center. On grades 1:4 or steeper, place staples in the same three rows, but spaced 2 feet apart. Ends of matting shall have staples placed every foot. Matting placed adjacent to boulders or other obstructions shall be stapled with no spaces between the staples.

3.06 EROSION CONTROL MULCHING BLANKET (if required)

A. Where one roll ends and a second roll begins, the upslope piece shall be brought over the end of the downslope roll so that there is a 12-inch overlap, placed in a 4-inch deep trench, stapled at 12 inches on center, backfilled, and tamped.

B. On slopes where two or more widths of blanket are applied, the two edges shall be overlapped 4 inches and stapled at 12-inch intervals along the exposed edge of the lap joint.

C. Staple the body of the blanket in a grid pattern with staples 3 feet on center, each way.

3.07 SEED FOR EROSION CONTROL

A. Sow seed when soils are moderately dry and when wind does not exceed five miles per hour or as directed by the Architect/Engineer.

B. Areas, which will be re-graded or otherwise disturbed later during construction, may be ordered to be seeded with rye grass to obtain temporary control. Sow seed at approximately one pound per 1,000 square feet, on the pure live seed basis.

3.08 SILT FENCES

A. Provide silt fences, as required, for the temporary control of erosion and to stop silt and sediment from reaching surface waters, adjacent properties, or entering catch basins, or damaging the work.

B. Erect silt fences as shown on the contract drawings.

C. Maintain and leave silt fences in place until permanent erosion control measures have stopped all erosion and siltation.

D. Along sloped areas, silt fences shall be placed at spacing not to exceed slope length shown below.

Slope Steepness	Maximum Slope Length, Ft.
2H : 1V	25
3H : 1V	50
4H : 1V	75
5H : 1V or flatter	100

E. Place silt fence along property boundaries where the grade is such that runoff may occur to adjacent property owners.

3.09 STABILIZED CONSTRUCTION ENTRANCES

A. Construct stabilized pads of aggregate underlain with filter cloth as shown on the Contract Drawings.

B. Place filter cloth over the entire area to be covered with aggregate prior to placing of the stone.

3.10 CHECK DAMS

A. Place stone filling to produce a reasonable well-graded mass of stone with smaller fragments filling the space between the larger ones, to result in the minimum practicable percentage of voids.

B. Inspect the check dams after each runoff event. Correct all damage immediately. Replace stones as needed to maintain cross sections of the structure.

C. Remove sediment accumulated behind the dam as needed to allow swale/channel to drain through the stone check dam and prevent large flows from carrying sediment over the dams.

D. Properly dispose removed sediment in a manner not to erode.

3.11 TEMPORARY SEDIMENT TRAP (if required)

A. Maintain sediment traps throughout the contract or until the drainage area has been stabilized as approved by the Architect/Engineer and/or Owner’s Designated Representative.

B. Remove and restore sediment and trap to its original dimensions when sediment has accumulated to 1/2 the design depth of the trap.

C. Properly remove and dispose sediment in a manner not to erode.

D. Inspect the sediment trap after each runoff event. Correct all damage immediately.

3.12 DEWATERING

A. Construct sump pits as shown on the Contract Drawings to dewater trench and other excavations.

B. Properly remove and dispose sediment in a manner not to erode.

3.13 SCHEDULE OF WORK

A. Submit proposed construction schedule, schedule for accomplishment of temporary and permanent erosion control work, as applicable for clearing and grubbing; grading; installation of utilities, building foundations, retaining walls, ramps and pavements; and, restoration to Architect/Engineer for acceptance. Submit, at the same time, proposed plan for disposal of surplus excavated materials for acceptance. Do not start work until the erosion control schedules and methods of operations are accepted by the Architect/Engineer. If climactic changes occur during construction, the Contractor may be required to submit a revised schedule for acceptance as directed by the Architect/Engineer.

B. Where conditions warrant, clearing and grubbing operations should be so scheduled and performed that grading operations and permanent erosion control features can follow immediately thereafter as the project conditions permit; otherwise temporary erosion control measures may be required between successive construction stages.

3.14 MAINTENANCE

A. Complete corrective actions, noted during weekly inspections, within 24 hours of being notified by the Qualified Inspector.

B. Immediately repair staples that become loose or raised, matting that becomes loose, torn, or undermined, and any temporary erosion and sediment control measures that are disturbed.

C. If seed is washed out before germination, repair any damage, refertilize, and reseed.

D. Maintain mulched and matted areas, silt stops, and other temporary control measures until the permanent control measures are established and no further erosion is likely.

E. Immediately remove sediment spilled, dropped, or washed onto the driveways, roadways, parking areas, walkways or public rights-of-way.

F. Maintain ditches and swales at all times so that they effectively drain. Refill, reshape, and re-compact where ruts or erosion occurs.

G. Maintain filter fabric placed at inlet grates. Clean and replace as necessary to protect the storm sewers from siltation and sediments.

H. Maintain areas temporarily seeded including repair of all damages, re-seeding, and refertilizing.

I. Flush and clean all storm sewers, structures and sumps. Capture and remove sediments prior to release into other downstream systems.

PART 4 – METHOD OF MEASUREMENT

4.01 EROSION AND SEDIMENT CONTROL

A. The quantity to be measured for payment is a single lump sum.

PART 5 – BASIS OF PAYMENT

5.01 ALL ITEMS

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

Payment will be made under:

ITEM NO.	**ITEM**	**PAY UNIT**
312500.01	Erosion and Sediment Control	Lump Sum

END OF SECTION

SECTION 316613

HELICAL PILES

PART 1 GENERAL

1.0 SUMMARY

The purpose of this specification is to detail the furnishing of all designs, materials, tools, equipment, labor and supervision, and installation techniques necessary to install Helical Piles as detailed on the drawings, including connection details.

1.01 RELATED WORK SPECIFIED ELSEWHERE

A. Earthwork and Grading: Section 312210.
B. Subsurface Investigation Report, include soil boring logs, included in the Project Specifications.

1.01 SCOPE OF WORK

This work consists of furnishing all necessary engineering and design services, supervision, labor, tools, materials, and equipment to perform all work necessary to install the Helical Piles per the specifications described herein, and as shown on the drawings. The Contractor shall install Helical Piles that will develop the load capacities as detailed on the drawings.

1.02 DEFINITIONS

A partial list follows:

Casing: Steel or PVC pipe used during the installation process to stabilize the annular volume surrounding the central steel shaft. Depending on the details of the helical pile construction and soil conditions, the casing may be extracted after grouting, or may remain partially or fully in place, as part of the final pile configuration.

Coupling: Central steel shaft connection means formed as integral part of the plain extension shaft material. For Type SS & RS Helical Piles, couplings are internal or external sleeves, or hot upset forged sockets.

Coupling Bolt(s): High strength, structural steel fasteners used to connect Helical Pile segments together. For Type SS segments, the coupling bolt transfers axial load. For Type RS segments, the coupling bolts transfer both axial and torsional forces.

Grout (PULLDOWN): Portland cement based grout that is gravity fed into the annular volume surrounding the central steel shaft during installation. The fine aggregate and admixtures provide flowability, resist washout, and provide additional corrosion protection. Provides the load transfer in skin friction to the surrounding soil along the length of the helical pile.

Helical Extension: Helical Pile foundation component installed immediately following the lead or starter section, if required. This component consists of one or more helical plates welded to a central steel shaft of finite length. Function is to increase bearing area.

Helix Plate: Generally round steel plate formed into a ramped spiral. The helical shape provides the means to install the helical pile, plus the plate transfers load to soil in end bearing. Helix plates are available in various diameters and thickness.

Helical Pile: A bearing type foundation element consisting of a lead or starter section, helical extension (if so required by site conditions), plain extension section(s), and a pile cap. A.k.a. helical screw pile, screw pile, helical screw foundation.

Installation Torque(T): The resistance generated by a Helical Pile when installed into soil. The installation resistance is a function of the soil type, and size and shape of the various components of the Helical Pile.

Lead Section: The first Helical Pile foundation component installed into the soil, consisting of single or multiple helix plates welded to a central steel shaft. A.k.a. Starter Section.

Pile Cap: Connection means by which structural loads are transferred to the Helical Pile. The type of connection varies depending upon the requirements of the project and type of Helical Pile material used.

Round Shaft (RS): Round steel pipe central Shaft elements ranging in diameter from 2-7/8" to 10". A.k.a. Hollow Shaft (Type HS), Type T/C, Type PIF.

Plain Extension: Central steel shaft segment without helix plates. It is installed following the installation of the lead section or helical extension (if used). The segments are connected with integral couplings and bolts. Plain extensions are used to extend the helix plates beyond the specified minimum depth and into competent load bearing stratum.

Safety Factor: The ratio of the ultimate capacity to the working or design load used for the design of any structural element.

Square Shaft (SS): Solid steel, round-cornered-Square central Shaft elements ranging in size from 1-1/4" to 2-1/4". A.k.a. Type SQ.

Torque Strength Rating: The maximum torque energy that can be applied to the helical pile foundation during installation in soil, a.k.a. allowable, or safe torque.

1.03 ALLOWABLE TOLERANCES

A. Centerline of Helical Piles shall not be more than 3 inches from indicated plan location.

B. Helical Pile plumbness shall be within 2° of design alignment.

C. Top elevation of Helical Pile shall be within +1 inch to –2 inches of the design vertical elevation.

1.04 QUALITY ASSURANCE

A. The Contractor shall employ an adequate number of skilled workers who are experienced in the necessary crafts and who are familiar with the specified requirements and methods needed for proper performance of the work of this specification.

B. Refer to Section 014533-Special Inspections and Testing, for Construction inspection and testing to be performed by the Owner's Inspection and Testing Agency.

1.05 DESIGN CRITERIA

A. Helical Piles shall be designed to meet the specified loads and acceptance criteria as shown on the drawings. The calculations and drawings required from the Contractor shall be submitted to the Architect for review and acceptance in accordance to Section 3.1 "Construction Submittals".

B. The overall length and installed torque of a Helical Pile shall be determined by the contractor such that the required in-soil capacity is developed by end-bearing on the helix plate(s) in an appropriate strata(s).

C. The Helical Pile attachment (pile cap) shall distribute the design load (DL) to the concrete foundation such that the concrete bearing stress does not exceed those in the ACI Building Code and the stresses in the steel plates/welds does not exceed AISC allowable stresses for steel members.

1.06 GROUND CONDITIONS

The logs of soil borings included in the Specification shall be considered to be representative of the in-situ subsurface conditions likely to be encountered on the project site. Said boring logs shall be the used as the basis for helical pile design using generally accepted engineering judgment and methods.

1.07 REFERENCES

Standards listed by reference, including revisions by issuing authority, form a part of this specification section to the extent indicated. Standards listed are identified by issuing authority, authority abbreviation, designation number, title, or other designation established by issuing authority. Standards subsequently referenced herein are referred to by issuing authority abbreviation and standard designation. In case of conflict, the particular requirements of this specification shall prevail. The latest publication as of the issue of this specification shall govern, unless indicated otherwise.

American Society for Testing and Materials (ASTM):

A. ASTM A29/A29M Steel Bars, Carbon and Alloy, Hot-Wrought and Cold Finished.
B. ASTM A36/A36M Structural Steel.
C. ASTM A53 Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
D. ASTM A153 Zinc Coating (Hot Dip) on Iron and Steel Hardware.
E. ASTM A325 Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
F. ASTM A500 Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
G. ASTM A513 Standard Specification for Electric Resistance Welded Carbon and Alloy Steel Mechanical Tubing.
H. ASTM A536 Standard Specifications for Ductile Iron Castings
I. ASTM A572 HSLA Columbium-Vanadium Steels of Structural Quality.
J. ASTM A618 Hot-Formed Welded and Seamless High-Strength Low-Alloy Structural Tubing.

K. ASTM A656 Hot-Rolled Structural Steel, High-Strength Low-Alloy Plate with Improved Formability.
L. ASTM A958 Standard Specification for Steel Castings, Carbon, and Alloy, with Tensile Requirements, Chemical Requirements Similar to Wrought Grades.
M. ASTM A1018 Steel, Sheet and Strip, Heavy Thickness Coils, Hot Rolled, Carbon, Structural, High-Strength Low-Alloy, Columbium or Vanadium, and High-Strength Low-Alloy with Improved Formability.

American Welding Society (AWS):
N. AWS D1.1 Structural Welding Code – Steel.

American Society of Civil Engineers (ASCE):
O. ASCE 20-96 Standard Guidelines for the Design and Installation of Pile Foundations.

Society of Automotive Engineers (SAE):
P. SAE J429 Mechanical and Material Requirements for Externally Threaded Fasteners.

1.08 SUBMITTALS

A. The Contractor shall prepare and submit to the Architect, for review and approval, working drawings and design calculations for the Helical Piles intended for use at least 14 calendar days prior to planned start of construction (but note also Paragraph 3.1.8).

B. The Contractor shall submit a detailed description of the construction procedures proposed for use to the Architect for review. This shall include a list of major equipment to be used.

C. The Working Drawings shall include the following:

1. Helical Pile number, location and pattern by assigned identification number
2. Helical Pile design load
3. Type and size of central steel shaft
4. Helix configuration (number and diameter of helix plates)
5. Minimum effective installation torque
6. Minimum overall length
7. Inclination of Helical Pile
7. Grout column length
8. Minimum cased length, if applicable
9. Grout column diameter(s)
10. Cut-off elevation
11. Helical Pile attachment to structure relative to grade beam, column pad, pile cap, etc.

D. The Contractor shall submit to the Architect copies of calibration reports for each torque indicator or torque motor, and all load test equipment to be used on the project. The calibration tests shall have been performed within forty five (45) working days of the date submitted. Helical Pile installation and testing shall not proceed until the Architect has received the calibration reports. These calibration reports shall include, but are not limited to, the following information:

1. Name of project and Contractor

2. Name of testing agency
3. Identification (serial number) of device calibrated
4. Description of calibrated testing equipment
5. Date of calibration
6. Calibration data

E. Work shall not begin until all the submittals have been received and approved by the Architect. The Contractor shall allow the Architect a reasonable time to review, comment, and return the submittal package after a complete set has been received. All costs associated with incomplete or unacceptable submittals shall be the responsibility of the Contractor.

F. Installation Records

The Contractor shall provide the Architect copies of Helical Pile installation records within 24 hours after each installation is completed. These installation records shall include, but are not limited to, the following information.

1. Name of project and Contractor
2. Name of Contractor's supervisor during installation
3. Date and time of installation
4. Name and model of installation equipment
5. Type of torque indicator used
6. Location of Helical Pile by assigned identification number
7. Actual Helical Pile type and configuration – including lead section (number and size of helix plates), number and type of extension sections (manufacturer's SKU numbers)
8. Helical Pile installation duration and observations
9. Total length of installed Helical Pile
10. Cut-off elevation
11. Inclination of Helical Pile
12. Installation torque at one-foot intervals for the final 10 feet
13. Comments pertaining to interruptions, obstructions, or other relevant information
14. Rated load capacities

G. Closeout Submittals

1. Manufacturer's Warranty: Submit, for Architect's Acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights the Architect may have under Contract Document.

PART 2 PRODUCTS

2.01 Central Steel Shaft:

The central steel shaft, consisting of lead sections, helical extensions, and plain extensions, shall be Type SS (Square Shaft) or RS (Round Shaft) or a combination of the two (SS to RS Combo Pile) as manufactured by CHANCE Civil Construction or approved equal.

A. SS175 1-3/4; SS200 2"; SS225 2-1/4" Material: Shall be hot rolled Round-Cornered-Square (RCS) solid steel bars meeting the dimensional and workmanship requirements of ASTM A29. The bar shall be High Strength Low

Alloy (HSLA), low to medium carbon steel grade with improved strength due to fine grain size.

B. SS175 = 11,000 ft-lb; SS200 = 16,000 ft-lb; SS225 = 23,000 ft-lb
Minimum yield strength = 90 ksi

C. *Type RS3500 3-1/2" OD Material*: Shall be structural steel tube or pipe, seamless or straight-seam welded, per ASTM A53, A252, ASTM A500, or ASTM A618. Wall thickness is 0.300" (schedule 80).

Torque strength rating = 13,000 ft-lb
Minimum yield strength = 50 ksi

D. *Type RS4500 4-1/2" OD Material*: Shall be structural steel tube or pipe, seamless or straight-seam welded, per ASTM A500 or A513. Wall thickness is 0.337" (schedule 80).

Torque strength rating = 23,000 ft-lb
Minimum yield strength = 50 ksi

2.02 Helix Bearing Plate:

Shall be hot rolled carbon steel sheet, strip, or plate formed on matching metal dies to true helical shape and uniform pitch. Bearing plate material shall conform to the following ASTM specifications.

A. *SS150 and SS175 Material*: Per ASTM A656 or A1018 with minimum yield strength of 80 ksi. Plate thickness is 3/8" or ½".
B. *SS200 and SS225 Material*: Per ASTM A656 or A1018 with minimum yield strength of 80 ksi. Plate thickness is ½".
C. *RS2875 Material*: Per ASTM A36, or A572, with minimum yield strength of 36 ksi. Plate thickness is 3/8" or ½".
D. *RS3500 Material*: Per ASTM A36, or A572, or A1018, or A656 depending on helix diameter, per the minimum yield strength requirements cited above. Plate thickness is 3/8" or ½".
E. *RS4500 Material*: Per ASTM A572 with minimum yield strength of 50 ksi. Plate thickness is ½".

2.03 Bolts:

The size and type of bolts used to connect the central steel shaft sections together shall conform to the following ASTM specifications.

A. *SS175 1-3/4" Material*: 7/8" diameter bolt per ASTM A193 Grade B7.
B. *SS200 2" Material*: 1-1/8" diameter bolt per ASTM A193 Grade B7.
C. *SS225 2-1/4" Material*: 1-1/4" diameter bolt per ASTM A193 Grade B7.
D. *RS3500 3-1/2" OD Material*: ¾" diameter bolts (3 or 4 per coupling) per SAE J429 Grade 5 or 8.
E. *RS4500 4-1/2" OD Material*: ¾" diameter bolts (4 per coupling) per SAE J429 Grade 8.

2.04 Couplings:

For type SS175, SS200, and SS225 material, the coupling shall be formed as an integral part of the plain and helical extension material as hot upset forged sockets.

For Type RS2875, RS3500, and RS4500 material, the couplings shall either be formed as an integral part of the plain and helical extension material as hot forge expanded sockets, or as internal sleeve wrought steel connectors. The steel connectors can be either tubing or solid steel bar with holes for connecting shaft sections together.

2.05 Plates, Shapes, or Pile Caps:

Depending on the application, the pile cap shall be a welded assembly consisting of structural steel plates and shapes designed to fit the pile and transfer the applied load. Structural steel plates and shapes for HELICAL PILE top attachments shall conform to ASTM A36 or ASTM A572 Grade 50.

2.06 Water

Water for mixing grout shall be potable, clean and free from impurities, which may be detrimental to grout or steel. Potable water shall be available in quantities sufficient to mix grout and for equipment clean-up.

2.07 Cement

Cement for helical pile grout shall be Portland cement conforming to ASTM C150 Type I or Type II. Pre-packaged, non-shrink cement grouts shall be subject to the review and acceptance of the Owner, and shall conform to the requirements of ASTM C1107.

2.08 Admixtures

Chemical admixtures for grout shall conform to the requirements of ASTM C494. Chemical admixtures which control bleed water, improve consistency, reduce water/cement ratio, and retard set may be used in the grout subject to the review and acceptance of the Owner. Expansive admixtures can be used to fill confined areas of the central steel shaft coupling joints, or to compensate for drying shrinkage. Accelerators shall not be permitted. Chemical admixtures, if used, shall be compatible with the central steel shaft and mixed in accordance with the grout manufacturer's recommendations.

Mineral admixtures for grout shall conform to the requirements of ASTM C618 (coal fly ash) or C1240 (silica fume). Mineral admixtures, which provide thixotropic consistency, reduce porosity, increase compressive strength, and resist segregation may be used in the grout subject to the review and acceptance of the Owner. Mineral admixtures, if used, shall be compatible with the central steel shaft and mixed in accordance with the grout manufacturer's recommendations.

2.09 Aggregate

Sand fillers may be used in the grout mix as an extender with large diameter grout columns, subject to the approval of the Owner. Use fine sand only. Medium or coarse sand shall not be permitted. Small diameter grout columns shall not include aggregate.

PART 3 EXECUTION

3.01 Site Conditions

A. Prior to commencing Helical Pile installation, the Contractor shall inspect the work of all other trades and verify that all said work is completed to the point where Helical Piles may commence without restriction.

B. The Contractor shall verify that all Helical Piles may be installed in accordance with all pertinent codes and regulations regarding such items as underground obstructions, right-of-way limitations, utilities, etc.

C. In the event of a discrepancy, the Contractor shall notify the Architect. The Contractor shall not proceed with Helical Pile installation in areas of discrepancies until said discrepancies have been resolved. All costs associated with unresolved discrepancies shall be the responsibility of the Architect.

3.02 Installation Equipment

A. Shall be rotary type, hydraulic power driven torque motor with clockwise and counter-clockwise rotation capabilities. The torque motor shall be capable of continuous adjustment to revolutions per minute (RPM's) during installation. Percussion drilling equipment shall not be permitted. The torque motor shall have torque capacity 15% greater than the torsional strength rating of the central steel shaft to be installed.

B. Equipment shall be capable of applying adequate down pressure (crowd) and torque simultaneously to suit project soil conditions and load requirements. The equipment shall be capable of continuous position adjustment to maintain proper Helical Pile alignment.

3.03 Installation Tooling

A. Shall consist of a Kelly Bar Adapter (KBA) and Type SS or RS drive tools as manufactured by CHANCE Civil Construction or approved equal and used in accordance with the manufacturers written installation instructions.

B. A torque indicator shall be used during Helical Pile installation. The torque indicator can be an integral part of the installation equipment or externally mounted in-line with the installation tooling.

1. Shall be capable of providing continuous measurement of applied torque throughout the installation.
2. Shall be capable of torque measurements in increments of at least 500 ft-lb
3. Shall be calibrated prior to pre-production testing or start of work. Torque indicators which are an integral part of the installation equipment, shall be calibrated on-site. Torque indicators which are mounted in-line with the installation tooling, shall be calibrated either on-site or at an appropriately equipped test facility. Indicators that measure torque as a function of hydraulic pressure shall be calibrated at normal operating temperatures.
4. Shall be re-calibrated, if in the opinion of the Architect and/or Contractor reasonable doubt exists as to the accuracy of the torque measurements.

3.04 Installation Procedures

A. Central Steel Shaft: (Lead and Extension Sections)

1. The Helical Pile installation technique shall be such that it is consistent with the geotechnical, logistical, environmental, and load carrying conditions of the project.
2. The lead section shall be positioned at the location as shown on the working drawings. Battered Helical Piles can be positioned perpendicular to the

ground to assist in initial advancement into the soil before the required batter angle shall be established. The Helical Pile sections shall be engaged and advanced into the soil in a smooth, continuous manner at a rate of rotation of 5 to 20 RPM's. Extension sections shall be provided to obtain the required minimum overall length and installation torque as shown on the working drawings. Connect sections together using coupling bolt(s) and nut torqued to 40 ft-lb.

3. Sufficient down pressure shall be applied to uniformly advance the Helical Pile sections approximately 3 inches per revolution. The rate of rotation and magnitude of down pressure shall be adjusted for different soil conditions and depths.

B. Grout

1. Grout shall be mixed with equipment capable of providing a steady supply at the required level of production. The water – cement ratio for neat cement grouts is typically between 0.4 and 0.5. When using a pre-packaged grout, the recommended water-cement ratios listed in the mixing instructions on the package shall be followed.
2. The grout shall be placed via a gravity fed reservoir located at the surface. The reservoir shall consist of a temporary casing or form, which is capable of containing liquid grout. The reservoir shall be appropriately sized (diameter and length) to accommodate the soil conditions and grout column diameter. The grout shall be placed in reservoir immediately prior to the advancement of the first LDP into the soil. The volume of grout contained in the reservoir shall be maintained at a level sufficient to maintain positive hydrostatic pressure on the grout column.
    a. Grout placement shall continue until the minimum grout column length has been achieved as shown on the working drawings. Volume measurements shall be taken throughout the installation in order to determine the actual grout column diameter.
    b. Grout shall be allowed to attain the minimum design strength prior to being loaded.

C. Casing

1. If required, casing shall be installed in segments corresponding to the sections of the central steel shaft.
2. The casing shall be advanced into the soil via direct connection with lead and extension displacement plates.
3. Each casing segment shall be filled with grout immediately after placement.

3.05 Termination Criteria

A. The torque as measured during the installation shall not exceed the torsional strength rating of the central steel shaft.

B. The minimum installation torque and minimum overall length criteria as shown on the working drawings shall be satisfied prior to terminating the Helical Pile installation.

C. If the torsional strength rating of the central steel shaft and/or installation equipment has been reached prior to achieving the minimum overall length required, the Contractor shall have the following options:

1. Terminate the installation at the depth obtained subject to the review and acceptance of the Architect, or:
2. Remove the existing Helical Pile and install a new one with fewer and/or smaller diameter helix plates. The new helix configuration shall be subject to review and acceptance of the Architect. If re-installing in the same location, the top-most helix of the new Helical Pile shall be terminated at least (3) three feet beyond the terminating depth of the original Helical Pile.

D. If the minimum installation torque as shown on the working drawings is not achieved at the minimum overall length, and there is no maximum length constraint, the Contractor shall have the following options:

1. Install the Helical Pile deeper using additional extension sections, or:
2. Remove the existing Helical Pile and install a new one with additional and/or larger diameter helix plates. The new helix configuration shall be subject to review and acceptance of the Architect. If re-installing in the same location, the top-most helix of the new Helical Pile shall be terminated at least (3) three feet beyond the terminating depth of the original Helical Pile.
3. De-rate the load capacity of the Helical Pile and install additional Helical Pile(s). The de-rated capacity and additional Helical Pile location shall be subject to the review and acceptance of the Architect.

E. If the Helical Pile is refused or deflected by a subsurface obstruction, the installation shall be terminated and the pile removed. The obstruction shall be removed, if feasible, and the Helical Pile re-installed. If the obstruction can't be removed, the Helical Pile shall be installed at an adjacent location, subject to review and acceptance of the Architect.

F. If the torsional strength rating of the central steel shaft and/or installation equipment has been reached prior to proper positioning of the last plain extension section relative to the final elevation, the Contractor may remove the last plain extension and replace it with a shorter length extension. If it is not feasible to remove the last plain extension, the Contractor may cut said extension shaft to the correct elevation. The Contractor shall not reverse (back-out) the Helical Pile to facilitate extension removal.

G. The average torque for the last three feet of penetration shall be used as the basis of comparison with the minimum installation torque as shown on the working drawings. The average torque shall be defined as the average of the last three readings recorded at one-foot intervals.

END OF SECTION

SECTION 321216

BITUMINOUS CONCRETE PAVEMENT

PART 1 GENERAL

1.00 GENERAL PROVISIONS

A. Attention is directed to the PROCUREMENT AND CONTRACTING REQUIREMENTS and all Sections within DIVISION 01, GENERAL REQUIREMENTS, which are made a part of this Section of the Specifications.

1.01 WORK INCLUDED

A. Provide all equipment and materials, and do all work necessary to construct the bituminous concrete paving, including new pavement following curb installation, as indicated on the Drawings and as specified.

1.02 RELATED WORK

A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that relate directly to work of this Section include, but are not limited to:

1. Section 014000, QUALITY REQUIREMENTS; Inspection and testing.
2. Section 312300, SITE EXCAVATING, BACKFILLING AND COMPACTING; Establishment of subgrade elevations; geotextile fabric.

1.03 REFERENCES

A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.

1. American Association of State Highway and Transportation Officials (AASHTO):

M 20	Penetration Graded Asphalt Cement
M 81	Cut-Back Asphalt (Rapid Curing Type)
M 140	Emulsified Asphalt

2. American Society for Testing and Materials (ASTM):

D 1557	Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3))

3. Federal Specifications (Fed. Spec.):

SS-S-1401	Sealing Compound, Hot Applied, for Concrete and

4. New York State Department of Transportation (NYSDOT):

Specifications	Standard Specifications - Construction and Materials.

1.04 QUALITY ASSURANCE

A. Unless otherwise specified, work and materials for construction of the asphaltic concrete paving shall conform to the applicable portions of the following:

1. NYSDOT Specifications Sections 402 and 403.

B. Paving work, base course etc., shall be done only after excavation and construction work which might injure them has been completed. Damage caused during construction shall be repaired before acceptance.

C. Repair and replace existing paving areas damaged and removed during this Project. Workmanship and materials for such repair and replacement shall match those employed in existing work, except as otherwise noted.

D. Pavement subbase shall not be placed on a muddy or frozen subgrade.

E. Existing pavement under state or local jurisdiction shall, if damaged or removed during the course of this project, be repaired or replaced under this section of the specification in conformance with applicable codes, standards, and practices.

F. Manufacturer Qualifications: A qualified manufacturer.

1. Manufacturer shall be a paving-mix manufacturer registered with and approved by authorities having jurisdiction or the DOT of the state in which Project is located.

G. The Owner reserves the right to retain an independent testing laboratory to perform inspection and testing of paving and associated work in accordance with Section 014000, QUALITY CONTROL.

H Asphalt-Paving Publication: Comply with AI MS-22, "Construction of Hot Mix Asphalt Pavements," unless more stringent requirements are indicated.

I. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01, GENERAL REQUIREMENTS.

1.05 SUBMITTALS

A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.

B. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.

C. Shop Drawings: Indicate pavement markings, lane separations, and defined parking spaces. Indicate, with international graphics symbol, spaces dedicated to people with disabilities.

D Samples: For each paving fabric, 12 by 12 inches (300 by 300 mm) minimum.

E. Qualification Data: For manufacturer.

F. Material Certificates: For each paving material, signed by manufacturers.

1.06 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp or if the following conditions are not met:

1. Prime and Tack Coats: Minimum surface temperature of 60 deg F (15.5 deg C).
2. Slurry Coat: Comply with weather limitations of ASTM D 3910.
3. Asphalt Base Course: Minimum surface temperature of 40 deg F (4 deg C) and rising at time of placement.
4. Asphalt Surface Course: Minimum surface temperature of 60 deg F (15.5 deg C) at time of placement.

PART 2 PRODUCTS

2.01 AGGREGATE (GRAVEL) BASE COURSE

A. Off-site material for aggregate base course shall be a graded, granular, non-frost susceptible, free-draining material, consisting of either durable stone and coarse sand or of blast furnace slag, practically free from loam and clay, and which can be readily compacted to form a stable foundation.

1. Material shall conform to NYSDOT Specifications Section 304, Type 2.

2.02 ASPHALTIC CONCRETE

A. Asphaltic concrete shall be produced from a minimum of 25% post consumer recycled asphalt.

B. Asphaltic concrete shall be a standard plant-mixed, hot-laid paving material for road work, consisting of clean, crushed rock aggregate, mineral filler, and asphalt conforming to NYSDOT Specifications Section 403.

1. Binder or bottom course paving for entry drive, parking lots, and walkways shall conform to NYSDOT Specifications Section 403.138902 M – Hot Mix Asphalt, Type 3, "Binder".
2. Top or wearing course paving for entry drive, parking lots, and walkways shall conform to NYSDOT Specifications Section 403.198902 M – Hot Mix Asphalt, Type 7, "Top".

C. Complete job mix formula, listing quantities and pertinent ingredient properties, shall be submitted to and approved by Architect at least two weeks before work is scheduled to begin.

2.03 BITUMINOUS MATERIALS

A. Prime Coat: Bituminous material for prime coat shall be one of the following:

1. Cut-back asphalt (rapid-curing type) conforming to AASHTO M 81, Grade RC-70 or RC-250.
2. Emulsified asphalt rapid-setting type conforming to AASHTO M 140, Grade RS-1.

B. Tack Coat: ASTM D 977 or AASHTO M 140, emulsified asphalt or ASTM D 2397 or AASHTO M 208, cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.

C. Bituminous material for tack coat shall be emulsified asphalt rapid-setting type conforming to AASHTO M 140, Grade RS-1.

D. Bitumen shall be a rapid-setting type emulsified asphalt conforming to AASHTO M 140, Grade RS-1.

E. Bituminous crack sealer shall be a hot-applied bituminous sealer conforming to Fed. Spec. SS-S-1401.

PART 3 EXECUTION

3.01 GRADING

A. Areas to be paved will be compacted and brought approximately to subgrade elevation under Section 312300, SITE EXCAVATING, BACKFILLING AND COMPACTING before work of this section is performed. Final fine grading, filling, and compaction of subgrade to receive paving, as required to form a firm, uniform, accurate, and unyielding subgrade at required elevations and to required lines, shall be done under this Section.

B. Existing subgrade material which will not readily compact as required shall be removed and replaced with satisfactory materials. Additional materials needed to bring subgrade to required line and grade and to replace unsuitable material removed shall be material conforming to Section 312300, SITE EXCAVATING, BACKFILLING AND COMPACTING.

C. Subgrade of areas to be paved shall be recompacted as required to bring top 8 in. of material immediately below gravel base course to a compaction of at least 90% of maximum density, as determined by ASTM D 1557, Method D. Subgrade compaction shall extend for a distance of at least 1 ft. beyond pavement edge.

D. Excavation required in pavement subgrade shall be completed before fine grading and final compaction of subgrade are performed. Where excavation must be performed in completed subgrade or subbase subsequent backfill and compaction shall be performed as directed by the Architect as specified in Section 312300, SITE EXCAVATING, BACKFILLING AND COMPACTING. Completed subgrade after filling such areas shall be uniformly and properly graded.

E. Areas being graded or compacted shall be kept shaped and drained during construction. Ruts greater than or equal to 2 in. deep in subgrade, shall be graded out, reshaped as required, and recompacted before placing pavement.

F. Materials shall not be stored or stockpiled on subgrade.

G. Disposal of debris and other material excavated and/or stripped under this section, and material unsuitable for or in excess of requirements for completing work of this Section shall be managed in accordance with Section 01570, CONSTRUCTION WASTE MANAGEMENT.

H. Prepared subgrade will be inspected by the Architect. Subgrade shall be approved by the Architect before installation of paving base course. Disturbance to subgrade caused by inspection procedures shall be repaired under this Section of the specification.

3.02 AGGREGATE BASE COURSES

A. Aggregate base courses for paving and the spreading, grading, and compaction methods employed shall conform to standard requirements for usual base course of this type for first class road work, and the following:

1. NYSDOT Specifications Section 304.

B. Compaction of aggregate base courses shall be to 95% of maximum density as determined by ASTM D 1557, Method D. Stone greater than 2-1/2 in. shall be excluded from course.

C. Width of base course shall be greater than or equal to the width of pavement surface, if continuous lateral support is provided during rolling, and shall extend at least 2 x base thickness beyond edge of the course above, if not so supported.

D. Aggregate materials shall be applied in lifts less than or equal to 4 in. thick, compacted measure. Each lift shall be separately compacted to specified density, using a 6 ton steel wheel roller or vibratory roller equivalent to a 6 ton static roller, or an approved equivalent.

1. Material shall be placed adjacent to wall, manhole, catch basin, and other structures only after they have been set to required grade and level.
2. Rolling shall begin at sides and progress to center of crowned areas, and shall begin on low side and progress toward high side of sloped areas. Rolling shall continue until material does not creep or wave ahead of roller wheels.
3. Surface irregularities which exceed 1/2 in. measured by means of a 10 ft. long straightedge shall be replaced and properly compacted.

E. Subgrade and base course shall be kept clean and uncontaminated. Less select materials shall not be permitted to become mixed with gravel. Materials spilled outside pavement lines shall be removed and area repaired.

F. Portions of subgrade or of construction above which become contaminated, softened, or dislodged by passing of traffic, or otherwise damaged, shall be cleaned, replaced, and otherwise repaired to conform to the requirements of this specification before proceeding with next operation.

3.03 SURFACE PREPARATION

A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

1. Sweep loose granular particles from surface of unbound-aggregate base course. Do not dislodge or disturb aggregate embedded in compacted surface of base course.

B. Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.15 to 0.50 gal./sq. yd. (0.7 to 2.3 L/sq. m). Apply enough material to penetrate and seal but not flood surface. Allow prime coat to cure for 72 hours minimum.

1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
2. Protect primed substrate from damage until ready to receive paving.

C. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd. (0.2 to 0.7 L/sq. m).

1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.04 ASPHALTIC PAVING

A. Asphaltic paving mixture, equipment, methods of mixing and placing, and precautions to be observed as to weather, condition of base etc., shall conform to standard practice for first class road work, and NYSDOT Specifications Section 400, "Bituminous Pavements".

B. Complete job mix formula, listing quantities and pertinent ingredient properties, shall be submitted to and approved by Architect at least two weeks before work is scheduled to begin.

C. Asphaltic binder and wearing surface courses shall each be applied individually, in single lifts of full thickness indicated on the Drawings.

D. Work shall not be performed during rainy weather or when temperature is less than 40^{o} F.

E. Adjacent concrete work, etc., shall be protected from stain and damage during entire operation. Damaged and stained areas shall be replaced or repaired to equal their original condition.

F. Existing paved surfaces to be resurfaced shall be cleaned of foreign and objectionable matter with blowers, power brooms, or hand brooms immediately before applying bituminous pavement. Cracks shall be cleaned and bituminous crack sealer applied to fully seal pavement.

G. The surface of the pavement to be resurfaced shall receive a bituminous prime coat before laying asphaltic binder course. Prime coat shall be applied at rate which will leave asphaltic residue of 5 to 7 gal./100 sq. yd. after evaporation of vehicle. Base surface shall be dry and clean when prime coat is applied. Asphaltic paving material shall not be placed until vehicle has completely evaporated from prime coat. Adjoining new paving shall be placed before prime coat has dried or dusted over.

H. Deliveries shall be timed to permit spreading and rolling all material during daylight hours, unless artificial light, satisfactory to Architect, is provided. Loads which have been wet by rain or otherwise will not be accepted. Hauling over freshly laid or rolled material will not be permitted.

I. Placing and rolling of mixture shall be as nearly continuous as possible. Rolling shall begin as soon after placing as mixture will bear the operation without undue displacement. Delays in rolling freshly spread mixture will not be permitted. Rolling shall proceed longitudinally, starting at edge of newly placed material and proceeding toward previously rolled areas. Rolling overlap on successive strips shall be greater than or equal to 1/2 width of roller rear wheel. Alternate trips of roller shall be of slightly different lengths. Corrections required in surface shall be made by removing or adding materials before rolling is completed. Skin patching of areas where rolling has been completed will not be permitted. Course shall be subjected to diagonal rolling, crossing lines of the first rolling while mixture is hot and in compactable condition. Displacement of mixture or other fault shall be corrected at once by use of rakes and application of fresh mixture or removal of mixture, as required. Rolling of each course shall be continued until roller marks are eliminated. Roller shall pass over unprotected edge of course only when paving is to be discontinued for sufficient time to permit mixture to become cold.

J. In places not accessible to roller, mixture shall be compacted with hand tampers. Hand tampers shall weigh at least 50 lb. and shall have a tamping face less than or equal to 100 sq. in. Mechanical tampers capable of equal compaction will be acceptable in areas in which they can be employed effectively.

K. Portions of pavement courses which become mixed with foreign material or are in any way defective shall be removed, replaced, replaced with fresh mixture, and compacted to density of surrounding areas. Asphaltic material spilled outside lines of finished pavement shall be immediately and completely removed. Such material shall not be employed in the work.

L. Joints shall present same texture, density, and smoothness as other sections of the course. Continuous bond shall be obtained between portions of existing and new pavements and between successive placements of new pavement. New material at joints shall be thick enough to allow for compaction when rolling. Compaction of pavement, base, and subgrade at joints shall be such that there is no yielding of new pavement relative to existing pavement when subjected to traffic. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions with same texture and smoothness as other sections of hot-mix asphalt course.

1. Clean contact surfaces and apply tack coat to joints.
2. Offset longitudinal joints, in successive courses, a minimum of 6 inches (150 mm).
3. Offset transverse joints, in successive courses, a minimum of 24 inches (600 mm).
4. Construct transverse joints as described in AI MS-22, "Construction of Hot Mix Asphalt Pavements."

5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
6. Compact asphalt at joints to a density within 2 percent of specified course density.

M. Contact surfaces of previously constructed pavement (if greater than or equal to seven days since binder placed), manholes, and similar structures shall be thoroughly cleaned and painted with a thin uniform coating of bitumen immediately before fresh mixture is placed. Tack coat shall be applied at rate which will leave asphaltic residue of 5 to 7 gal./100 $yd.^2$ after evaporation of vehicle. Base surface shall be dry and clean when tack coat is applied. Asphaltic paving material shall not be placed until vehicle has completely evaporated from tack coat. Adjoining new paving shall be placed before tack coat has dried or dusted over.

N. Earth or other approved material shall be placed along pavement edges in such quantity as will compact to thickness of course being constructed, allowing at least 1 ft. of shoulder width to be rolled and compacted simultaneously with rolling and compacting surface. Pavement edge shall be trimmed neatly to line before placing earth or other approved material along edge.

1. After final rolling, vehicular traffic shall not be permitted on pavement until it has cooled and hardened, and in no case less than six hours.

O. Variations in smoothness of finished surface shall be less than or equal to the following tolerances when tested with a 10 ft. straightedge, applied both parallel to and at right angles to centerline of paved area.

1. For surface course - 1/4 in. in 10 ft.
2. At joint with existing pavement, and at other locations where an essentially flush transition is required, pavement elevation tolerance shall not exceed 0.01 ft.
3. At other areas pavement elevation tolerance shall not exceed $\pm$ 0.05 ft.
4. Irregularities exceeding these amounts or which retain water on surface shall be corrected by removing defective work and replacing with new material conforming to this Section.
5. The rubberized surface contractor shall review and approve the finished asphaltic concrete surface prior to acceptance of the work of this Section by the Architect.

3.05 REPAIRS TO EXISTING PAVEMENT

A. Subgrade shall be done in strict accordance with Paragraph 3.01, above.

B. Aggregate base course shall be replaced in strict conformance with Paragraph 3.03, above.

C. Asphaltic concrete paving mixture, equipment, and methods of mixing and placing shall conform to NYSDOT Specifications Section 400, "Bituminous Pavements".

3.06 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and to prepare test reports.

1. Testing agency will conduct and interpret tests and state in each report whether tested Work complies with or deviates from specified requirements.

B. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

C. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.

D. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.

E. Revise methods of verifying field compaction if using the Superpave mix design system. Consult state or local DOT for methods that have been successfully used.

F. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to ASTM D 979 or AASHTO T 168.

1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.
2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.
    a. One core sample will be taken for every 1000 sq. yd. (836 sq. m) or less of installed pavement, with no fewer than 3 cores taken.
    b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.

G. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

END OF SECTION

SECTION 321313

PORTLAND CEMENT CONCRETE PAVEMENT

PART 1 GENERAL

1.00 GENERAL PROVISIONS

A. Attention is directed to the PROCUREMENT AND CONTRACTING REQUIREMENTS and all Sections within DIVISION 01, GENERAL REQUIREMENTS, which are made a part of this Section of the Specifications.

1.01 WORK INCLUDED

A. Provide all equipment and materials and do all work necessary to construct the Portland cement concrete paving work, complete, as indicated on the Drawings and as specified. Portland cement concrete paving shall include but not be limited to: pedestrian concrete walkways and sidewalks.

1.02 RELATED WORK

A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:

1. Section 014000, QUALITY REQUIREMENTS; Inspection and testing.
2. Section 312300, SITE EXCAVATING, BACKFILLING AND COMPACTING; Establishment of subgrade elevations; geotextile fabric.
3. Section 033001, CAST-IN-PLACE CONCRETE – SITEWORK; Below grade bases and slabs.
4. Section 079200, EXTERIOR SEALANTS.

1.03 REFERENCES

A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.

1. American Concrete Institute (ACI):

301	Specifications for Structural Concrete for Buildings
305R	Hot Weather Concreting
306R	Cold Weather Concreting
325.9R	Guide for Construction of Concrete Pavements and Concrete Bases.

2. American Society for Testing and Materials (ASTM):

A 185	Welded Steel Wire Fabric for Concrete Reinforcement
A 615	Deformed and Plain Billet - Steel Bars for Concrete Reinforcement
C 33	Concrete Aggregates
C 94	Ready-Mixed Concrete
C 143	Slump of Portland Cement Concrete
C 150	Portland Cement
C 171	Sheet Materials for Curing Concrete
C 231	Air Content of Freshly Mixed Concrete by the Pressure Method
C 260	Air Entraining Admixtures for Concrete
C 309	Liquid Membrane-Forming Compounds for Curing Concrete
C 494	Chemical Admixtures for Concrete
C 920	Elastomeric Joint Sealants
C 962	Guide for Use of Elastomeric Joint Sealants
D 226	Asphalt-Saturated Organic Roofing Felt for Use in Membrane Waterproofing and Built-Up Roofing
D 1557	Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3))
D 1752	Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

3. Americans with Disabilities Act (ADA):

Appendix to Part 1191	Accessibility Guidelines for Buildings and Facilities

4. New York State Department of Transportation (NYSDOT):

Specifications	Standard Specifications - Construction and Materials

5. Corps of Engineers (COE):

CRD-C 621	Specification for Nonshrink Grout: Hardened State Volume Change

6. Federal Specifications (Fed Spec.):

TT-S-00227	Sealing Compound: Elastomeric Type, Multi-Component (For Calking, Sealing, and Glazing in Buildings and other Structures)

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products who complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

B. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.

C. ACI Publications: Unless otherwise specified, work and materials for construction of the Portland cement concrete paving shall conform to ACI 325.9R.

D. Work, materials, and color of the handicap ramp paving shall conform to applicable sections of Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities.

E. Paving work, base course etc., shall be done only after excavation and construction work which might injure them have been completed. Damage caused during construction shall be repaired before acceptance.

F. Existing paving areas shall, if damaged or removed during course of this project, be repaired or replaced under this section of the specification. Workmanship and materials for such repair and replacement, except as otherwise noted, shall match as closely as possible those employed in existing work.

G. Pavement, base, or subbase shall not be placed on a muddy or frozen subgrade.

1.05 PRECONSTRUCTION MOCK-UP PANELS

A. General

1. Schedule mock-up casting for acceptance 30 days prior to casting of concrete surfaces represented by the mockups.
2. Locate mock-up panels in non-public areas accepted by the Architect.

3. Continue to cast mock-ups until acceptable mock-ups area produced. Accepted mock-ups shall be the standard for color, texture, and workmanship for the work.
4. Mock-up sequence of forming, placing, form removal, curing, and finishing shall be reviewed and accepted by the Architect.
5. Mock-up formwork shall be inspected and accepted by the Architect before placing of concrete.
6. Use the same concrete mixes and placement procedures, accepted in mock-ups, in the final work, unless otherwise directed by the Architect.
7. Protect accepted mock-ups from damage until completion and acceptance of the work represented by the mock-up.
8. Remove mock-up panels from site at completion of project, as directed by the Architect.

B. Construct mock-up panels or areas as indicated to demonstrate the ability to cast concrete for concrete paving to achieve shape, color, and textured finish required. Mock-ups shall include or meet the following requirements:

1. Provide 8 ft. x 8 ft. mock-up panel.
2. Provide mock-ups simulating actual design and execution conditions for concrete mix materials, reinforcement, formwork, placing sequence, form removal, curing, finishing, and methods and materials of stain removal and correction of defective work.
3. On mock-ups where directed by the Architect, provide minimum of three variation of mix color to be used in the repair of defective work, in order to determine acceptable color and texture match.
4. Demonstrate in the construction of the mock-up formwork the sealer material, form release agent, and curing materials and methods to be used.

C. Source of Materials. Utilize the same source, stock, or brand of concrete materials for each class or mix of concrete which is to be exposed. Do not interchange materials or mixes until an additional mock-up shows that uniformity in finish texture and color, as compared to original mock-up will be maintained. If necessary, obtain and stockpile materials in sufficient quantity to ensure continuity and uniformity.

1.05 SUBMITTALS

A. Description of Methods and Sequence of Placement. For each type of specially-finished concrete provide description of methods and sequence of placement.

B. Submit manufacturer's product data for the following:

1. Form release agent.
2. Concrete coloring additive.
3. Preformed joint filler.
4. Sealants.

C. Submit samples of the following:

1. Preformed joint filler.
2. Color chart for selection of sealant color.

D. Design Mixtures: For each concrete pavement mixture. Include alternate mixture designs when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1.06 TESTING AND INSPECTION

A. The Owner reserves the right to inspect and test paving and associated work in accordance with Section 010000, GENERAL REQUIREMENTS.

PART 2 - PRODUCTS

2.01 AGGREGATE BASE COURSE

A. Material for aggregate base course shall be a graded, granular, free-draining material, consisting of either durable stone and coarse sand or of blast furnace slag, practically free from loam and clay, and which can be readily compacted to form a stable foundation.

1. Material shall confom to NYSDOT Specifications Section 304, Type 2.

2.02 STEEL REINFORCEMENT

A. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 60 percent.

B. Welded wire fabric reinforcement shall conform to the following applicable requirements. Fabric reinforcement shall be furnished in flat sheets. Fabric reinforcement in rolls will not be permitted.

1. Plain-Steel Welded Wire Reinforcement: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.

C. Joint Dowel Bars: Plain steel bars, ASTM A 615/A 615M, Grade 60 (Grade 420). Cut bars true to length with ends square and free of burrs.

D. Epoxy-Coated Joint Dowel Bars: ASTM A 775/A 775M; with ASTM A 615/A 615M, Grade 60 (Grade 420), plain steel bars.

E. Tie Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

F. Epoxy Repair Coating: Liquid two-part epoxy repair coating, compatible with epoxy coating on reinforcement.

G. Zinc Repair Material: ASTM A 780.

2.03 PORTLAND CEMENT CONCRETE

A. Portland cement concrete for pavements and slabs shall be air-entrained type with a maximum water-cement ratio of 0.50 conforming to ACI 325.9R. Minimum compressive strengths at 28 days shall be as follows: Flexural strength with third point loading - 650 psi; compressive strength - 4000 psi.

1. Concrete shall be air-entrained type, conforming to ASTM C 94. Air content by volume shall be 6% + 1%, and shall be tested in accordance with ASTM C 231.
2. Concrete slump shall be no less than 2 in. nor greater than 4 in., determined in accordance with ASTM C 143.
3. Cement shall be Portland cement, conforming to ASTM C 150, Type I or II. Only one color of cement, all of the same manufacturer, shall be used for the work. Type III cement shall be used only with the prior approval of the Architect.
4. Fine and coarse aggregates shall conform to ASTM C 33.
5. Concrete shall contain a water reducing agent to minimize cement and water content of the concrete mix at the specified slump. Water reducing agent shall conform to ASTM C 494.
6. No calcium chloride or admixtures containing calcium chloride shall be added to the concrete. No admixtures other than those specified shall be used in the concrete without the specific written permission of the Architect in each case.

2.04 CHEMICAL ADMIXTURES

A. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.

2.05 COLOR ADMIXTURE

A. Color admixture shall be suitable for flatwork concrete and shall meet or exceed the requirements set by Portland Cement Association (PCA) and ASTM C 494.

B. Color admixture shall be of a type and quality which will not adversely affect workability, setting, or strength of concrete. Color pigments shall consist of chemically inert, non-fading, alkali-fast mineral oxides, finely ground and specially prepared for use in both cement and mortar. Admixture shall not contain calcium chloride.

C. Color admixture shall be black iron oxide color additive to match Davis Color #860, manufactured by Davis Colors, 3700 East Olympic Blvd., Los Angeles, CA 90023, or approved equal.

D. Mix design shall conform to manufacturer's recommendations, and directions of the Architect to achieve proposed color. Strictly monitor additive/cement ratio throughout job to ensure uniform color.

2.06 CURING MATERIALS FOR COLORED CONCRETE

A. Concrete colored with pigments or colored cements shall be cured with material recommended by the manufacturer of the pigment or cement to correctly maintain the system concept.

2.07 CURING MATERIALS

A. Curing shall be by moist curing or by use of curing compound.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) dry.

C. Moisture-Retaining Cover: Curing paper shall be nonstaining, fiber reinforced laminated kraft bituminous product conforming to ASTM C 171. Four mil polyethylene sheeting may be substituted for curing paper.

D. Curing compound shall be a resin-base, white pigmented compound conforming to ASTM C 309, Type 2.

E. Water: Potable.

2.08 EXPANSION JOINTS

A. Unless otherwise indicated on the Drawings, expansion joints shall be located 30 ft. o.c., maximum.

B. Expansion joint filler shall be preformed, nonbituminous type joint filler conforming to ASTM D 1752, Type II, similar to Sealtight Cork Expansion Joint Filler, manufactured by W.R. Meadows, Inc., Elgin, IL 60120, or approved equal.

1. Premolded filler shall be one piece for the full depth and width of the joint leaving a sealant recess as indicated.
2. Use of multiple pieces of lesser dimensions to make up required depth and width of joint will not be permitted.
3. Except as otherwise noted on the Drawings, joint filler shall be 3/8 in. thick.

2.09 CONTROL JOINTS

A. Control joints indicated to be sawn shall be made by saw cutting concrete slab after concrete is finished and when the surface is stiff enough to support the weight of workmen without damage to the slab. Saw blade shall cut into slab 25% of slab depth.

2.10 CONSTRUCTION JOINTS

A. Transverse construction joints shall be placed whenever placing of concrete is suspended for more than 30 minutes.

1. Butt joint with dowels or thickened edge joint shall be used if construction joints occurs at location of control joint.
2. Keyed joints with tiebars shall be used if the joint occurs at any other location.

2.11 GROUT

A. Grout shall be mixed in the proportions of one part Portland cement to two parts sand, by volume. Only sufficient water shall be used to enable grout to barely hold its shape when squeezed into a ball in the hand. Sand for grout shall be "Fine Aggregate", conforming to ASTM C 33.

B. Nonshrink grout shall be pre-mixed non-shrinking, high strength grout. Compressive strength in 28 days shall be 5,000 psi minimum, but in no case less than the specified strength of the adjacent concrete. Manufacturer shall provide evidence that the material meets the requirements of the COE CRD-C 621 (558). Grout permanently exposed to view shall be nonoxidizing; metallic grout may be used in other locations.

1. Nonshrink grout shall be one of the following, or approved equal:

Manufacturer	Product
Gifford-Hill Co.	Supreme
Master Builders Co.	Embeco
U.S. Grout Corporation	Five Star Grout

2.12 SEALANT

A. Sealant for sealing of control joints and expansion joints in concrete walks shall be a two component polyurethane based sealant conforming to ASTM C 920 and Section 079200, EXTERIOR SEALANTS.

1. Color of sealant shall be selected by the Architect from the manufacturer's full color range.
2. Primer shall be that recommended by the sealant manufacturer for the use intended.
3. Joint backing where required shall be as recommended by the sealant manufacturer.

2.13 BOND BREAKER

A. Bond breaker shall be asphalt felt conforming to ASTM D 226, Type I or 6 mil polyethylene sheeting.

PART 3 - EXECUTION

3.01 PREPARATION OF SUBGRADE

A. Areas to be paved will be compacted and brought to subgrade elevation under Section 312300, SITE EXCAVATING, BACKFILLING AND COMPACTING before work of this section is performed. Final fine grading, filling, and compaction of areas to receive paving, as required to form a firm, uniform, accurate, and unyielding subgrade at required elevations and to required lines, shall be done under this Section.

B. Existing subgrade material which will not readily compact as required shall be removed and replaced with satisfactory materials. Additional materials needed to bring subgrade to required line and grade and to replace unsuitable material removed shall be material conforming to Section 312300, SITE EXCAVATING, BACKFILLING AND COMPACTING.

C. Subgrade of areas to be paved shall be recompacted as required to bring top 8 in. of material immediately below gravel base course to a compaction at optimum moisture of at least 95% of maximum density, as determined by ASTM D 1557. Subgrade compaction shall extend for a distance of at least 1 ft. beyond pavement edge.

1. Field testing shall be conducted to determine in-place density, accompanied by visual inspection of the compaction methods being used.

D. Excavation required in pavement subgrade shall be completed before fine grading and final compaction of subgrade are performed. Where excavation must be performed in completed subgrade, subbase, base, or pavement, subsequent backfill and compaction shall be performed as directed by the Architect as specified in Section 312300, SITE EXCAVATING, BACKFILLING AND COMPACTING. Completed subgrade after filling such areas shall be uniformly and properly graded.

E. Areas being graded or compacted shall be kept shaped and drained during construction. Ruts greater than or equal to 2 in. deep in subgrade, shall be graded out, reshaped as required, and recompacted before placing pavement.

F. Materials shall not be stored or stockpiled on subgrade.

G. Disposal of debris and other material excavated under this section, and material unsuitable for or in excess of requirements for completing work of this section shall be disposed of off-site.

H. Prepared subgrade will be inspected by the Architect. Subgrade shall be approved by the Architect before installation of gravel base course. Disturbance to subgrade caused by inspection procedures shall be repaired under this section of the specification.

3.02 AGGREGATE BASE COURSE

A. Aggregate base course for paving and the spreading, grading, and compaction methods employed shall conform to standard requirements for usual base course of this type for first class road work, and the following:

1. NYSDOT Specifications Section 304.

B. Width of base course shall be greater than or equal to the width of pavement surface, if continuous lateral support is provided during rolling, and shall extend at least 2 x base thickness beyond edge of the course above, if not so supported.

C. Aggregate material shall be applied in lifts less than or equal to 6 in. thick, compacted measure. Each lift shall be separately compacted to specified density, using a 6 ton smooth drum vibratory roller equivalent to a 6 ton static roller, or an approved equivalent. Smaller areas or areas impossible to reach with large drum rollers shall be compacted to specified density using a vibrating plate compactor.

1. Material shall be placed adjacent to wall, manhole, catch basin, and other structures only after they have been set to required grade and level.
2. Rolling shall begin at sides and progress to center of crowned areas, and shall begin on low side and progress toward high side of sloped areas. Rolling shall continue until material does not creep or wave ahead of roller wheels.
3. Surface irregularities which exceed 1/2 in. as measured by means of a 10 ft. long straightedge, shall be replaced and properly recompacted.

D. Base course shall be compacted at optimum moisture content to not less than 95% of maximum density as determined by ASTM D 1557.

E. Subgrade and base course shall be kept clean and uncontaminated. Less select materials shall not be permitted to become mixed with gravel. Materials spilled outside pavement lines shall be removed and area repaired.

F. Portions of subgrade or of construction above which become contaminated, softened, or dislodged by passing of traffic, or otherwise injured, shall be cleaned, replaced, or otherwise repaired to conform to the requirements of this specification before proceeding with next operation.

3.03 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

B. Before being placed in position, reinforcing for reinforced concrete shall be thoroughly cleaned of loose mill and rust scale, dirt, ice, and other foreign material which may reduce the bond between the concrete and reinforcing. Where there is delay in placing concrete after reinforcement is in place, bars shall be reinspected and cleaned when necessary.

C. Unless otherwise indicated on the Drawings, reinforcing shall extend within 2 in. of formwork and expansion joints. Reinforcing shall continue through control joints. Adjacent sheets of fabric reinforcing shall lap 6 in.

D. After forms have been coated with form release agent, but before concrete is placed, reinforcing steel anchors shall be securely wired in the exact position called for, and shall be maintained in that position until concrete is placed and compacted. Chair bars and supports shall be provided in a number and arrangement satisfactory to the Architect.

E. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

F. Epoxy-Coated Reinforcement: Use epoxy-coated steel wire ties to fasten epoxy-coated reinforcement. Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963/D 3963M.

3.04 PORTLAND CEMENT CONCRETE PAVING

A. Paving mix, equipment, methods of mixing and placing, and precautions to be observed as to weather, condition of base etc., shall meet the requirements of ACI 325.9R. Pavement shall be constructed in accordance with the Drawings.

B. The Architect shall be notified of concrete placement sufficiently in advance of start of operation to allow his representative to complete preliminary inspection of the work, including subgrade, forms, and reinforcing steel, if used.

C. Normal concrete placement procedures shall be followed. Concrete shall arrive at the jobsite so that no additional water will be required to produce the desired slump. When conditions develop that required addition of water to produce the desired slump, permission of the Architect must be obtained. The concrete shall be transported from the mixer to its place of deposit by a method that will prevent segregation or loss of material.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
2. If concrete can not be mechanically consolidated, concrete shall be thoroughly spaded and tamped to secure a solid and homogeneous mass, thoroughly worked around reinforcement and into corners of forms.

E. Work shall not be performed during rainy weather or when temperature is less than 40^{o} F. (4.4^{o} C).

F. Adjacent work, etc., shall be protected from stain and damage during entire operation. Damaged and stained areas shall be replaced or repaired to equal their original conditions.

G. Existing concrete, earth, and other water-permeable material against which new concrete is to be placed shall thoroughly damp when concrete is placed. There shall be no free water on surface.

H. Concrete which has set or partially set before placing shall not be employed. Retempering of concrete will not be permitted.

I. Concrete Wearing Course: When joining fresh concrete to concrete which has attained full set, latter shall be cleaned of foreign matter, and mortar scum and laitance shall be removed by chipping and washing. Clean, roughened base surface shall be saturated with water, but shall have no free water on surface. A coat of 1:1 cement-sand grout, approximately 1/8 in. thick, shall be well scrubbed into thoroughly dampened concrete base. New concrete shall be placed immediately, before grout has dried or set.

3.05 FINISHING

A. Concrete flatwork surfaces shall be screeded off, bullfloated, power or hand floated, troweled and finished true to line and grade, and free of hollows and bumps. Surface shall be dense, smooth, and at exact level and slope required.

1. Finished concrete surface for exposed concrete pavement shall be wood-floated and steel troweled to a smooth surface. Surface shall not deviate more than 1/8 in. in 10 ft.

B. Unless otherwise indicated, horizontal surfaces of concrete surfaces which will be exposed shall be finished as follows:

1. Broom Finish: Light broomed finish, with direction of grooves in concrete surface perpendicular to length of concrete band, slab, or pad. After concrete has set sufficiently to prevent coarse aggregate from being torn from surface, but before it has completely set, brooms shall be drawn across it to produce a pattern of small parallel grooves. Broomed surface shall be uniform, with no smooth, unduly rough or porous spots, or other irregularities. Coarse aggregate shall not be dislodged by brooming operation. No trowel edges shall be leeft visible.
2. Grooved Finish: Grooved finish, with direction of grooves in concrete surface perpendicular to length of concrete band, slab, or pad. After concrete has set sufficiently to prevent coarse aggregate from being torn from surface, but before it has completely set, tines shall be drawn across it to produce a pattern of medium parallel grooves as indicated on the Drawings. Grooved surface shall be uniform, with no smooth, unduly rough or porous spots, or other irregularities. Coarse aggregate shall not be dislodged by grooving operation.

C. Immediately following finishing operations, arrises at edges and both sides of expansion joints shall be rounded to a 1/4 in. radius. Control joints to be tooled shall be scored into slab surface with scoring tool. Adjacent edges of control joint shall at same time be finished to a 1/4 in. radius.

D. Where finishing is performed before end of curing period, concrete shall not be permitted to dry out, and shall be kept continuously moist from time of placing until end of curing period, or until curing membrane is applied.

3.06 CURING

A. It is essential that concrete be kept continuously damp from time of placement until end of specified curing period. It is equally essential that water not be added to surface during floating and troweling operations, and not earlier than 24 hours after concrete placement. Between finishing operations surface shall be protected from rapid drying by a covering of waterproofing paper. Surface shall be damp when the covering is placed over it, and shall be kept damp by means of a fog spray of water, applied as often as necessary to prevent drying, but not sooner than 24 hours after placing concrete. None of the water so applied shall be troweled or floated into surface.

B. Concrete surfaces shall be cured by completely covering with curing paper or application of a curing compound.

1. Concrete cured using waterproof paper shall be completely covered with paper with seams lapped and sealed with tape. Concrete surface shall not be allowed to become moistened between 24 and 36 hours after placing concrete. During curing period surface shall be checked frequently, and sprayed with water as often as necessary to prevent drying, but not earlier than 24 hours after placing concrete.
2. If concrete is cured with a curing compound, compound shall be applied at a rate of 200 sq. ft. per gallon, in two applications perpendicular to each other.
3. Curing period shall be seven days minimum.

3.07 CONSTRUCTION JOINTS

A. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour unless pavement terminates at isolation joints.

1. Continue steel reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of pavement strips, unless otherwise indicated.
2. Provide tie bars at sides of pavement strips where indicated.
3. Butt Joints: Use bonding agent at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
4. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
5. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.08 EXPANSION JOINTS

A. Expansion joints (isolation joints) shall be 3/8 in. wide and unless otherwise indicated on the Drawings, shall be located 30 ft. o.c. and at places where pavement meets other structures. Expansion joint shall be formed in the concrete to required width with preformed joint filler in place. Joint filler shall extend the full width and depth of the slab. Joint filler shall extend the full length of the expansion joint.

1. For concrete pavements, depth of joint filler shall be as required to form a 1-1/4 in. deep sealant and backer rod recess below finished concrete surface.

3.09 CONTROL JOINTS

A. Joints shall be sawn as soon as the concrete will withstand the energy of sawing without raveling or dislodging aggregate particles. For most concrete mixtures, this means sawing should be completed within the first 6 to 18 hours and never delay more than 24 hours. Early-entry saws may be used to allow cutting to begin within a few hours after placement.

B. Control joints indicated shall be sawn 1/8 in. wide by using a diamond blade concrete power saw. Saw shall cut into slab at least 25% of slab depth. Saw cut joints shall be straight and accurate to line.

1. Saw cut joints shall be sawn flush to vertical surfaces.
2. Unless otherwise indicated on the Drawings, control joints in pedestrian pavements shall be located 10 ft. o.c. maximum.
3. Doweled Control Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.10 COLD WEATHER CONCRETING

A. Materials for concrete shall be heated when concrete is mixed, placed, or cured when the mean daily temperature is below 40^{O}F. or is excepted to fall to below 40^{O}F. within 72 hours, and the concrete after placing shall be protected by covering, heat, or both.

B. Details of handling and protecting of concrete during freezing weather shall be subject to the approval and direction of the Architect. Procedures shall be in accordance with provisions of ACI 306R.

3.11 HOT WEATHER CONCRETING

A. Concrete just placed shall be protected from the direct rays of the sun and the forms and reinforcement just prior to placing shall be sprinkled with cold water. Every effort shall be made to minimize delays which will result in excessive mixing of the concrete after arrival on the job.

B. During periods of excessively hot weather (95^{O}F., or above), ingredients in the concrete shall be cooled insofar as possible and cold mxing water shall be used to maintain the temperature of the concrete at permissible levels all in accordance with the provisions of ACI 305. Any concrete with a temperature above 95^{O}F., when ready for placement will not be acceptable, and will be rejected.

C. Temperature records shall be maintained throughout the period of hot weather giving air temperature, general weather conditions (calm, windy, clear, cloudy, etc.) and relative humidity. Records shall include checks on temperature of concrete as delivered and after placing in forms. Data should be correlated with the progress of the work so that conditions surrounding the construction of any part of the structure can be ascertained.

3.12 SEALING OF JOINTS

A. Where indicated on the Drawings, expansion joints and control joints shall be sealed with joint sealant in accordance with Sectionm 079200, EXTERIOR SEALANTS.

3.13 FIELD QUALITY CONTROL

A. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least 1 composite sample for each 5000 sq. ft. or fraction thereof of each concrete mix placed each day.
   a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C 39/C 39M; test 1 specimen at 7 days and 2 specimens at 28 days.
   a. A compressive-strength test shall be the average compressive strength from 2 specimens obtained from same composite sample and tested at 28 days.

C. Strength of each concrete mix will be satisfactory if average of any 3 consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).

D. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.

G. Remove and replace concrete pavement where test results indicate that it does not comply with specified requirements.

H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.14 PROTECTION OF CONCRETE SURFACES

A. Concrete surfaces shall be protected from traffic or damage until surfaces have hardened sufficiently. If necessary 1/2 in. thick plywood sheets shall be used to protect the exposed surface.

B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to pavement with epoxy adhesive.

END OF SECTION

SECTION 321413

CONCRETE UNIT PAVING

PART 1 GENERAL

1.00 GENERAL PROVISIONS

A. Attention is directed to the PROCUREMENT AND CONTRACTING REQUIREMENTS and all Sections within DIVISION 01, GENERAL REQUIREMENTS, which are made a part of this Section of the Specifications.

1.01 WORK INCLUDED

A. Provide all equipment and materials, and do all work necessary to construct the concrete pavers, as indicated on the Drawings and as specified herein. Concrete pavers shall be set as follows:

1. On bituminous setting bed, over concrete base, with sand or polymeric sand swept joints.

1.02 RELATED WORK

A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:

1. Section 014000, QUALITY REQUIREMENTS; Inspection and testing.
2. Section 033001, CAST-IN-PLACE CONCRETE – SITEWORK; Reinforced concrete base slab.
3. Section 334915, DRAINS, GRATES AND FRAMES.

1.03 REFERENCES

A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirement shall govern.

1. American Association of State Highway and Transportation Officials (AASHTO):

M 43	Standard Size of Coarse Aggregate for Highway Construction
M 81	Cut-back Asphalt (Rapid-Curing Type)
M 140	Emulsified Asphalt
M 208	Cationic Emulsified Asphalt

2. American Society for Testing and Materials (ASTM):

C 33	Concrete Aggregates
C 67	Brick and Structural Clay Tile
C 91	Masonry Cement
C 136	Sieve Analysis of Fine and Coarse Aggregates
C 144	Aggregate for Masonry Mortar
C 902	Pedestrian and Light Traffic Paving Brick
C 936	Solid Concrete Interlocking Paving Units
D 36	Softening Point of Bitumen (Ring-and-Ball Apparatus)
D 113	Ductility of Bituminous Materials
D 1557	Moisture-Density Relations of Soils and Soil Aggregate Mixtures Using 10-lb. (4.54-kg) Rammer and 18-in. (457-mm) Drop
D 3381	Viscosity-Graded Asphalt Cement for Use in Pavement Construction.

3. Americans with Disabilities Act (ADA):

Appendix to Part 1191	Accessibility Guidelines for Buildings and Facilities

4. National Concrete Masonry Association (NCMA):

A-10	Solid Concrete Masonry Paving Units

1.04 SUBMITTALS

A. Manufacturer's Product Data: Manufacturer's product data shall be submitted for the following items:

Concrete paver
Neoprene–modified asphalt adhesive
Polymeric sand
Filter fabric
Edge restraint

B. Submit a minimum of three concrete pavers of each type and size required to Architect for approval. Samples shall exhibit the full color range of pavers to be provided.

1. Include as part of the sample submittal at least three individual accent pavers, and at least one fabricated two color combination unit for accent paver.

C. Submit a 1 lb. sample of polymeric sand to Architect for approval.

D. Submit a sample of edge material, 12 in. length, with one stake.

E. Test Report:

1. Test report of precast concrete paver shall be submitted.
2. Testing shall be done by an independent testing laboratory. Test procedures shall conform to ASTM C 936 methods, where applicable.
3. Test report shall indicate, as a minimum, the following:
   a. Compressive strength, psi.
   b. Absorption, 5 hr. submersion in cold water.
   c. Absorption, 24 hr. submersion in cold water.
   d. Maximum saturation coefficient.
   e. Initial rate of absorption (suction).
   f. Abrasion index.
   g. Freeze-thaw.

1.05 FIELD MOCK-UP

A. Prior to start of precast concrete paving the Contractor shall construct a sample panel for use as a prototype for concrete pavers for each application. Each sample panel shall be 8 ft. x 8 ft. minimum. Panel shall exhibit the specified base, thickness, colors, jointing, pattern, finish, surface sealant and workmanship. The Contractor shall not proceed with the precast concrete paving work until the Architect has approved each sample panel. If panel is not acceptable, the Contractor shall construct additional panels as required until an acceptable panel is obtained. The accepted panel shall become the standard for the entire job and shall remain undisturbed until completion of the precast concrete paving.

1. Build mockups in the location and of the size indicated or, if not indicated, as directed by Architect.
2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
3. Demonstrate the proposed range of aesthetic effects and workmanship.
4. Obtain Architect's approval of mockups before starting unit paver installation.
5. Demolish and remove mockups when directed.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed unit paver installations similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Source Limitations: Obtain each type of unit paver, joint material, and setting material from one source with resources to provide materials and products of consistent quality in appearance and physical properties.

1.07 PROJECT CONDITIONS

A. Cold-Weather Protection: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace unit paver work damaged by frost or freezing.

B. Weather Limitations for Bituminous Setting Bed: Comply with the following requirements:

1. Apply asphalt adhesive when ambient temperature is above 50 deg F (10 deg C) and when temperature has not been below 35 deg F (2 deg C) for 12 hours immediately before application. Do not apply when base is wet or contains excess moisture.
2. Install bituminous setting bed only when atmospheric temperature is above 40 deg F (4 deg C) and when base is dry.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Pavers shall be carefully packed and loaded for shipment and all necessary precautions taken against damage in transit and handling.

B. Aggregate materials shall be kept dry and free from soiling.

C. Pavers damaged in any manner will be rejected and replaced with new materials at no additional cost to the Owner.

PART 2 - PRODUCTS

2.01 CONCRETE PAVERS

A. Pavers shall be Hanover Plankstone Paver, 2-7/8 in. x 8-13/16 in. x 4 in., manufactured by Hanover Architectural Products, Inc., 5000 Hanover Road, Hanover, PA 17331; Tel. 717-637-0500; Fax: 717-637-7145; Web; www.hanoverpavers.com,, or approved equal.

1. Pavers shall have 1/16” bevel and hidden spacers. Gauged to1/32 in.
2. Colors:
   a. M3039
   b. M2638

B. Pavers shall be solid concrete unit pavers produced from a single homogenous mix (no lamination) containing laminin and possessing the following physical characteristics:

1. No efflorescence after 7 days exposure to water ASTM C-67
2. UV Resistant ASTM G 154
3. Absorption less than 4% ASTM C 936
4. Average compressive strength 8,000 psi ASTM C 936
5. Average absorption less than 5% ASTM C 936
6. Average Abrasion coefficient .0937 ASTM C 418
7. Static coefficient of friction Dry 1.08 Wet .85 ASTM C 1028
8. Stain resistant ASTM C 1378

2.02 EDGING

A. Edging shall be “StructurEdge”, extruded aluminum, 6063 alloy, T6 hardness aluminum edging, for straight-line and curvilinear applications in corrugated L-shaped profile, manufactured by PermaLoc Corporation, Holland MI 49424, telephone (800) 356-9660; (616) 399-9600, or approved equal. Edging shall be 3/16 in. thick x 1-5/8 in. height. Horizontal base shall have holes spaced 4 inches (102 mm) apart along its length to receive spikes

1. Length: 8 feet (2.44 meters).
2. Connection Method: Section ends shall splice together with horizontal 0.060 inch (1.52 mm) thick x 1 inch (25 mm) wide x 4 inches (102 mm) long aluminum sliding connector.
3. Anchoring: 1 inch or longer Ardox concrete nail or drive pin fastener equal to Hilti DX 40 powder actuated pin, Ramset Trakfast Automatic Fastening System pin, or Tapcon.
4. Finish: Natural Mill Aluminum.

2.03 SAND FOR JOINT FILLER

A. Joint filler shall be Hanover Polymeric Sand for Paving Joints, manufactured by Hanover Architectural Products, Inc., Hanover, PA 17331, or approved equal. Provide the following type:

1. HP POLYMERIC SAND: high-performance mix made of the latest-generation of polymers; specially formulated for the filling of paver or slab joints in heavy-traffic areas. Capable of filling joints up to a maximum width of 1 in. Minimum depth: 1.25 in.

2.04 DRAIN STONE

A. Drain stone for filling vertical weeps shall be crushed stone (peastone) consisting of washed, durable, crushed rock free from fine sand, slit, or rock flour. Gradation shall conform to the following:

Sieve Size	% Passing by Weight
3/4 in.	100
1/2 in.	90-100
3/8 in.	40-70
No. 4	0-15
No. 8	0-5

2.05 FILTER FABRIC

A. Filter fabric shall be a non-woven polypropylene fabric equal to Mirafi 140N, manufactured by Tencate, 365 South Holland Drive, Pendergrass, GA 30567; Tel 800 685 9990; Tel 706 693 2226; Fax 706 693 4400; www.mirafi.com, or approved equal.

2.06 BITUMINOUS SETTING BED

A. Asphalt cement to be used in the bituminous setting bed shall conform to ASTM D 3381. Viscosity grade shall be A.C. 10 or A.C. 20.

B. Fine aggregate to be used in the bituminous setting bed shall be clean, hard sand with durable particles and free from adherent coating, lumps of clay, alkali salts, and organic matter. Aggregate shall be uniformly graded from "coarse" to "fine" with 100% by weight passing the No. 4 sieve and shall meet the gradation requirements when tested in accordance with ASTM C 136 and ASTM D 1073, No. 2 or No. 3..

C. Fine aggregate shall be dried and shall be combined with hot asphalt cement, and the mix shall be heated to approximately 300^{O}F. at an asphalt plant. The approximate proportion of materials shall be 7% cement asphalt and 93% fine aggregate. Each ton of material shall be apportioned by weight in the approximate ratio of 145 lb. asphalt to 1,855 lb. sand. The Contractor shall determine the exact proportions to produce the best possible mixture for construction of the bituminous setting bed to meet specified requirements.

2.07 NEOPRENE-MODIFIED ASPHALT ADHESIVE

A. Paving manufacturer's standard adhesive consisting of oxidized asphalt combined with 2 percent neoprene and 10 percent long-fibered mineral fibers containing no asbestos. Neoprene modified asphalt adhesive shall meet the following requirements:

1. Mastic (asphalt adhesive):
   a. Solids (base) content by volume = 75$\pm$1%.
   b. Weight = 8 to 8.5 lb./gal.
   c. Solvent vehicle = Varsol (over 100^{O}F. flash).
2. Base (2% neoprene, 10% fibers, 88% asphalt):
   a. Melting point (ASTM D 36) = 200^{O}F., minimum.
   b. Penetration at 77^{O}F. 100 gram load 5 second (0.1 mm) = 23 to 27.
   c. Ductility (ASTM D 113 at 25^{O}C, 5 cm/minute) = 125 cm, minimum.

2.08 ASPHALTIC PRIMER

A. Primer for base slab beneath bituminous setting bed and precast concrete pavers shall be an emulsified asphalt rapid setting type conforming to AASHTO M 140, Grade RS-1, or AASHTO M 208, Grade CRS-1.

2.09 WATER

A. Water shall be potable and shall be free of injurious contaminants.

2.10 SURFACE SEALANT

A. Surface sealant shall be water based “Natural Sealer”, manufactured by Hanover Architectural Products, Inc., Hanover, PA 17331, or approved equal.

PART 3 - EXECUTION

3.01 ACCEPTABILITY OF BASE

A. Contractor shall examine the cast-in-place concrete base slab to determine its adequacy to receive concrete pavers and setting bed. Evidence of inadequate base shall be brought to the immediate attention of the Architect.

B. Start of work of this Section shall constitute acceptance of base work.

3.02 PREPARATION

A. Vacuum clean concrete or bituminous concrete substrates to remove dirt, dust, debris, and loose particles.

3.03 VERTICAL WEEPHOLES

A. Drill 1 in. diameter vertical weepholes in concrete base slab at low points, fill with drain stone and cover with 12 in. x 12 in. geotextile fabric.

3.04 EDGING (StructurEdge)

A. Locate border line of edging with string or other means to assure border straightness and curves as designed.

B. Edging Installation: Install base of edging resting on concrete base and facing away from paver.

1. Drive powder actuated nails through aluminum base.
2. Anchor each section end with anchor.
3. Concrete Base: Hilti DX A41 Fully Automatic Powder Actuated Tool is desirable where sufficient hold can be obtained. Provide 1 inch (25 mm) or longer nail at 4 inches (102 mm) to 12 inches (305 mm) on center spacing with applicable charge recommended. Anchor into outer 1 inch (25 mm) of base of restraint edging and not less than 2.5 inches (63.5 mm) from edge of concrete.
4. Securely connect sections in accordance with manufacturer's instructions. Provide additional anchors at closer spacing as necessary to firmly secure edging for permanent intended use.

3.05 INSTALLATION, GENERAL

A. Do not use unit pavers with chips, cracks, voids, discolorations, and other defects that might be visible or cause staining in finished work.

B. Mix pavers from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures.

C. Cut unit pavers with motor-driven masonry saw equipment to provide clean, sharp, unchipped edges. Cut units to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible. Hammer cutting is not acceptable.

D. Joint Pattern: As indicated n the Drawings.

E. Tolerances: Do not exceed 1/16-inch (1.6-mm) unit-to-unit offset from flush (lippage) nor 1/8 inch in 24 inches (3 mm in 600 mm) and 1/4 inch in 10 feet (6 mm in 3 m) from level, or indicated slope, for finished surface of paving.

F. Provide edge restraints as indicated. Install edge restraints before placing unit pavers.

3.06 ASPHALT PRIME COAT

A. Emulsified asphalt primer shall be applied to base slab at a rate sufficient to act as an adhesive between the base slab and the bituminous setting bed.

3.07 BITUMINOUS SETTING BED

A. Apply primer to concrete slab or bituminous concrete base course immediately before placing setting bed.

B. Bituminous setting bed shall be installed over the fully cured concrete or bituminous concrete base. Control bars 3/4 in. deep shall be placed directly over the base approximately 11 feet (3.3 m) apart and parallel to one another, to serve as guides for striking board. Adjust bars to subgrades required for accurate setting of paving units to finished grades indicated. If grades must be adjusted, wood chocks under depth control bars shall be set to proper grade. Set two bars parallel to each other to serve as guides for the striking board. The depth control bars must be set carefully to bring the pavers, when laid, to proper grade.

C. While still hot (not less than 250^{O}F.) some of the bituminous bed material shall be placed between the parallel depth control bars. This bed shall be pulled with the striking board over the control bars several times. After each passage, low porous spots shall be showered with fresh bituminous material to produce a smooth, firm, and even 3/4 inch (19 mm) thick setting bed. As soon as this initial panel is completed, advance the first bar to the next position in readiness for striking the next panel. After the depth control bars and wood chocks have been removed, carefully fill any depressions that remain.

3.08 SETTING CONCRETE PAVERS – BITUMINOUS BED

A. Concrete pavers shall be on a bituminous setting bed over a primed base and set in neoprene-modified asphalt adhesive. All setting shall be done by competent masons under adequate supervision.

B. After the modified asphalt adhesive is applied, carefully place the concrete pavers by hand with hand tight joints and uniform top surface.

C. Concrete pavers shall be set true to the required lines and grades and pattern indicated on the Drawings. Concrete pavers shall be neatly cut and fitted at all perimeters and closures to fit neatly and closely, with joints uniform in thickness. Pavers shall be cut with a water-cooled, cut-off wheel masonry saw using a diamond blade. Slivers shall no tbe permitted.

D. Joints between pavers shall be 1/8 in.

E. Joint Treatment: Spread dry polymeric sand and fill joints immediately after setting. Minimum depth: 1.25".

1. Installation:
   Surface must be completely dry. Cover surface with product; using a push broom, sweep product so as to fill joints completely down to their full depth; sweep surface clean of polymeric sand to avoid staining during compaction.
   Joints must be filled up to the bottom of the paver chamfer or at minimum 1/8” below the top of the pavers.
2. Compaction:
   Compact surface at least twice with a plate vibrator.
   Repeat steps 1 and 2.
   A rubber roller attachment or carpet can be used under the plate to protect pavers or slabs from damage. Check with the paver supplier as to the suitability of compacting pavers or slabs 2 inches or less in thickness.
3. Wetting:
   Important: Surface must be free of polymeric sand; clean it with a fine bristle brush or a leaf blower. Wetting must be performed gradually in at least three sprayings; each time, especially during the first spraying, be sure not to flood pavement or generate run-off, as this could wash out the binder, especially on sloped sites.
   Spraying principles: Use a very fine mist so that the water falls lightly on pavement without displacing polymeric sand; take care not to aim the jet directly on the surface.
   First spraying: Dampen surface very lightly with a fine mist; this first spraying will stabilize polymeric sand on the surface and make it more absorbent for subsequent sprayings. Wait for 5 to 10 minutes. Subsequent sprayings: Lightly spray surface in 5 to 10 minute intervals, so as to gradually moisten joints; repeat sprayings until joints are moistened down to the bottom, and this, using a minimum amount of water; using a small screwdriver, check wetting progress in several spots by emptying a little section of polymeric sand down to the bottom of the joint.
4. Drying time:
   Drying time is directly influenced by ambient humidity and temperature - at least 24 hours for pedestrian areas; - at least 48 hours is recommended for vehicular areas.
   NOTE: Drying time can be considerably less in dry climates
   After application, if there is a risk of rain during drying time, protect the pavement with a tarp.

F. Where required, pavers shall be accurately cut with a masonry or concrete saw. Cut edges shall be plumb and straight. Scoring and breaking will not be acceptable.

3.09 SURFACE SEALER

A. Apply to dry clean paver surface before filling joints. Apply two coats minimum at recommended coverage rates in strict compliance with manufacturer's published application and safety instructions.

3.10 CLEANING OF PAVED SURFACE

A. After completion of the concrete pavers, paved areas shall be thoroughly swept clean and surface shall be left unsoiled. Where required, surface shall be cleaned with water or an approved cleaner.

END OF SECTION

SECTION 321440

GRANITE PAVING

PART 1 GENERAL

1.00 GENERAL PROVISIONS

A. Attention is directed to the PROCUREMENT AND CONTRACTING REQUIREMENTS and all Sections within DIVISION 01, GENERAL REQUIREMENTS, which are made a part of this Section of the Specifications.

1.01 WORK INCLUDED

A. Provide all equipment and materials, and do all work necessary to construct the granite paving, including etched graphics, text and bronze inlays, as indicated on the Drawings and as specified, including but not limited to:

1. Granite pavers on bituminous setting bed over concrete base with sand swept joints.
2. Granite pavers on mortar setting bed over concrete base with mortar joints.

1.02 RELATED WORK

A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:

1. Section 014000, QUALITY REQUIREMENTS; Inspection and testing.
2. Section 033001, CAST-IN-PLACE CONCRETE – SITEWORK; Reinforced concrete base slab.
3. Section 079200, EXTERIOR SEALANTS.
4. Section 083100, ACCESS DOORS; Access doors in pavement for vault acess.
5. Section 334915, DRAINS, GRATES AND FRAMES.

1.03 REFERENCES

A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirement shall govern.

1. American Society for Testing and Materials (ASTM):

B 36	Brass Plate, Sheet, Strip, And Rolled Bar
B 43	Seamless Red Brass Pipe, Standard Sizes
B 62	Composition Bronze or Ounce Metal Castings
B 135	Seamless Brass Tube
B 455	Copper-Zinc-Lead Alloy (Leaded-Brass) Extruded Shapes

B 584	Copper Alloy Sand Castings for General Applications
C 91	Masonry Cement
C 97	Absorption and Bulk Specific Gravity of Natural Building Stone
C 144	Aggregate for Masonry Mortar
C 170	Compressive Strength of Dimension Stone
C 615	Granite Dimension Stone
C 880	Flexural Strength of Natural Building Stone
C 1028	Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method
D 36	Softening Point of Bitumen (Ring-and-Ball Apparatus)
D 113	Ductility of Bituminous Materials
D 3381	Viscosity-Graded Asphalt Cement for Use in Pavement Construction.

1.04 SUBMITTALS

A. Samples: Samples of granite pavers shall be "range samples" provided from the exact quarry granite pavers will be supplied from. Samples of the following shall be submitted:

Item	Quantity and Size
Granite Paver	2 required, size and finish specified.
Granite Setts	2 required, size and finish specified.
Granite Paver with Etched Graphics and Text	1 required, size and finish specified, graphics and text as directed by Architect.
Mortar Pointing Grout	Cured sample, 2 x 2 in., color specified.
Bronze inlay	As directed by Architect.

B. Manufacturer's Product Data: Manufacturer's product data shall be submitted for the following items:

Neoprene-modified asphalt adhesive
Polymeric sand
Grout materials, including additives
Mortar coloring additive
Mortar materials, including additives
Infill paint

C. Shop Drawings: Shop drawings of granite pieces specified here in shall be submitted. Drawings shall indicate sizes, dimensions, layout, and finishes and relationship to adjacent items.

D. Contractor's Review: Before commencing work, submit written statement signed by the Contractor stating that the Contract Documents have been reviewed with a qualified representative of the granite supplier, and that he is in agreement that the selected materials and construction are proper, compatible, and adequate for the application shown.

E. Test Report: Submit reports from tests conforming to ASTM C 67 methods indicating:

1. Compressive strength, psi. (ASTM C 170)
2. Density, lbs./c.f. (ASTM C 97)
3. Absorption by weight, % (ASTM C 97)
4 Abrasion resistance (ASTM C 241)
5. Flexural strength psi, (MPa) (ASTM C 880)

F. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information

1.05 SAMPLE PANEL

A. Construct a sample panel of each type of granite paving on the specified base before start of any granite paving. Sample panel shall exhibit granite pavers, bronze inlays, grain and grain direction, and required jointing and relationship to adjacent paving. Minimum size of panel shall be 10 ft. x 10 ft. Sample panel shall be inspected by the Architect. If the original sample is not acceptable, construct additional panels at no cost to the Owner until an acceptable panel is constructed. The acceptable panel shall become the standard for the entire job, and shall remain undisturbed until completion of all granite paving.

1. Build mockups in the location and of the size indicated or, if not indicated, as directed by Architect.
2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
3. Demonstrate the proposed range of aesthetic effects and workmanship.
4. Obtain Architect's approval of mockups before starting unit paver installation.
5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
6. Demolish and remove mockups when directed.

1.06 QUALITY ASSURANCE

A. Granite shall conform to the requirements of ASTM C 615, Architectural Grade and NBGQA Specifications, except as modified herein.

1. Existing installations of the specified granite shall be used as a measure of the material's ability to withstand the effects of environmental elements. The condition of the product after many years in actual service is a far more reliable indication of its ability to perform than an accelerated laboratory test..

B. Installer Qualifications: An experienced installer who has completed unit paver installations similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

C. Source Limitations: Obtain each type of unit paver, joint material, and setting material from one source with resources to provide materials and products of consistent quality in appearance and physical properties.

1. Granites shall be quarried by members of the National Building Granite Quarries Association, Inc. and shall meet the specified test criteria.
2. Granite shall be free of cracks, seams, starts or other defects which may impair its strength, durability or appearance. Color, texture and finish shall be within the range of samples approved by the Architect.

1.07 LAYOUT

A. The granite paving layout indicated on the Drawings is approximate. The final configuration of the paving will be determined in the field by the Architect.

1.08 DELIVERY, HANDLING, AND STORAGE

A. Granite shall be carefully packed and banded by the supplier for shipment. Following shipping granite shall be stored on wood skids or pallets, covered with non-staining, waterproof membrane and protected from the weather. Skids shall be placed and stacked in such a manner as to evenly distribute the weight of the granite materials and to prevent breakage, cracking, and damage to granite pieces. Granite materials shall be stored in such a manner as to allow air to circulate around the granite material. Granite shall not be permitted to be in direct contact with the ground any time during storage.

B. Granite damaged in any manner will be rejected and replaced with new materials at no additional cost to the Owner.

1.09 PROTECTION OF FINISHED SURFACES

A. Finished surfaces adjacent to the paving work shall be adequately protected from soiling, staining, and other damage.

1.10 JOB CONDITIONS

A. Cold Weather Protection:

1. Remove any ice or snow formed on granite or concrete bed by carefully applying heat until top surface is dry to touch.
2. Remove granite work determined to be damaged by freezing conditions.
3. Perform the following construction procedures while work is progressing:

Air Temperature	Procedures
40^{o} - 32^{o}F.	Heat sand to produce mortar temperatures between 40^{o} and 120^{o}F.
32^{o} - 25^{o}F.	Heat sand to produce mortar temperatures between 40^{o} and 120^{o}F. Maintain temperature of mortar on boards above freezing.

25° - 20°F.	Heat sand to produce mortar temperatures between 40° and 120°F. Maintain temperature of mortar on boards above freezing. Use wind breaks when wind is in excess of 15 mph.
20°F. - below	Heat sand to produce mortar temperatures between 40° and 120°F. Provide enclosures and auxiliary heat to maintain air temperature above 32°F. Do not lay units which have a surface temperature below 20°F.

4. Latex admixture shall be kept at 40°F. minimum.

B. Cold Weather Protection for Completed Granite Work:

Mean Daily Air Temperatures	Procedures
40° - 32°F.	Protect granite work from rain or snow for at least 24 hours by covering with weather-resistive membrane.
32° - 25°F.	Completely cover granite work with weather-resistive membrane for at least 24 hours.
25° - 20°F.	Completely cover granite work with insulating blankets or similar protection for at least 24 hours.
20°F. - below	Maintain granite work at temperature above 32°F. for 24 hours using enclosures and supplementary heat.

1. Do not use frozen materials or materials mixed or coated with ice or frost. Do not lower the freezing point of mortar by use of admixtures or antifreeze agents, and do not use calcium chloride in mortar or grout.
2. Do not build on frozen work; remove and replace granite work damaged by frost or freezing.
3. During all seasons, protect partially completed granite work against weather when work is not in progress.

C. Weather Limitations for Bituminous Setting Bed: Comply with the following requirements:

1. Apply asphalt adhesive when ambient temperature is above 50 deg F (10 deg C) and when temperature has not been below 35 deg F (2 deg C) for 12 hours immediately before application. Do not apply when base is wet or contains excess moisture.
2. Install bituminous setting bed only when atmospheric temperature is above 40 deg F (4 deg C) and when base is dry.

PART 2 PRODUCTS

2.01 PAVERS - GENERAL

A. Granite shall conform to ASTM C 615 and be of the sizes and dimensions indicated on the Drawings.

2.02 GRANITE PAVERS

A. Granite shall be supplied by J.C. Stone, Inc. 539 Rockland Road, Jefferson, Maine 04348, (P) 207-549-4729; (F) 207-549-4032, or other Architect approved supplier. Granite pavers shall conform to the following requirements:

1. Absorption by weight shall not exceed 0.4 %
2. Compressive strength of not less than 19,000 psi.
3. Minimum density of 160 pcf.

B. Pavers – Without graphics and text:

1. Size: as indicated on the Drawings. No slivers permitted.
2. Finish: Sawn sides and bottom with thermal top
3. Color: “Englishman’s Bay” , as approved by Architect.

C. Pavers – With graphics and text:

1. Size: as indicated on the Drawings. No slivers permitted.
2. Color: “Englishman’s Bay” , as approved by Architect.
3. Finish:
   a. laser and/or water jet etching of text and graphics (Text and graphics will be provided by Architect.)
   b. painted infill in areas
   c, bronze inlays.

D. Granite shall be cut to exact dimensions and radii required by the fabricator prior to shipment to the project site.

2.03 INFILL PAINT (AT PAVER GRAPHICS AND TEXT)

A. Painted Graphics and Text Finish: Provide Lithichrome Stone Paint, manufactured by Granite City Tool 247 28th Ave. S., Waite Park, MN 56387; www.granitecitytool.com, or approved equal.

1. “Overcoat” (Clear Coat): Provide Lithco Clear, manufactured by Granite City Tool 247 28th Ave. S., Waite Park, MN 56387; www.granitecitytool.com, or approved equal.

2.04 BRONZE INLAYS (AT PAVER GRAPHICS AND TEXT

A. Copper and Copper Alloys, General: Provide alloys indicated and temper to suit application and forming methods but with strength and stiffness not less than H01 (quarter-hard) for plate, sheet, strip, and bars and H55 (light-drawn) for tube and pipe.

1. Extruded Shapes, Bronze: ASTM B 455, alloy UNS No. C38500 (architectural bronze).
2. Seamless Pipe, Bronze: ASTM B 43, alloy UNS No. C23000 (red brass, 85 percent copper).

3. Seamless Tube, Bronze: ASTM B 135 (ASTM B 135M), alloy UNS No. C23000 (red brass, 85 percent copper).
4. Castings, Bronze: [Composition bronze castings complying with ASTM B 62, alloy UNS No. C83600 (85-5-5-5 or No. 1 composition commercial red brass)] [or] [sand castings complying with ASTM B 584, alloy UNS No. C86500 (No. 1 manganese bronze)].
5. Plate, Sheet, Strip, and Bars; Bronze: ASTM B 36/B 36M, alloy UNS No. C28000 (muntz metal, 60 percent copper).

B. Fasteners: Copper-Alloy (Bronze) Items: Silicon bronze (Alloy 651 or 655) fasteners[where concealed, muntz metal (Alloy 280) fasteners where exposed].

C. Fabrication – General: Form bronze inlays to required shapes and sizes, true to line and level with true curves and accurate angles and surfaces. Finish exposed surfaces to smooth, sharp, well-defined lines and arris. Take special care in choosing materials that are smooth and free of blemishes such as pits, roller marks, trade names, scale and roughness. Fabricate work with uniform, hairline tight joints.

1. Form simple and compound curves in bars and extruded shapes by bending members in jigs to produce uniform curvature for each configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces.

D. Finish: Finish designations for copper alloys comply with the system established for designating copper-alloy finish systems defined in NAAMM's "Metal Finishes Manual for Architectural and Metal Products".

1. Fine-Matte Finish: M42 (Mechanical Finish: nondirectional finish, fine matte).

2.05 POLYMERIC SAND FOR JOINT FILLER

A. Joint Filler Sand shall be Alliance Gator Maxx polymeric sand, manufactured by Alliance Designer Products Inc., 225 Boulevard Bellerose West Laval, Quebec H7L 6A1; TOLL FREE: 1.866.212.1611; MAIN OFFICE: 450.624.1611; Technical Support TOLL FREE: 1.855.847.7767; Fax: 450.624.1622, or approved equal.

1. Color; will be selected by Architect.

2.06 BITUMINOUS SETTING BED

A. Asphalt cement to be used in the bituminous setting bed shall conform to ASTM D 3381. Viscosity grade shall be A.C. 10 or A.C. 20.

B. Fine aggregate to be used in the bituminous setting bed shall be clean, hard sand with durable particles and free from adherent coating, lumps of clay, alkali salts, and organic matter. Aggregate shall be uniformly graded from "coarse" to "fine" with 100% by weight passing the No. 4 sieve and shall meet the gradation requirements when tested in accordance with ASTM C 136.

C. Fine aggregate shall be dried and shall be combined with hot asphalt cement, and the mix shall be heated to approximately 300^{O}F. at an asphalt plant. The approximate proportion of materials shall be 7% cement asphalt and 93% fine aggregate. Each ton of material shall be apportioned by weight in the approximate ratio of 145 lb. asphalt to 1,855 lb. sand. The Contractor shall determine the exact proportions to produce the best possible mixture for construction of the bituminous setting bed to meet specified requirements.

2.07 NEOPRENE-MODIFIED ASPHALT ADHESIVE

A. Paving manufacturer's standard adhesive consisting of oxidized asphalt combined with 2 percent neoprene and 10 percent long-fibered mineral fibers containing no asbestos. Neoprene modified asphalt adhesive shall meet the following requirements:

1. Mastic (asphalt adhesive):
   a. Solids (base) content by volume = 75$\pm$ 1%.
   b. Weight = 8 to 8.5 lb./gal.
   c. Solvent vehicle = Varsol (over 100^{O}F. flash).
2. Base (2% neoprene, 10% fibers, 88% asphalt):
   a. Melting point (ASTM D 36) = 200^{O}F., minimum.
   b. Penetration at 77^{O}F. 100 gram load 5 second (0.1 mm) = 23 to 27.
   c. Ductility (ASTM D 113 at 25^{O}C, 5 cm/minute) = 125 cm, minimum.

2.08 CUT-BACK ASPHALT

A. Primer for concrete base slab beneath granite pavers subject to vehicular traffic shall be with rapid curing cut-back asphalt conforming to AASHTO M 81.

2.09 EDGING

A. Edging shall be “StructurEdge”, extruded aluminum, 6063 alloy, T6 hardness aluminum edging, for straight-line and curvilinear applications in corrugated L-shaped profile, manufactured by PermaLoc Corporation, Holland MI 49424, telephone (800) 356-9660; (616) 399-9600, or approved equal. Edging shall be 3/16 in. thick x 2-1/4 in. height. Horizontal base shall have holes spaced 4 inches (102 mm) apart along its length to receive spikes

1. Thickness: 3/16 inch (4.8 mm) gage section shall have 0.210 inch (5.33 mm) thick exposed top lip.
2. Length: 8 feet (2.44 meters).
3. Connection Method: Section ends shall splice together with horizontal 0.060 inch (1.52 mm) thick x 1 inch (25 mm) wide x 4 inches (102 mm) long aluminum sliding connector.
4. Anchoring (Aggregate base): 3/8 inch x 10 inches (9.5 mm x 254 mm) bright spiral steel spike. Use plastic washers if desired.
5. Anchoring (Concrete base): 3/16 inch x 1-1/2 inches (4.8 mm x 38 mm) or longer Ardox concrete nail or drive pin fastener equal to Hilti DX 40 powder actuated pin, Ramset Trakfast Automatic Fastening System pin, or Tapcon.
6. Finish: Black DuraFlex Painted, AAMA 2603, electrostatically baked on paint.

2.10 WATER

A. Water shall be potable and shall be free of injurious contaminants.

2.11 SETTING BED MORTAR

A. Setting bed mortar shall be equal to "Laticrete 3701 Fortified Mortar Bed", a polymer fortified blend of carefully selected polymers, portland cement and graded aggregates, manufactured by Laticrete International, Inc., One LATICRETE Park North, Bethany, CT 06524-3423 USA · 1.800.243.4788 · +1.203.393.0010, or approved equal. Mix with water according to manufacturer's instructions..

2.12 BOND COAT

A. High strength bond coat between concrete base slab and setting bed mortar, and between setting bed mortar and granite paver shall be equal to "Laticrete 254 Platinum", one-step, polymer fortified, thin-set mortar bond coat, manufactured by Laticrete International, Inc., One LATICRETE Park North, Bethany, CT 06524-3423 USA · 1.800.243.4788 · +1.203.393.0010, or approved equal.

2.13 MORTAR GROUT FOR POINTING

A. Sanded Grout: shall be 1500 Sanded Grout, a premium, factory prepared grout designed to be mixed with water. 1500 Sanded Grout is formulated from a blend of high strength portland cement, graded aggregates, polymers and color-fast pigments and provides a grout joint that is dense, hard and durable, manufactured by Laticrete International, Inc., One LATICRETE Park North, Bethany, CT 06524-3423 USA · 1.800.243.4788 · +1.203.393.0010, or approved equal.

1. For grout joint widths of 1/16" (1.5 mm) up to 3/8" (9 mm).
2. Color shall match color of granite pavers.

PART 3 EXECUTION

3.01 ACCEPTABILITY OF CONCRETE BASE

A. Contractor shall examine the concrete base to determine its adequacy to receive granite paving and setting bed. Evidence of inadequate base shall be brought to the immediate attention of the Architect.

B. Start of work of this Section shall constitute acceptance of the concrete base.

3.02 PREPARATION

A. Vacuum clean substrate to remove dirt, dust, debris, and loose particles.

B. Remove substances from concrete base slab that could impair bond.

3.03 INSTALLATION, GENERAL

A. Do not use granite pavers with chips, cracks, voids, discolorations, and other defects that might be visible or cause staining in finished work.

B. Mix pavers from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures.

C. Cut granite pavers with motor-driven masonry saw equipment to provide clean, sharp, unchipped edges. Cut units to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible. Hammer cutting is not acceptable. No slivers shall be permitted.

D. Joint Pattern: As indicated on the Drawings.

E. Tolerances: Do not exceed 1/32-inch (0.8-mm) unit-to-unit offset from flush (lippage) nor 1/8 inch in 10 feet (3 mm in 3 m) from level, or indicated slope, for finished surface of paving.

3.04 EDGING

A. Locate border line of edging with string or other means to assure border straightness and curves as designed.

B. Concrete Base - Edging Installation: Install base of edging resting on compacted level base and facing as indicated on the Drawings.

1. Drive powder actuated nails through aluminum base.
2. Anchor each section end with anchor.
3. Concrete Base: Hilti DX A41 Fully Automatic Powder Actuated Tool is desirable where sufficient hold can be obtained. Provide 3/4 inches (19 mm) to 1 inches (25 mm) nail at 4 inches (102 mm) to 12 inches (305 mm) on center spacing with applicable charge recommended. Anchor into outer 1 inch (25 mm) of base of restraint edging and not less than 2.5 inches (63.5 mm) from edge of concrete.
4. Securely connect sections in accordance with manufacturer's instructions. Provide additional anchors at closer spacing as necessary to firmly secure edging for permanent intended use.

3.05 BITUMINOUS SETTING BED

A. Apply primer to concrete slab or binder course immediately before placing setting bed.

B. Bituminous setting bed shall be installed over the fully cured concrete base. Control bars 3/4 in. deep shall be placed directly over the base approximately 11 feet (3.3 m) apart and parallel to one another, to serve as guides for striking board. Adjust bars to subgrades required for accurate setting of paving units to finished grades indicated. If grades must be adjusted, wood chocks under depth control bars shall be set to proper grade. Set two bars parallel to each other to serve as guides for the striking board. The depth control bars must be set carefully to bring the pavers, when laid, to proper grade.

C. While still hot (not less than 250^{O}F.) some of the bituminous bed material shall be placed between the parallel depth control bars. This bed shall be pulled with the striking board over the control bars several times. After each passage, low porous spots shall be showered with fresh bituminous material to produce a smooth, firm, and even setting bed. As soon as this initial panel is completed, advance the first bar to the next position in readiness for striking the next panel. After the depth control bars and wood chocks have been removed, carefully fill any depressions that remain.

1. Roll setting bed with power roller to a nominal depth of 3/4 inch (19 mm) while still hot. Adjust thickness as necessary to allow accurate setting of granite pavers to finished grades indicated.

2. Apply neoprene-modified asphalt adhesive to cold setting bed by squeegeeing or troweling. If troweled on, use trowel with serrations not exceeding 1/16 inch (1.6 mm). Proceed with setting of paving units only after adhesive is dry to the touch.

3.06 SETTING GRANITE PAVERS ON BITUMINOUS SETTING BED

A. Granite pavers shall be on a bituminous setting bed over a prepared concrete base. All setting shall be done by competent masons under adequate supervision.

B. Granite pavers with chips, cracks, stains, or other defects which might be visible in the finished work shall not be used.

C. After the modified asphalt adhesive is applied, carefully place the pavers by hand in straight courses with hand tight joints and uniform top surface.

D. Granite pavers shall be set true to the required lines and grades in the pattern detailed on the Drawings. Granite pavers shall be neatly cut and fitted at all perimeters and closures to fit neatly and closely, with joints uniform in thickness. Pavers shall be cut with a water-cooled, cut-off wheel masonry saw using a diamond blade. No slivers shall be permitted.

3.07 INFILL PAINT

A. Apply a thinned (thinned about half with Lithco Solvent) color and then a regular coat of color. If applying by brush, do a minimum of brush “stroking” as excessive brushing results in poor adhesion.

B. Follow with an “overcoat” of Lithco Clear for added stone color durability.

3.08 BRONZE INLAYS

A. Perform cutting and fitting required to install inlays as indicated on the Drawings. Set inlays accurately in location, alignment, and elevation; measured from established lines and levels. Unless otherwise indicated, set inlays flush with granite surface.

3.09 JOINT TREATMENT

A. Spread dry polymeric sand and fill joints immediately after setting pavers. Minimum depth: 1.25".

1. Make sure that the pavers’ side and top surfaces are dry before applying the polymeric sand. Spread GATOR MAXX SAND over the pavers then use a hard-bristle brush to sweep the sand into the joints,filling them completely. Run a vibrating plate over the pavers in several directions to compact the sand inside the joints (this action is not appropriate for slabs). Repeat this step (spreading the sand, then compacting) at least two more times. If a vibrating plate compactor cannot be used, tamp the stones with a rubber mallet and make sure the GATOR MAXX SAND is densely packed in the joints.
2. Using a fine-bristle broom, remove any excess from paver surfaces. Make sure the finished sand level is at least 1/8 in. lower than the surface of the pavers. Using a leaf blower, remove any sand residue from paved surfaces. Depending on the physical layout, it may be more appropriate to remove residue by using a vacuum unit.
3. At a height of 4 feet (1.2m), use a water gun connected to a hose to direct a fine mist (water gun setting: “mist” or equivalent) of water on a specific paved area for 10 to 15 seconds. Wait 3 to 4 minutes (not longer).

4. From a height of 2 feet (.60m), aim the water mist directly at the paved surface. Mist and rinse simultaneously so as to eliminate any GATOR MAXX SAND residue left on the pavers. Any GATOR MAXX SAND residue should go directly into the paver joints. Wait 3 to 4 minutes (not longer).
5. From a height of 2 feet (.60m), aim the water mist again directly at the paved surface. Again, mist and rinse simultaneously so as to eliminate any GATOR MAXX SAND residue left on the pavers. The GATOR MAXX SAND residue should go directly into the paver joints. However, stop misting (ALERT) when you see a minimal amount of water retention on the paver joints. **NOTE :** Repeat the directions of steps 3 to 5 for all other areas that have not been misted with water
6. Use a leaf blower to remove any excess water lying on paver pores and crevices. This blowing action is necessary to help remove any remaining GATOR MAXX SAND residue that was left on the paver surface from the previous steps.

3.10 SETTING ON MORTAR BED

A. All setting shall be done by competent granite setters under adequate supervision.

B. Granite units with chips, cracks, stains, or other defects which might be visible in the finished work shall not be used.

C. Before setting, granite shall be clean and free of dirt, and foreign matter on all sides. Granite shall be dry before setting.

D. Granite shall be set true to the required lines and grades. Joints shall be uniform in thickness. Expansion joints shall be 1/2 in. thick. Unless otherwise indicated on the Drawings all other joints shall be 3/8 in. thick. Direct bearing contact between granite pieces shall be prohibited.

E. Granite pavers shall be set on a mortar setting bed over a prepared concrete base slab. All setting shall be done by competent masons under adequate supervision.

F. Bond coat shall be applied to concrete base slab using flat trowel. Thickness of bond coat shall be approximately 1/16 in.

G. Mortar bed shall be spread evenly over the troweled bond coat. Mortar setting shall be 1 in. thick, minimum. Bond coat shall then be applied to mortar bed using flat trowel to thickness of 1/16 in.

H. Before setting, the back of each granite shall be dampened and shall receive a slurry of mortar to ensure maximum contact with mortar bed. Each piece shall be carefully bedded in a full bed of mortar and tapped home to a full and solid bearing. Particular care shall be exercised to equalize bed and joint openings and eliminate the need for redressing of exposed surfaces.

I. Granite pavers shall be set true to the required lines and grades in the pattern detailed on the Drawings. Granite pavers shall be neatly cut and fitted at all perimeters and closures to fit neatly and closely, with joints uniform in thickness. Pavers shall be cut with a water-cooled, cut-off wheel masonry saw using a diamond blade. No slivers shall be permitted.

J. Exposed surfaces shall be kept free from mortar at all times. Excess mortar shall be immediately removed before latex modified mortar can set.

K. All joints except expansion joints shall be completely filled with mortar, then raked out to a depth of not less than 3/4 in. Raked joints shall be brushed clean and pointed with colored mortar to a flat cut joint. Mortar grout between granite pieces shall be uniform in appearance, texture, and color. After initial set of mortar, joints shall be finished by tooling with a rounded, non-staining jointer to produce a glassy-hard, polished, slightly, concave joint, free of drying cracks.

L. After pointing granite work shall be carefully cleaned, removing all dirt, excess mortar and stains. Expansion joints shall be cleaned of all mortar and left ready for sealing of joints under Section 079200, EXTERIOR SEALANTS.

M. Upon completion of granite paving, surfaces shall be left in a clean, unsoiled condition, acceptable to the Architect.

3.11 ADJUST AND CLEAN

A. Remove and replace granite pieces which are broken, chipped, stained, or otherwise damaged. Remove and replace units which are misaligned or not to grade or do not match adjoining granite work. Provide new matching units, install as specified and refill with sand to eliminate evidence of replacement. Repair defective and unsatisfactory joints as required to provide a neat, uniform appearance.

B. Exposed surfaces shall be kept free from mortar at all times. Any mortar smears shall be immediately removed with a clean sponge and clean water before latex modified mortar can set.

C. Sweep areas of granite on setting bed clean of excess sand.

D. Clean granite work not less than six days after completion of work, using clean water and stiff-bristle brushes. Do not use wire brushes, acid type cleaning agents, or other cleaning compounds with caustic or harsh fillers.

END OF SECTION

SECTION 321543

AGGREGATE BOUND SURFACING

PART 1 GENERAL

1.00 GENERAL PROVISIONS

A. Attention is directed to the PROCUREMENT AND CONTRACTING REQUIREMENTS and all Sections within DIVISION 01, GENERAL REQUIREMENTS, which are made a part of this Section of the Specifications.

1.01 WORK INCLUDED

A. Provide all equipment and materials, and do all work necessary to construct the aggregate bound surfacing at tree pits, a low maintenance porous paving system using a variety of natural or recycled aggregates and UV stable Polyurethane (PU) resin binder to provide a highly porous surface allowing the tree roots access to both air and water penetration, as indicated on the Drawings and as specified.

1.02 RELATED WORK

A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:

1. Section 312300, SITE EXCAVATING, BACKFILLING AND COMPACTING; Excavation and backfill and establishment of subgrade elevations.
2. Section 329115, STRUCTURAL SOIL.
3. Section 329300, PLANTS.
4. Section 329313, PLANTING SOILS.

1.03 REFERENCES

A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.

1. American Society for Testing and Materials (ASTM):

D 448	Standard Classification for Sizes of Aggregate for Road and Bridge Construction
D 1883	CBR (California Bearing Ratio) of Laboratory-Compacted Soils

1.04 SUBMITTALS

A. Samples: The following samples shall be submitted:

Material	Sample Size or Quantity
Aggregate	5 lb.
Geotextile fabric	1 sq. ft.

B. Manufacturer's Product Data: Manufacturer's product data shall be submitted for the following materials:

Geotextile fabric

1.05 TESTING AND INSPECTION

A. The Owner reserves the right to test and inspect materials and construction of stone dust surfacing in accordance with the requirements of Division 01, GENERAL REQUIREMENTS.

1.06 PRODUCT DELIVERY

A. Transport, deliver and handle aggregate bond surfacing materials so as to prevent drying, moisture damage, overexposure, contamination, or freezing prior to installation.

1.07 QUALITY ASSURANCE

A. Regulatory Requirements: Meet requirements of applicable laws, codes, and regulations required by authorities having jurisdiction over such work.

B. Installation of aggregate bound surfacing system shall be by applicators trained and certified by the aggregate bound surfacing system manufacturer.

C. Pavement Performance: Upon request, aggregate bound surfacing system manufacturer shall submit for reference the information and contacts for no fewer than three public agency projects where the manufacturer’s paving mix material has been installed and in service for a period of not less than three years, and which has a proven wear resistance surface without the continuing generation of fine particle material from the full surface of the pavement installation and does not need ongoing or regular application of additional seal coat treatments in order to preserve the integrity of the pavement.

PART 2 PRODUCTS

2.01 RESIN BOUND AGGREGATE

A. Resin bound aggregate surfacing system shall be “Addapave” Tree Pit System, manufactured by Chameleon Ways Inc. PO Box 387, Center Valley, PA 18034. P. 877-426-5687 F. 610-797-4654 E. info@chameleonways.com , or approved equal.

1. Decorative aggregate color shall be “Silver Granite”.

2.02 STONE AGGREGATE BASE

A. Crushed stone with 90% fractured faces, LA Abrasion < 40 per ASTM C 131, minimum CBR of 80% per ASTM D 1883.

B. Do not use rounded river gravel.

C. All stone materials shall be washed with less than 1% passing the No. 200 sieve.

D. Conforming to ASTM D 448 gradation as follows:

ASTM No. 57 Base - Grading Requirements

Sieve Size	Percent Passing
37.5 mm (1 1/2 in.)	100
25 mm (1 in.)	95 to 100
12.5 mm (1/2 in.)	25 to 60
4.75 mm (No. 4)	0 to 10
2.36 mm (No. 8)	0 to 5

2.03 GEOTEXTILE FABRIC

A. Geotextile for weed barrier shall be Mirafi MSCAPE geotextile, needlepunched, heat bonded nonwoven polypropylene landscape fabric designed specifically to act as a weed barrier, soil separator and light drainage filter, manufactured by Tencate, 365 South Holland Drive, Pendergrass, GA 30567; Tel 800 685 9990; Tel 706 693 2226; Fax 706 693 4400; www.mirafi.com, or approved equal.

1. Geotextile fabric shall be inert to biological degradation and resistant to naturally encountered chemicals, alkalis and acids.

2.04 STRUCTURAL SOIL

A. Refer to Section 329115, STRUCTURAL SOIL.

PART 3 EXECUTION

3.01 GRADING

A. Areas to receive aggregate bound surfacing system will be compacted and brought to subgrade elevation under Section 312300, SITE EXCAVATING, BACKFILLING AND COMPACTING and Section 329115, STRUCTURAL SOIL, before work of this section is performed. Final fine grading, furnishing and installing stone aggregate base course, geotextile fabric, and aggregate bound surfacing materials as required to form a firm, uniform, accurate, and unyielding paving at required elevations and to required lines, shall be done under this Section.

B. Structural soil material which will not readily compact as required shall be removed and replaced with satisfactory materials. Additional materials needed to bring subgrade to required line and grade and to replace unsuitable material removed shall be material conforming to Section 329115, STRUCTURAL SOIL.

C. Structural soil areas beneath aggregate bound surfacing shall be recompacted as required under work of Section 329115, STRUCTURAL SOIL..

3.02 STONE AGGREGATE BASE

A. General

1. Keep area where aggregate bound surfacing system is to be constructed free from sediment during entire job. Geotextiles and base materials contaminated with sediment shall be removed and replaced with clean materials.

B. Geotextiles

1. Place on top of prepared Structural Soil. Secure in place.
2. Overlap a minimum of (12 in.) in the direction of drainage.

C. Aggregate Base

1. Moisten, spread and compact No. 57 stone base in 100 mm (4 in.) lift over the Structural Soil and installed geotextile fabric with a minimum 10 t (10 T) vibratory roller until there is no visible movement of the No. 57 stone. Do not crush aggregate with the roller.
2. The surface tolerance the compacted No. 57 base should not deviate more than. ±1 in. (25 mm) over a 10 ft (3 m) straightedge.

3.03 EXAMINATION

A. Examine site and verify that conditions are suitable to proceed with the aggregate bound surfacing system installation and that no visible defects or errors are present which would cause a defective installation of the system or cause latent defects in function.

B. Unsuitable Conditions: Before proceeding with work, notify the Architect in writing of unsuitable conditions and conflicts.

3.04 WEATHER LIMITATIONS

A. Aggregate bound surfacing system shall not be applied when it is raining or when rain is expected. Weather forecasts should indicate no rain during application procedures and for at least 24 hours following application. The ambient temperature must be above 16 degrees C (60 degrees F) for application of aggregate bound surfacing system unless otherwise approved in writing by the manufacturer.

3.05 INSTALLATION OF AGGREGATE BOUND SURFACING SYSTEM

A. Areas to be filled with Aggregate bound surfacing system shall be clean and dry with a minimum infill depth available of 4 in.; 6 in. preferable..

B. At base of tree trunk place a loose aggregate wedge utilizing the decorative aggregate used for the aggregate bound surfacing, funnel upwards to within 3/8 – 5/8 in. below the final expected finished grade.

C. Mix and install aggregate bound surfacing materials in strict accordance with manufacturer's printed instructions.

3.06 TOLERANCES

A. In-Place Compacted Thickness Variation from Design Thickness: Maximum ⅜-inch (.375") plus/minus 0-inch.

B. Finished Surface Smoothness of aggregate bound surface: Maximum ⅜-inch (.375") variation from a 10-foot long straight edge laid parallel to the road center lines, except at intersections, grade breaks and tie-in points to adjacent pavements and hard surfaced pedestrian walking paths.

C. Grade requirements for ADA accessibility have priority over smoothness tolerances. In any place where the smoothness tolerance of the RP surface course described in Section 3.06.B. conflicts with maintaining slope requirements governed by ADA accessible surface regulations, the ADA grade requirement supersedes the finished smoothness tolerance.

3.07 FIELD QUALITY CONTROL

A. Finished Surface Smoothness:

1. Test pavement continuously following initial compaction for smoothness and correct profile by laying a 10-foot straightedge on the paving finished surface parallel to road or path centerline.
2. Surface shall not vary more than ⅜-inch (.375"), except at intersections, grade breaks, and tie-in points to adjacent pavements.
3. Correct areas not meeting specified surface tolerance immediately after initial compaction.

B. Course Thickness:

1. In-Place Compacted Thickness Variation from Design Thickness: Maximum ⅜-inch (.375") plus/minus 0-inch.

2. If verification tests are to be conducted by Owner's testing agency for In-Place Compacted Thickness, tests should be conducted immediately following final compaction. Installer should be previously notified to store appropriate quantity of touch-up mix in sealed container to provide for the required repairs of test areas. This test will require removal of pavement and a patch repair that will be visible as a patch in the final pavement product. Any concerns of the Owner regarding the appearance and location of test patches, beyond thickness and smoothness tolerances specified, will be the responsibility of the Architect. To conduct the thickness test, remove a small section of pavement to expose base course. Measure from bottom of straight edge placed across excavation to surface of base and record distance to nearest 0.01 foot. Installer should immediately proceed with pavement repair once measurements are taken.

3.08 REPLACEMENT OF DEFICIENT OR DAMAGED AGGREGATE BOUND SURFACING SYSTEM

A. Areas to Be Replaced:

1. Replace full depth of aggregate bound surfacing system thickness if aggregate bound surfacing is contaminated or if paving work is defective.

B. Installation:

1. Place aggregate bound surfacing system in areas where paving was removed in sufficient quantity that will allow finished surface to conform to elevation and tolerance requirements after final compaction.
2. Thoroughly compact RPM so that cured patch meets requirements specified.

3.09 PROTECTION

A. Traffic Restriction:

1. Do not permit traffic on aggregate bound surface until curing is complete. Protect pavement surface against traffic until pavement has cured sufficiently to support traffic without marring, rutting, tearing, distressing, or damaging the pavement in any way. Utilize warning signs, barricades, and protection fencing to protect pavement from traffic. If the pavement structural section design and edge design are for pedestrian and bicycle traffic only, then restoration of traffic applies to pedestrian and bicycle traffic only. If the pavement structural section design and edge design are for light duty vehicular traffic use only, then restoration of traffic applies to light duty vehicular traffic only. All damage to the pavement by contractor construction equipment and construction truck traffic will be the responsibility of the Contractor to repair.

B. Protection from Water Damage:

1. Provide drainage during construction to prevent water from collecting or standing on or adjacent to areas to be paved or areas of freshly placed pavement.
2. Installer shall notify Architect and require notification of Owner, that landscape irrigation water is to be absolutely restricted from the pavement surface or from ponding near pavement edges during the full period of traffic restriction as required. Any landscape watering in the vicinity of the newly installed aggregate bound surfacing system during the traffic restriction period should be conducted by hand watering and timers for automatic sprinkler and watering systems should be shut off with explanatory written notices attached.
3. In the event of forecasted rain, newly installed aggregate bound surfacing shall be temporarily covered with plastic liner for protection as needed during the first 48 hours after placement. Liner must be placed so that the edges extend past the newly installed aggregate bound surfacing system by a minimum of twelve-inches (12”) on all sides and secured to prevent the liner from excessive movement and exposing the aggregate bound surfacing system until the return of dry weather and appropriate pavement curing conditions.

END OF SECTION

SECTION 321640

GRANITE CURB

PART 1 GENERAL

1.00 GENERAL PROVISIONS

A. Attention is directed to the PROCUREMENT AND CONTRACTING REQUIREMENTS and all Sections within DIVISION 01, GENERAL REQUIREMENTS, which are made a part of this Section of the Specifications.

1.01 WORK INCLUDED

A. Furnish and install equipment and materials to construct flush granite curb and vertical granite curb, as indicated on the Drawings and as specified.

1.02 RELATED WORK

A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:

1. Section 033001, CAST-IN-PLACE CONCRETE - SITEWORK; Cast-in-place concrete.
2. Section 044302, GRANITE; Planter curb.
3. Section 312300, SITE EXCAVATING, BACKFILLING AND COMPACTING; Excavation and backfill.
4 Section 321313, PORTLAND CEMENT CONCRETE PAVEMENT; Concrete pavement.

1.03 REFERENCES

A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.

1. American Society for Testing and Materials (ASTM):

C 131	Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
C 615	Structural Granite

2. New York State Department of Transportation (NYSDOT):

Specifications	Standard Specifications - Construction and Materials.

1.04 SUBMITTALS

A. Submit complete shop drawings of each curb type and size for Architect's approval.

B. Samples: The following samples shall be submitted:

Material	Sample Size or Quantity
Granite curb	36 in. length, straight section
Granite curb	36 in. length, radial section

1.05 QUALITY ASSURANCE

A. Unless otherwise indicated, granite curb materials and construction shall conform to the applicable portions of the following:

1. NYSDOT Specifications Section 714-01.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Granite curb units shall be delivered to the job adequately protected from damage during transit.

B. Curb shall be protected against staining, chipping, and other damage. Cracked, badly chipped, or stained units will be rejected and shall not be employed in the work.

PART 2 PRODUCTS

2.01 AGGREGATE BASE COURSE

A. Material for aggregate base course shall be a graded, granular, free-draining material, consisting of either durable stone and coarse sand or of blast furnace slag, practically free from loam and clay, and which can be readily compacted to form a stable foundation.

1. Material shall confom to NYSDOT Specifications Section 304, Type 2.

2.02 GRANITE CURB

A. Granite shall be a structural granite conforming to ASTM C 615, Class I Engineering Grade, suitable for curbstone use, and NYSDOT Specifications Section 609, "Curbing, Gutters and Concrete Mall". Unless otherwise indicated in NYSDOT Specifications Section 609, curbing shall conform to the following:

1. Curb shall be light grey, to match existing curb, free from seams which impair structural integrity, and with percentage of wear less than 32%, as determined by ASTM C 131.
2. Granite curb shall be furnished in two types: vertical and transition curb, of size, shape, and dimensions indicated on the Drawings. Finish shall be sawn top, split face, and jointed.
3. Granite curb shall have the following dimensions: .minimum length = 6 ft., width at top = 6 in., depth = 17-19 in.
4. Top surface shall be free from wind, shall be peen hammered or sawn to an approximately true plane, and shall have no projections or depressions greater than 1/8 in.
5. Front and back arris lines shall be be pitched straight and true, and there shall be no projection on the back surface for 3 in. down from the top which would exceed a batter of 4 in. in 1 ft.

6. Front face shall be at right angles to the planes of the top and ends, and shall be smooth quarry split, free from drill holes and with no projection of more than 1 in. and no depression of more than 1/2 in. measured from the vertical plane of the face through the arris pitch line for a distance down from the top of 8 in.. For the remaining distance there shall be no projection or depression greater than 1 in. measured in the same manner.
7. The ends of the stone shall be squared with the planes of the top and face so that when the stones are placed end to end as closely as possible, no space shall show in the joint at the top and face of more than 1/2 in. for the full width of the top and for 8 in. down on the face, after which the the end may break back not over 8 in. from the plane of the joint. The arris formed by the intersection of the plane of the joint with the planes of the top and exposed faces shall have no variation from the plane of the top and exposed faces greater than 1/8 in.

2.03 CEMENT MORTAR

A. Mortar for pointing joints between curbstones shall be a cement mortar composed of one part Portland cement and two parts sand, by volume with sufficient water to form a workable, stiff mixture.

2.04 CONCRETE

A. Concrete for foundation at granite curb shall conform to NYSDOT Specifications Section 500, 4000 psi, (Class A).

PART 3 EXECUTION

3.01 AGGREGATE BASE COURSE

A. Aggregate base course for paving and the spreading, grading, and compaction methods employed shall conform to standard requirements for usual base course of this type for first class road work, and the following:

1. NYSDOT Specifications Section 304.

B. Width of base course shall be greater than or equal to the width of curb surface, if continuous lateral support is provided during rolling, and shall extend at least 2 x base thickness beyond edge of the course above, if not so supported.

C. Aggregate material shall be applied in lifts less than or equal to 6 in. thick, compacted measure. Each lift shall be separately compacted to specified density, using a 6 ton smooth drum vibratory roller equivalent to a 6 ton static roller, or an approved equivalent. Smaller areas or areas impossible to reach with large drum rollers shall be compacted to specified density using a vibrating plate compactor.

1. Material shall be placed adjacent to wall, manhole, catch basin, and other structures only after they have been set to required grade and level.
2. Rolling shall begin at sides and progress to center of crowned areas, and shall begin on low side and progress toward high side of sloped areas. Rolling shall continue until material does not creep or wave ahead of roller wheels.
3. Surface irregularities which exceed 1/2 in. as measured by means of a 10 ft. long straightedge, shall be replaced and properly recompacted.

D. Base course shall be compacted at optimum moisture content to not less than 95% of maximum density as determined by ASTM D 1557.

E. Subgrade and base course shall be kept clean and uncontaminated. Less select materials shall not be permitted to become mixed with gravel. Materials spilled outside pavement lines shall be removed and area repaired.

F. Portions of subgrade or of construction above which become contaminated, softened, or dislodged by passing of traffic, or otherwise injured, shall be cleaned, replaced, or otherwise repaired to conform to the requirements of this specification before proceeding with next operation.

32 SETTING CURB

A. Curb shall be set in an 18 in. wide trench, with trench bottom at 6 in. below bottom of curb. Excavation shall be filled to required level with base course material conforming to the requirements of this Section.

B. Vertical face of vertical curb shall be plumb, with curb top parallel to adjacent surface.

C. Curb shall be set accurately to line and grade. Curb units shall be fitted together as closely as possible. Curb shall not be field cut.

D. Joints, between curb units shall be carefully filled with a cement mortar, and neatly pointed on the top and front exposed portions. After pointing excess mortar shall be cleaned from curb surface.

E. Backfill material on each side of curb shall be as specified for adjacent surface and shall be thoroughly compacted by means of power tampers. Extreme care shall be taken not to destroy alignment. Curb sections disturbed during backfilling or otherwise shall be reset to line and grade, and properly backfilled.

END OF SECTION

SECTION 321816.12

PLAYGROUND SAFETY SURFACING

PART 1 GENERAL

1.00 GENERAL PROVISIONS

A. Attention is directed to the PROCUREMENT AND CONTRACTING REQUIREMENTS and all Sections within DIVISION 01, GENERAL REQUIREMENTS, which are made a part of this Section of the Specifications.

1.01 WORK INCLUDED

A. Provide all equipment and materials, and do all work necessary to furnish and install the poured-in-place playground safety surfacing, complete, as indicated on the Drawings and as specified.

1.02 RELATED WORK

A. Examine Contract Documents for requirements that affect Work of this Section. Other Specification Sections that directly relate to Work of this Section include, but are not limited to:

1. Section 033001, CAST-IN-PLACE CONCRETE - SITEWORK; Concrete base, ready to receive playground safety surfacing.
2. Section 116816, PLAY STRUCTURES.

1.03 REFERENCES

A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.

1. American Society for Testing and Materials (ASTM):

D412	Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers-Tension.
D624	Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.
D2047	Static Coefficient of Friction of Polish-Coated Floor Surfaces as Measured by the James Machine.
D2859	Flammability of Finished Textile Floor Covering Materials.
E303	Measuring Surface Frictional Properties Using the British Pendulum Tester.

F1292	Impact Attenuation of Surface Systems Under and Around Playground Equipment.
F1951	Determination of Accessibility of Surface Systems Under and Around Playground Equipment.

2. International Playground Equipment Manufacturer’s Association (IPEMA)

1.04 SUBMITTALS

A. Certified test data indicating that safety surface meets or exceeds the following:

1. Current Consumer Product Safety Commission (CPSC) guidelines issued in "A Handbook for Public Playground Safety" (latest edition) for a minimum fall height of 6 feet.
2. Current Americans with Disabilities Act Guidelines (ADAG).
3. Current ASTM F-1292 requirements.

B. Shop drawings of playground safety surfacing indicating colors, dimensions, and layout of surfacing shall be submitted.

C. Manufacturer's product data, and catalogue cuts, shall be submitted for playground safety surfacing system including certifications and other data as may be required to show compliance with Contract Documents..

D. Verification Samples: Submit 12 in. x 12 in. color samples of safety surfacing on 1/4 in. plywood backing as many times as necessary to obtain Architect's approval.

E. Manufacturer's Review: Submit written statement, signed by safety surfacing installer stating that Drawings and Specifications have been reviewed by qualified representatives of materials manufacturer, and that they are in agreement that materials and system to be used for safety surfacing are proper and adequate for applications shown.

F. Substrate Acceptability: Submit a certified statement issued by manufacturer of safety surfacing materials and countersigned by applicator, attesting that areas and surfaces designated to receive safety surfacing have been inspected and found satisfactory for reception of Work covered under this Section; and are not in conflict with "Warranty" requirements. Application of materials will be construed as acceptance of surfaces.

G. Statement of Supervision: Upon completion of Work, submit a written statement signed by manufacturer stating that field supervision of manufacturer's representative was sufficient to insure proper application of materials, that Work was installed in accordance with Contract Documents, and that installation is acceptable to manufacturer.

H. Certification: Furnish certificate accompanying delivery of safety surface material indicating compliance with the Contract Documents.

1.05 PERFORMANCE REQUIREMENTS

A. Performance Requirements: Provide a 2 layer rubber-polyurethane playground surfacing system which has been designed, manufactured and installed to meet the following criteria:

1. Shock Attenuation (ASTM F1292):
   a. Gmax: Less than 200.
   b. Head Injury Criteria: Less than 1000.
2. Flammability (ASTM D2859): Pass.
3. Tensile Strength (ASTM D412): 60 psi (413 kPa).
4. Tear Resistance (ASTM D624): 140%.
5. Water Permeability: 0.4 gal/yd2/second.
6. Accessibility: Comply with requirements of ASTM F1951.

1.06 QUALITY ASSURANCE

A. Qualifications: Utilize an installer approved, trained and certified by the manufacturer of the playground surfacing system, and must have completed at least 50 installations of areas of greater than 1,000 sf over the past 3 years.

1. Safety surfacing work shall be performed by a firm with ten years experience in installation of materials specified on comparable projects. The firm shall have the approval of the safety surface materials manufacturer.
2. Certifications: Certification by manufacturer that installer is an approved applicator of the playground surfacing system.
3. International Play Equipment Manufacturers Association (IPEMA) certified.

B. The safety surface manufacturer shall provide evidence indicating that the specified materials have been successfully utilized on work of similar scope to that shown and specified for this Project. The safety surface system examples cited shall have been completed and in use for five years without any evidence of failure.

C. The Owner reserves the right to retain an independent testing laboratory to test and inspect the work specified herein. The presence of the testing laboratory, nor any observations and testing performed by the laboratory shall relieve the Contractor of his responsibilities for the Work.

D. Installed safety surface shall meet or exceed CPSC performance guidelines with respect to the Critical Heights of the proposed in-place play equipment.

E. Material used in construction of the safety surface system shall be tested for conformance with requirements of ASTM F 1292, and shall be IPEMA Certified.

F. Material shall have a Class A fire rating.

G. Material shall be vandal resistant, firmly secured so that it cannot be pulled away from the playground surface.

1.07 MATERIAL TESTING

A. Shock Absorbency: When tested in accordance with ASTM F 1292, Test Method F355, Procedure C (Metal Headform), the surface shall not impart to the headform upon impact, a peak deceleration exceeding 200 times the acceleration due to gravity (200G's). Drop heights used in this test shall be the heights relevant to the proposed play structures used in conjunction with the safety surfacing areas indicated on the Drawings.

B. Weathering: After being subjected to a freeze-thaw cycle in accordance with ASTM C 67 and after being subject to 200^{o} F. for seven days in accordance with ASTM D 573, the sample shall be retested in compliance with ASTM F 1292 at 72^{o} F. only. A peak deceleration reading not exceeding 200G's shall be maintained.

C. Slip Resistance: Wet dynamic reading shall not be less than 40 when tested in accordance with ASTM E 303, using the British Portable Skid Resistance Tester.

D. Flammability: Minimum critical radiant flux of 0.22 Watts/CM^{2} when tested in accordance with ASTM E 648.

1.08 WARRANTY

A. Provide a written warranty stating that work executed under this Section will be free from defects of materials and workmanship for a period of (5) five years from date of Substantial Completion, and that material breakdown and unraveling will be remedied on written notice at no additional cost to Owner. The warranty shall be in writing and shall be signed by the Contractor and safety surface materials manufacturer. Warranty shall include removal and replacement of materials as required to repair safety surfacing, at no cost to Owner.

1. Project Warranty: Refer to Conditions of the Contract for project warranty provisions.
2. Manufacturer’s Warranty: Submit, for Owner’s acceptance, manufacturer’s standard warranty document executed by authorized company official. Manufacturer’s warranty is in addition to, and not a limitation of, other rights Owner may have under contract documents.
3. Proper drainage is critical to the longevity of the PlayBound Poured-in-Place surfacing system. Inadequate drainage will cause premature breakdown of the poured system in affected areas; and void the warranty.

1.09 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's unopened containers or bundles fully identified with brand, type, grade, date of manufacture, class, lot number, and other qualifying information.

B. Store materials in original tightly sealed containers or unopened packages. Materials shall be stored out of weather, off the ground, in dry area, in compliance with manufacturer's maximum storage temperature range.

1.10 JOB CONDITIONS

A. Environmental Requirements: Install surfacing system when minimum ambient temperature is 40 degrees F (1 degree C) and maximum ambient temperature is 90 degrees F (32 degrees C). Do not install in steady or heavy rain.

B. Maintain manufacturer's current installation instructions at the job site at all times for safety surface material to be used on the Project.

C. Maintain material storage area at minimum 60^{o}F., but not above 90^{o}F. for 48 hours prior to application.

D. Proceed with work of this section only after substrate construction and penetrating work have been completed.

E. Do not proceed with work during inclement weather. Comply with manufacturer's recommendations for application and curing under specific climatic conditions.

F. Coordinate application of safety surfacing with work of other trades.

1.11 PROTECTION

A. Protect the safety surface from damage, resulting from spillage, dripping, and dropping of materials. Prevent materials from entering and clogging drains. Repair, restore or replace work which is soiled or damaged in connection with the performance of the work.

PART 2 - PRODUCTS

2.01 SAFETY SURFACE - GENERAL

A. General: Poured-in-Place surfacing shall be a 2-layer system consisting of a basemat of 100% post-consumer recycled SBR (styrene butadiene rubber) and polyurethane and a top surface consisting of recycled post-industrial EPDM (ethylene propylene diene monomer) rubber and polyurethane.

2.02 SAFETY SURFACE SYSTEM

A. Playground safety surfacing shall be "Playbound Poured-In-Place System", poured- in - place cushioned play surface, manufactured by Surface America, P.O. Box 157, Williamsville, NY 14231; Tel. 1-800-999-0555; Fax: 716-632-8324; Email: info@surfaceamerica.com; Web; www.surfaceamerica.com, or approved equal.

1. Base Mat: shall be a monolithic poured in place cushioned pad, made from a field-mix blend of 100% post-consumer recycled styrene buttadiene rubber (SBR), (ground into 3/8 in. shredded strands with less than 4% dust), and a polyurethane binder.
   a. Thickness: 2 1/2" (64 mm) as required to meet ASTM F1292 requirements for critical fall heights.
   b. Formulation Components: Blend of strand and granular material.
2. Top Surface Course: shall be a monolithic poured-in-place top surface made from a blend of UV stable recycled post-industrial ethylene propylene diene monomer (EPDM) colored rubber particles measuring 1 to 3 mm and a polyurethane binder.
   a. Dry Static Coefficient of Friction (ASTM D2047): 1.0.
   b. Wet Static Coefficient of Friction (ASTM D2047): 0.9.
   c. Dry Skid Resistance (ASTM E303): 89.
   d. Wet Skid Resistance (ASTM E303): 57.
   e. Thickness: Nominal 1/2" (12.7 mm), minimum 3/8" (9.5 mm), maximum 5/8" (15.9 mm). as required to meet ASTM F1292 requirements for critical fall heights.
3. Primer: Urethane.

B. Color(s): 1/3 Dark Grey (1210)/ 1/3 Eggshell (1306)/ 1/3 Pearl (290), or other combination selected by Architect from manufacturer's standard range.

C. Material shall be delivered to the construction site in its original unopened containers clearly labeled with trade name and name of manufacturer, container weight, and safety precautions.

2.03 MIXES

A. Required mix proportions by weight:

1. Basemat: 16+% polyurethane (as ratio: 14% polyurethane divided by 86% rubber). 14% polyurethane, 86% rubber (based on entire rubber & polyurethane mix).
2. Top Surface: 22% polyurethane (ratio: 18% polyurethane divided by 82% rubber). 18% polyurethane, 82% rubber (based on entire rubber & polyurethane mix).

PART 3 - EXECUTION

3.01 GENERAL

A. The entire safety surfacing system shall be applied in accordance with the playground surfacing manufacturer's printed instructions.

3.02 EXAMINATION

A. Substrate preparation must be in accordance with surfacing manufacturer's specification. New concrete must be fully cured – up to 7 days.

B. Proper drainage is critical to the longevity of the PlayBound Poured-in-Place surfacing system. Inadequate drainage will cause premature breakdown of the poured system in affected areas; and void the warranty. Coordinate installation with drain inlet work of Section 334100, STORM UTILITY DRAINAGE SYSTEM. Evidence of problematic drainage sytem shall immediately be brought to Architect's and Construction Manager's attention.

3.03 SURFACE PREPARATION

A. Final Surface Inspection: Prior to application of safety surface system, the concrete base surface shall be flooded with water and allowed to drain. Any depressions thereupon holding water deeper than 1/16 in. shall be patched and leveled in accordance with recommendations of the manufacturer of the safety surfacing material specified hereinafter. Start of playground safety surfacing application shall constitute acceptance of the concrete base surface to receive safety surfacing.

B. Surface Preparation: Using a brush or short nap roller, apply primer to the substrate perimeter and any adjacent vertical barriers such as playground equipment support legs, curbs or slabs that will contact the surfacing system at the rate of 300 ft2/gal (7.5 m2/L).

3.04 SAFETY SURFACING INSTALLATION

A. Do not proceed with playground surfacing installation until all applicable site work, including substrate preparation, storm drainage system, fencing, playground equipment installation and other relevant work, has been completed.

B. Application of the playground safety surfacing shall occur only after the concrete surface has been thoroughly prepared, leveled, cleaned and dried in accordance with manufacturer's recommendations. The safety surface material shall be applied in strict accordance with manufacturer's printed instructions.

C. Basemat Installation:

1. Using screeds and hand trowels, install the basemat at a consistent density of 29 pounds, 1 ounce per cubic foot (466 kg/m3) to the specified thickness.
2. Allow basemat to cure for sufficient time so that indentations are not left in the basemat from applicator foot traffic or equipment.
3. Do not allow foot traffic or use of the basemat surface until it is sufficiently cured.

D. Primer Application: Using a brush or short nap roller, apply primer to the basemat perimeter and any adjacent vertical barriers such as playground equipment support legs, curbs or slabs that will contact the surfacing system at the rate of 300 ft2/gal (7.5 m2/L).

E. Top Surface Installation:

1. Using a hand trowel, install top surface at a consistent density of 58 pounds, 9 ounces per cubic foot (938 kg/m3) to a nominal thickness of 1/2" (12.7 mm).
2. Allow top surface to cure for a minimum of 48 hours.
3. At the end of the minimum curing period, verify that the top surface is sufficiently dry and firm to allow foot traffic and use without damage to the surface.
4. Do not allow foot traffic or use of the surface until it is sufficiently cured.

F. In all cases, manufacturer's directions for achieving maximum wearability and resilience shall be strictly adhered to.

3.05 PROTECTION AND CLEAN UP

A. Protect the installed playground surface from damage resulting from subsequent construction activity on the site.

B. Contractor shall remove all containers and surplus materials leaving the site in a clean and orderly condition acceptable to the Construction Manager.

END OF SECTION

SECTION 328000

IRRIGATION SYSTEM

PART 1 GENERAL

1.00 GENERAL PROVISIONS

A. Attention is directed to the PROCUREMENT AND CONTRACTING REQUIREMENTS and all Sections within DIVISION 01, GENERAL REQUIREMENTS, which are made a part of this Section of the Specifications.

1.01 WORK INCLUDED

A. This is a Design/Build Specification: The Contractor is responsible for the design and engineering of the entire irrigation system including sizing all piping, calculating system hydraulics, testing, and all other work required for a complete operable system and for providing the specified guarantees. Design and install irrigation system in compliance with ASIC Standards.

B. Unless otherwise indicated on the Drawings, irrigation lines shall be installed to a point 10 ft. from outer face of the foundation wall.

C. On-Site Conditions

1. Inspection of the Site: The Contractor shall acquaint himself with all on-site conditions. Should utilities not shown on the Drawings be found during excavations, the Contractor shall promptly notify the Owner for instruction as to further action. Failure to do so will make the Contractor liable for any and all damage thereto arising from his operations subsequent to discovery of such utilities not shown on the Drawings.
2. Protection of Property: The Contractor shall be responsible for the preservation and protection of all site conditions to remain from damage due to this work. In the event damage does occur, all damage shall be completely repaired to its original condition at no additional cost to the Owner.
3. Trenching: All trenching or other work under the leaf canopy of any and all trees shall be done by hand or by other methods so that no branches, and minimal root systems are damaged in any way.
    a. Trenching around existing plant material shall be done by hand so as to minimize root disturbance.
    b. Buildings, walks, walls, and other property shall be protected from damage. Open ditches left exposed shall be flagged and barricaded by the Contractor by approved means. The Contractor shall restore disturbed areas to their original condition.
4. Protection and Repair of Underground Utilities: The Contractor shall be responsible for requesting the proper utility company to stake the exact location of any underground lines including but not limited to electric, gas, telephone service, water, and cable.
    a. The Contractor shall take whatever precautions are necessary to protect these underground lines from damage. In the event damage does occur, all damage shall be completely repaired to its original condition, at no additional cost to the Owner.

1.02 RELATED WORK

A. Carefully examine all of the Contract Documents for requirements which affect the work of this Section. Other specification sections which directly relate to the work of this section include, but are not limited to the following:

1. Section 014000, QUALITY REQUIREMENTS; Inspection and testing.
2. Section 312300, SITE EXCAVATING, BACKFILLING AND COMPACTING; Excavation and backfill and establishment of subgrade elevations.
3. Section 321216, BITUMINOUS CONCRETE PAVEMENT; Asphaltic concrete paving, including asphaltic concrete base for concrete pavers.
4. Section 321313, PORTLAND CEMENT CONCRETE PAVEMENT; Cast-in-place portland cement concrete paving.
5. Section 329300, PLANTS.
6. Section 329313, PLANTING SOILS.
7. Section 033001, CAST-IN-PLACE CONCRETE - SITEWORK; Concrete.

1.03 REFERENCES

A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.

1. American National Standards Institute (ANSI):

B16.26	Cast Copper Alloy Fittings for Flared Copper Tubes

2. American Society of Irrigation Consultants (ASIC):

Standards	Minimum Standards for Landscape Irrigation

3. American Society for Testing and Materials (ASTM):

B 88	Seamless Copper Water Tube
D 1785	Poly (Vinyl Chloride)(PVC) Plastic Pipe, Schedules 40, 80, and 120
D 2239	Polyethylene (PE) Plastic Pipe (SLPR - PR) Based On Controlled Diameter.
D 2241	Poly(Vinyl Chloride) (PVC) Plastic Pipe (SDR-PR)
D 2464	Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
D 2466	Poly (Vinyl Chloride)(PVC) Plastic Pipe Fittings, Schedule 40
F 690	Underground Installation of Thermoplastic Pressure Piping Irrigation Systems

1.04 SUBMITTALS

A. Submit a complete materials list indicating name of manufacturer, with model numbers of proposed irrigation system equipment and accessories.

B. Submit piping diagram showing sizes and zone valves in relationship to existing system, planting material and hard surficial site elements.

C. After completion of installation, furnish complete as-built drawings showing locations of all sprinkler heads, valves, drains, and piping to scale, with dimensions where required or necessary.

1.05 LAWS, CODES, AND ORDINANCES

A. Irrigation system shall be installed in accordance with the latest laws, ordinances, rules, and regulations of all local, state, and federal authorities having jurisdiction.

1.06 WARRANTY

A. The Contractor will be held strictly responsible for all parts of his work. If failure in the irrigation system or appurtenances develop within one (1) year from the date of final approval and acceptance of the work, the Contractor will be required to replace all faulty materials at his full expense.

B. Labor and materials to fulfill the requirements of this warranty shall be furnished by the Contractor at no additional cost to the Owner. All labor shall include premium time to correct any faulty material or workmanship.

1.07 QUALITY ASSURANCE

A. All applicable ANSI, AWWA, and ASTM Standards and Specifications, and all applicable building codes and other public agencies having jurisdiction upon the work.

B. Protection of Existing Plants and Site Conditions: The Contractor shall take necessary precautions to protect site conditions to remain. Should damages be incurred, this Contractor shall repair the damage to its original condition at his own expense. Any disruption, destruction, or disturbance of any existing plant, tree, shrub, or turf, or any structure shall by completely restored to the satisfaction of the Owner, solely at the Contractor's expense.

C. Permits and Fees: Obtain all permits and pay required fees to any governmental agency having jurisdiction over the work. Inspection required by local ordinances during the course of construction shall be arranged as required. On completion of the work, satisfactory evidence shall be furnished to Architect to show that all work has been installed in accordance with the ordinances and code requirements.

D. The Contractor shall provide full coverage in all irrigated areas and shall be responsible for additional heads and components as required, installed at his own cost.

E. On-Site Observation: At any time during the installation of the irrigation system by the Contractor, the Owner or Architect may visit the site to observe work underway. Upon request, the Contractor shall be required to uncover specified work as directed by the Owner or Architect without compensation. Should the material, workmanship or method of installation not meet the standards specified herein, the Contractor shall replace the work at his own expense.

F. Workmanship: All work shall be installed by skilled personnel, proficient in the trades required, in a neat, orderly, and responsible manner with recognized standards of workmanship. The Contractor shall have had considerable experience and demonstrated ability in the installation of sprinkler irrigation systems of this type.

PART 2 PRODUCTS

2.01 PIPE AND FITTINGS

A. Polyvinyl chloride (PVC) plastic pipe shall be continuously and permanently marked with the following information: Manufacturer's name, pipe size, type of pipe and material, SDR number, ASTM number, and the NSF (National Sanitation Foundation) seal.

B. Main Lines (irrigation line on the supply side of the system up to the zone control valves).

1. Pipe 4 in. diameter and less shall be Schedule 40 polyvinyl chloride (PVC) plastic pipe 1120 or 1220, NSF approved, conforming to ASTM D 1785.
2. Pipe larger than 4 in. diameter shall be polyvinyl chloride (PVC) plastic pipe, SDR 21, 1120 or 1220, conforming to ASTM D 2241, with a minimum pressure rating of 200 psi.
3. Plastic pipe fittings shall be polyvinyl chloride (PVC) molded fittings manufactured of the same material as the pipe and shall be suitable for solvent weld or slip joint ringtite seal (Schedule 40) conforming to ASTM D 2466, or threaded connections (Schedule 80) conforming to ASTM D 2464.
4. Slipfitting socket taper shall be sized so that a dry unsoftened pipe end conforming to these specifications can be inserted no more than halfway into the socket. Plastic saddle and flange fittings shall not be used. Only Schedule 80 pipe may be threaded.

C. Lateral Lines (irrigation lines on the sprinkler head side of the system from the control valves to the sprinkler heads).

1. Pipe 2 in. diameter and less shall be polyethylene (PE) pipe, SIDR 9, Class 160, Type III, Grade 3, Class C conforming to ASTM D 2239, with a minimum pressure rating (PR) of 160 psi.
2. Pipe larger than 2 in. diameter shall be polyvinyl chloride (PVC) plastic pipe, SDR 26 conforming to ASTM D 2241, with a minimum pressure rating (PR) of 160 psi.
3. Polyethylene pipe fittings shall be insert PVC or nylon type fitting recommended by pipe manufacturer. Fittings shall conform to NSF Standards, supplied by Harvard, Liverpool, NY, or approved equal. Joints 1-1/4 in. and greater shall be double clamped with stainless steel clamps.

D. Copper tubing: Hard, straight lengths of domestic manufacture only Type "K" conforming to ASTM B 88. No copper tube of foreign extrusion or thin wall copper tubing shall be used.

1. Where necessary, joints shall be made with cast brass three-part compression coupling or flared tube fittings conforming to ANSI B16.26.

E. Sleeves

1. For Control Wires: Schedule 40 PVC pipe or Schedule 40 galvanized steel pipe.
2. For Water Lines: Schedule 40 PVC or Schedule 40 galvanized steel pipe.
3. Sleeve size shall be at least twice the diameter of the pipe line.

F. Adapters

1. All adapters shall be provided as required by the manufacturer, and are required to construct the proposed system.

2.02 WARNING AND DETECTOR TAPE

A. Detector tape for identification of irrigation main locations shall be manufactured by Reef Industries, Inc., Houston, TX 77275-0218, or approved equal. Detector tape shall consist of a solid aluminum foil core running the full length and width of the tape and encased in a protective, high visibility, color coded inert plastic jacket.

1. Color of tape shall be "Safety Precaution Blue."
2. Tape shall be imprinted with the following legend: "Caution Buried Irrigation Line Below".

2.03 SPRINKLERS AND RISER ASSEMBLY

A. Sprinklers: Manufacturer's standard sprinklers designed for uniform coverage over entire spray area indicated, at available water pressure.

1. Flush, Surface Sprinklers: Fixed pattern, with screw-type flow adjustment.
2. Bubblers: Fixed pattern, with screw-type flow adjustment.
3. Pop-up, Spray Sprinklers: Fixed pattern, with screw-type flow adjustment and stainless-steel retraction spring.
4. Pop-up, Rotary, Spray Sprinklers: Gear drive, full-circle and adjustable part-circle types.
5. Pop-up, Rotary, Impact Sprinklers: Impact drive, full-circle and part-circle types.

2.04 DRIP SYSTEM COMPONENTS (Ground Cover Beds)

A. Dripperline and Integral Dripperline Components: The dripperline shall be Techline CV or Techline pressure compensating dripperline or 8mm Techlite non-pressure compensated dripperline as manufactured by Netafim Irrigation, Inc. Dripper flow rate and spacing shall be as indicated on drawings.

1. Techline CV/Techline/8mm Techlite Fittings: All Techline CV/Techline/8mm Techlite connections shall be made with approved Techline CV/Techline/8mm Techlite insert fittings.
2. Soil Staples: All on-surface/under mulch Techline CV/Techline/8mm Techlite installations shall be held in place with Techline Soil Staples spaced evenly every 3’ - 5’ on center, and with two staples on each change of location.

3. Line Flushing Valves: All Techline/Techlite systems shall be installed with Netafim Automatic Line Flushing Valves. Techline CV zones do not require an automatic line flushing valve but must have a manual flushing port(s) in the position that an automatic flush valve would be positioned.
4. Air/Vacuum Relief Valves: Each independent Techline subsurface irrigation zone shall be installed with an Air/Vacuum Relief Valve at the zone's highest point(s). Techline CV zones do not require an Air/Vacuum Relief Valve.
5. Pressure Regulator: A pressure regulator shall be installed at each zone valve or on the main line to ensure operating pressures do not exceed system requirements. The pressure regulator shall be a Netafim Pressure Regulator.
6. Disc Filter: A disc filter shall be installed at each zone valve or on the main line to ensure proper filtration. The filter shall be a Netafim Disc Filter.
7. Reduced Pressure or other Backflow Prevention Units: Reduced pressure backflow prevention units or any unit as required by local codes shall be provided as indicated on drawings and shall comply with local codes.

2.05 SOIL MOISTURE SENSOR

A. Soil moisture sensor shall sense soil moisture status by measuring the conductivity of a soil volume between two stainless steel probes. Moisture sensor device shall interrupt programmed irrigation cycles until the soil moisture matrix potential has reached a predetermined state. Soil moisture sensor shall be "Baseline Watertec S100" Soil Moisture Sensor, manufactured by Baseline LLC, 2700 E Lanark St. Ste. 100, Meridian, ID 83642 USA; Tel. Day Time Voice (208) 323-1634; Fax (208) 323-1834; Toll Free (866) 294-5847, or approved equal.

1. Soil moisture sensor shall be electrically isolated from other electrical potentials, and be wired from the sensor controller to the probes with water tight materials and connections.

2.06 AUTOMATIC REMOTE CONTROL VALVE AND BOX

A. Automatic remote control valves shall be pressure regulating electric remote control valves. Valve size shall not be less than the size of the lateral served.

B. Each remote control valve shall have a valve box.

1. Valve box shall be impact resistant cycolac plastic with locking cover, similar to those manufactured by Ametek, Sheboygan, WI 53081. Cover color shall be green.

C. Remote control valve tags shall be yellow with thermofused numbers.

2.07 GATE VALVE AND BOX

A. Gate valves 2 in. and smaller shall be cast iron body, bronze mounted with non-rising stem and working pressure rating of 200 psi.

B. Gate valves larger than 2 in. shall be mechanical joint or flanged cast iron with non-rising stem and working pressure rating of 200 psi.

C. Gate valves for above grade or pit use shall be supplied with wheel handles.

D. Gate valve for underground use shall be supplied with 2 in. square operating nut.

E. Each gate valve shall have a valve box.

1. Valve box shall be impact resistant cycolac plastic with locking cover, similar to those manufactured by Ametek, Sheboygan, WI 53081. Cover color shall be green.

2.08 DRAIN VALVE AND BOX

A. Drain valves shall be all bronze construction manual angle valves installed at low points in system.

B. Each drain valve shall have a valve box.

1. Valve box shall be impact resistant cycolac plastic with locking cover, similar to those manufactured by Ametek, Sheboygan, WI 53081. Cover color shall be green.

2.09 CONTROL AND GROUND WIRE

A. Control and ground wiring shall be minimum Type "UF", #12 wire, 600 volt, solid copper, single conductor wire with PVC insulation and shall bear UL approval for direct underground burial feeder cable.

B. A minimum of one extra wire for each direction of run to last valve shall be supplied. Extra wire shall be a fugitive color, loop at each valve.

C. Wire types, connectors, splices, and installation procedures shall conform to applicable local codes.

D. Multi conductor cable will not be acceptable.

E. Wire splices shall be made with "scotch lock connectors" or "snip snap caps" (per title connectors) or other approved method.

2.10 QUICK COUPLING VALVES

A. Quick coupling valves shall be 1 in. heavy duty brass construction one-piece body design, with locking rubber cover. Furnish to the Owner the following additional items: three hollow coupler keys and three swivel hose ell adapters.

1. For use on systems using non-potable water, locking rubber cover shall have molded-in warnings of "DO NOT DRINK" in English and Spanish

2.11 BACKFLOW PREVENTER

A. Backflow preventer shall be required at all cross-connections between irrigation system and potable water.

B. Backflow preventer, based upon prevailing local codes, shall be of the following type:

1. Double check valve backflow preventer

2.12 AUTOMATIC CONTROLLER

A. Automatic controller shall be of a high performance hybrid type that combines electro-mechanical and micro-electronic circuitry, weatherproof and locking type, capable of fully automatic, semi-automatic, and manual operation of irrigation system design. Controller shall be Rain Bird Series, or approved equal.

B. Controller shall be UL listed and tested.

C. Location of controller unit and type of mounting will be selected by the Architect.

D. Controller shall be equipped with a valve output lightning/electrical surge protection kit.

E. Exterior Controller Enclosure: NEMA 250, Type 4, weatherproof, with locking cover and 2 matching keys; include provision for grounding.

1. Material: Stainless-steel.
2. Mounting: Surface type for wall mounting.

2.13 THRUST BLOCKS

A. Concrete for thrust blocks shall be 2500 psi, minimum, air-entrained concrete.

PART 3 EXECUTION

3.01 GENERAL

A. Coordinate all installation/repair work with landscape planting work, especially fine grading, and soil preparation for planting areas per Section 329300, PLANTS and Section 329313, PLANTING SOILS.

B. Excavation required for the installation of the irrigation system shall conform to ASTM F 690.

3.02 PIPE, CONTROL VALVE, AND CONTROL WIRE INSTALLATION

A. Plastic pipe shall be delivered to the site in manufacturer's packaging, stacked in such a manner as to provide adequate protection from compression and deformation of the pipe ends. Pipe shall be protected from exposure to direct sunlight.

B. Pipe interior shall be thoroughly cleaned of all dirt or foreign matter before lowering pipe into trenches. Pipe interiors shall be kept clean during pipe installation by plugs or other approved methods. Piping shall not be installed in water or mud. Ends of pipe shall be securely closed when work is not in progress to prevent water and foreign matter from entering the lines.

C. PVC pipe shall be cut with a hand saw or hack saw with the assistance of a square in sawing vise, or other manner to ensure a square cut. Burrs at cut ends shall be removed prior to installation so that a smooth unobstructed flow will be obtained.

D. Installation of plastic pipe shall conform strictly to manufacturer's recommendations and to ASTM F 690.

1. Metallic fittings shall not be supported by PVC pipe. Metallic fittings shall be supported by a concrete block or cradle.
2. When damaged, plastic pipe shall be replaced by cutting out entire damaged area and replacing with same Schedule, Class, and type of pipe, or heavier, at no additional cost. Plastic pipe shall be thoroughly dry when this replacement is made.

E. Snake pipe in trench from side to side to allow for expansion and contraction.

F. Threaded Joints for Plastic Pipes:

1. Use Teflon tape on the threaded PVC fittings except where Marlex fittings are used.
2. Use strap-type friction wrench only: Do not use metal-jawed wrench.
3. When connection is plastic to metal, male adapters shall be used. Male adapter shall be hand tightened, plus one turn with a strap wrench. Joint compound shall be Teflon tape or equal upon approval.

G. Threaded Joints for Galvanized Steel Pipes:

1. Factory-made nipples shall be used wherever possible. Field-cut threads in pipes will be permitted only where absolutely necessary and approved by Architect; when field threading, cut threads accurately on axis with sharp dies.
2. Use pipe joint compound or Teflon tape to male threads only.

H. Joints for Polyethylene Pipes:

1. Double-clamp all connections 1-1/4 in. diameter and greater.
2. Make all connections between polyethylene pipes and metal valves or pipes with threaded fittings using male adapters.

I. Connections between plastic pipe and metal valves or steel pipe shall be made with threaded fittings using plastic toe nipples or shall be made with adapters and a nonhardening pipe compound applied to male threads.

J. Solvent weld joints shall be made according to manufacturer's instructions. Joints shall be tight and inseparable. Joints shall be allowed to cure 24 hours at temperatures over 40^{O}F. before testing.

1. Solvent shall be compatible with plastic material of heads, pipe, and fittings.

K. Remote control valve shall be installed in a valve box with a locking lid.

1. Clearance between the highest part of the valve and the bottom of the valve box lid shall be 2 in., minimum, and 4 in., maximum. The lid shall not rest on any part of the valve.
2. Clearance between the top of the piping and the bottom of the valve box or the valve box knock-outs shall be 2 in., minimum. Valve box shall not rest on piping.
3. Clearance between the valve body and the sides of the valve box shall be 3 in., minimum.

L. Control wire splices shall be made at electric valve locations. Make no splices between the controller and the remote control valve. Lay to the side of pipeline. Provide looped slack at valves and snake wires in trench to allow for contraction. Tie wires in bundles at 10 ft. intervals. Control wires crossing under pavements shall be installed in conduit.

1. Install a minimum of one extra control wire to the control valve located the greatest distance from the controller in each direction and label each end.
2. Install tag to valve wire before making final connection.
3. Separate color coding of control wires by satellite if required.

3.03 INSTALLATION OF SPRINKLER HEADS

A. After irrigation piping and risers are in place and connected, and prior to installation of sprinkler heads, the control valves shall be opened and a full head of water used to flush out the system. Sprinkler heads shall be installed only after flushing of the system has been completed.

B. Sprinklers shall be set plumb and perpendicular to finish grade.

C. Sprinklers and valve box covers adjacent to walls, curbs, and other paved areas, shall be set to finish grade unless otherwise noted on Drawings.

3.04 INSTALLATION OF DRIP SYSTEM

A. Dripperline Installation:

1. Install all dripperline as indicated on drawings. Use only Teflon tape on all threaded connections.
2. Clamp Techline/Techlite fittings with Oetiker clamps when operating pressure exceeds specific dripperline fitting requirements.
3. When installing Techline CV, Techline, or 8mm Techlite dripperlines on-surface, install soil staples as listed below:
   a. Sandy Soil - One staple every three (3') feet and two (2) staples on each change of direction (tee, elbow, or cross).
   b. Loam Soil - One staple every four (4') feet and two (2) staples on each change of direction (tee, elbow, or cross).
   c. Clay Soil - One staple every five (5') feet and two (2) staples on each change of direction (tee, elbow, or cross).
4. Cap or plug all openings as soon as lines have been installed to prevent the intrusion of materials that would obstruct the pipe. Leave in place until removal is necessary for completion of installation.
5. Thoroughly flush all water lines before installing valves.

3.05 GATE VALVES

A. Install isolation and branch gate valves directly on main as required.

B. Where gate valves isolate branch mains of a smaller size, size valve to largest main and add reducing fittings downstream of valves.

C. Install valve and valve box to finish grade as indicated on the Drawings.

3.06 TESTING AND COMPLETION

A. Hydrostatic Tests: After installation of mainline piping, contractor shall perform a hydrostatic test in the presence of the Architect. Pipe joints shall not be backfilled over, center load pipe with joints exposed until the installation has been inspected, tested and approved in writing by the Architect.

B. Furnish force pump and all other equipment required to adequately perform hydrostatic tests. All testing shall be approved prior to the installation of remote control valves, quick coupling valves, and other types of valve assemblies.

C. Threaded caps shall be installed in place of remote control valves, quick coupling valves, and other type of valve assemblies.

D. Contractor shall maintain 150-psi in the mainline for not less than 4 hours. If leaks develop, remake joints and repeat tests until the entire system is proven watertight.

E. Perform all tests prior to backfilling over pipe joints.

F. Coverage Test: After completion of the system, test the operation of entire system and adjust sprinklers as directed by the Architect. Demonstrate to the Architect that all irrigated areas are being adequately covered. Furnish and install materials required to correct inadequacies of coverage.

G. The Architect shall be notified 48 hours in advance for inspections.

H. During final inspection, Contractor shall be responsible for having two-way communication and sufficient personnel to provide instantaneous communication between the inspection area and the controller for the system.

I. Instruct Owner's designated personnel in proper operation of irrigation system, including programming controller; valves; adjustment of sprinkler heads.

3.07 BACKFILL AND COMPACTING

A. After system is operating and required tests and inspections have been made, backfill excavations and trenches with clean soil, free of debris.

B. Backfill for all trenches, regardless of the type of pipe covered, shall be compacted to minimum 95% density under pavements, 85% under planted areas.

C. Dress off all areas to finish grades.

3.08 PRESSURE SETTING

A. Prior to final inspection Contractor shall adjust each remote control valve to an agreed operating pressure by installing temporary pressure gauge on schrader valve and making necessary adjustments while valve is operating.

3.09 SEASONAL SHUTDOWN

A. At the end of the first irrigation season, the system shall be fully drained by use of compressed air (600 CFM or larger; do not exceed 50 psi) and shutdown for the season.

B. Electro-Mechanical Controllers: A.C. power shall remain on at the controller and place the manual/automatic switch into the manual position.

C. Instruct Owner's designated personnel in proper seasonal shutdown procedures.

3.10 SEASONAL START UP

A. Prior to the start of the second irrigation season, the system shall be restarted, checked, and repaired. This start up procedure shall include but not be limited to:

1. Testing of all system components, (valves, heads, controllers, quick coupling valves, piping, etc.) for proper working order.
2. Adjustments, repair, or replacement of all system components that are not in proper working order.
3. Instruction of Owner's designated personnel in proper seasonal start up procedures.

END OF SECTION

SECTION 329115

STRUCTURAL SOIL

PART 1 GENERAL

1.00 GENERAL PROVISIONS

A. Attention is directed to the PROCUREMENT AND CONTRACTING REQUIREMENTS and all Sections within DIVISION 01, GENERAL REQUIREMENTS, which are made a part of this Section of the Specifications.

1.01 WORK INCLUDED

A. The work of this section consists of all Structural Soil (CU-Soil) work and related items as indicated on the Drawings and as specified herein.

1. CU-Soil™ is a proprietary material patented by Cornell University (US Patent #5,849,069) and marketed under the registered trademark, CU-Structural Soil®. Only licensed companies are authorized to produce this material, meeting the specifications described in this text.
2. For a list of licensed CU-Soil™ producers, call AMEREQ, INC. at 800-832-8788.

1.02 RELATED WORK

A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that relate directly to work of this Section include, but are not limited to the following:

1. Section 312300, SITE EXCAVATING, BACKFILLING AND COMPACTING.
2. Section 321313, PORTLAND CEMENT CONCRETE PAVEMENT.
3. Section 321413, CONCRETE UNIT PAVING.
4. Section 321440, GRANITE PAVING.
5. Section 321543, AGGREGATE BOUND SURFACING.
6. Section 328300, PLANTS.
7. Section 329313, PLANTING SOILS.

1.03 RELATED WORK

A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirement shall govern.

1. ASTM: American Society of Testing Materials
2. USDA: United States Department of Agriculture
3. AASHTO: American Association of State Highway and Transportation Officials
4. Standard Specifications: Regional or Municipal Standard Specifications Documentation for the location of proposed usage
5. AOAC: Association of Official Agricultural Chemists

1.04 SAMPLES AND SUBMITTALS

A. At least 30 days prior to ordering materials, the installing contractor shall submit to the engineer representative samples, certificates, manufacturer's literature and test results for materials specified below. No materials shall be ordered until the required samples, certificates, manufacturer's literature, producer's current license and test results have been reviewed and approved by the landscape architect and/or engineer. The engineer reserves the right to reject any material that does not meet CU-Structural Soil® specifications. Delivered materials shall closely match the approved samples.

B. Submit from licensed producer, $^{1}/_{2}$ cubic foot representative sample of clay loam, one cubic foot representative sample of crushed stone, and one cubic foot representative sample of CU-Structural Soil® mix for approval. In the event of multiple source fields for clay loam, submit a minimum of one set of samples per source field or stockpile. The samples of all clay loam, crushed stone, and CU-Structural Soil® shall be submitted to the engineer as a record of the soil color and texture.

C. Submit soil test analysis reports for sample of clay loam from an independent soil-testing laboratory. The testing laboratory for particle size and chemical analysis may include a public agricultural extension service agency.

D. Submit a mechanical analysis of the clay loam sample and particle size analysis including the following gradient of mineral content:

USDA Designation	Size in mm.
Gravel	+2 mm
Sand	0.05 – 2 mm
Silt	0.002-0.05 mm
Clay	minus 0.002 mm

1. Sieve analysis shall be performed and compared to USDA Soil Classification System.
2. Sieve analysis shall be done by a combined hydrometer and wet sieving using sodium hexametaphosphate as a dispersant in compliance with ASTM D422 after destruction of organic matter by hydrogen peroxide.

E. Submit a chemical analysis, performed in accordance with current AOAC Standards, including the following:
   a. pH and buffer pH.
   b. Percent organic matter as determined by the loss of ignition of oven dried samples. Test samples shall be oven dried to a constant weight at a temperature of 230 degrees F, plus or minus 9 degrees.
   c. Analysis for nutrient levels by parts per million.
   d. Soluble salt by electrical conductivity of a 1:2 soil/water sample measured in Millimho per cm.
   e. Cation Exchange Capacity (CEC).
   f. Carbon/Nitrogen Ratio.

F. Submit one cubic foot sample of crushed stone which will be used in production of CU-Soil™.

G. Provide particle size analysis:

USDA Designation	Size in mm.
3”	+76 mm
$2^1/_2$”	63-76 mm
2”	50-63 mm
$1^1/_2$”	37-50 mm
1”	25-37 mm
¾”	19-25 mm

H. Fine gravel 2-19 mm

I. Provide the manufacturers analysis of the loose and rodded unit weight

J. Losses from LA Abrasion tests- not to exceed 40%

K. Minimum 90% with 2 or more fractured faces

L. Percent pore space analysis

M. At the engineer’s discretion, the sample of CU-Structural Soil® may be tested for the following:

N. Compaction in accordance with ASTM D698/AASHTO T99

O. California Bearing Ratio in accordance with ASTM D1883- soaked CBR shall equal or exceed a value of 50

P. Measured dry-weight percentage of stone in the mixture

Q. The approved CU-Structural Soil® sample shall be the standard.

R. Any deviation from the specified crushed stone and clay loam specifications shall be approved by Amereq Inc., and Landscape Architect.

1.05 DELIVERY, STORAGE AND HANDLING

A. Delivered CU-Structural Soil® shall be at or near optimum compaction moisture content as determined by AASHTO T 99 (ASTM D 698) and should not be placed in frozen, wet or muddy sites.

B. Protect CU-Structural Soil® from exposure to excess water and from erosion at all times. Do not store CU-Soil™ unprotected. Do not allow excess water to enter site prior to compaction. If water is introduced into the CU-Soil™ after grading, allow water to drain to optimum compaction moisture content.

1.06 EXAMINATION OF CONDITIONS

A. All areas to receive CU-Structural Soil® shall be inspected by the installing contractor before starting work and all defects such as incorrect grading, compaction, and inadequate drainage shall be reported to the engineer prior to beginning this work.

1.07 QUALITY ASSURANCE

A. Qualifications of installing contractor: The work of this section should be performed by a contracting firm which has a minimum of five years experience. Proof of this experience shall be submitted as per paragraph, SAMPLES and SUBMITTALS, of this section.

PART 2 - MATERIALS

2.01 CLAY LOAM

A. Soil shall be a “loam” with a minimum clay content of 20% or a “clay loam” based on the “USDA classification system” as determined by mechanical analysis (ASTM D-422) and it shall be of uniform composition, without admixture of subsoil. It shall be free of stones, lumps, plants and their roots, debris and other extraneous matter. It shall not contain toxic substances harmful to plant growth. Clay loam shall contain not less than 2% or more than 5% organic matter as determined by the loss on ignition of oven-dried samples. Test samples shall be oven-dried to a constant weight at a temperature of 230 degrees F., plus or minus 9 degrees.

B. Mechanical analysis for the loam or clay loam shall be as follows:

Textural Class	% of Total Weight
Gravel	less than 5%
Sand	20-45%
Silt	20-50%
Clay	20-40%

C. Chemical analysis: Meet, or be amended to meet the following criteria:
1. pH between 5.5 to 6.5
2. Percent organic matter 2% - 5% by dry weight
3. Adequate nutrient levels
4. Soluble salt less than 1.0 mmho/cm
5. Cation Exchange Capacity (CEC) greater than 10
6. Carbon/Nitrogen ratio less than 33:1

D. Loam or clay loam shall not come from USDA - classified prime farmland.

2.02 FERTILIZER (if needed)

A. Should nutrient analysis suggest that the loam or clay loam need additional nutrients, it shall be amended by Amereq’s licensed producer.

2.03 SULFUR (if needed)

A. Sulfur shall be a commercial granular, 96% pure sulfur, with material and analysis appearing on the labeled container.

B. Sulfur used to lower pH shall be a ferrous sulfate formulation.

C. Application rates shall be dependent on soil test results.

2.04 LIME (if needed)

A. Agricultural lime containing a minimum of 85% carbonates.

B. Application rates shall be dependent on soil test results.

2.05 CRUSHED STONE

A. The size of the crushed stone shall be 0.75 inches to 1.5 inches allowing for 5% – 10% being greater than 1.5 inches, and 5% – 10% less than 0.75 inches.

B. Acceptable aggregate dimensions will not exceed 2.5:1.0 for any two dimensions.

C. Minimum 90% with two or more fractured faces.

D. Results of Aggregate Soundness Loss test shall not exceed 18%.

E. Losses from LA Abrasion tests shall not exceed 40%.

2.06 HYDROGEL

A. Hydrogel shall be a coated potassium propenoate-propenamide copolymer (Gelscape® Hydrogel Tackifier) as manufactured by Amereq, Inc. 800-832-8788.

2.07 WATER

A. The installing contractor shall be responsible to furnish his own supply of water (if needed) free of impurities, to the site.

2.08 CU-STRUCTURAL SOIL®

A. CU-Soil™ is a proprietary material patented by Cornell University (US Patent #5,849,069) and marketed under the registered trademark, CU-Structural Soil®. Only licensed companies are authorized to produce this material, meeting the specifications described in this text. For a list of licensed CU-Soil™ producers, call AMEREQ, INC. at 800-832-8788.

B. A uniformly blended urban tree mixture of crushed stone, clay loam and Gelscape® Hydrogel Tackifier, as produced by an Amereq-licensed company, mixed in the following proportion:

Material	Unit of Weight
specified crushed Stone	100 units dry weight
specified clay loam	20 – 25 units (to achieve minimum CBR of 50)
Gelscape® Hydrogel Tackifier	0.035 units dry weight
moisture	ASMT D698/AASHTO T-99 optimum moisture

PART 3 - EXECUTION

3.01 CU-SOIL™ MIXING AND QUALITY CONTROL TESTING

A. All CU-Structural Soil® mixing shall be performed at the licensed producer's yard using appropriate soil measuring, mixing and shredding equipment of sufficient capacity and capability to assure proper quality control and consistent mix ratios. No mixing of CU-Structural Soil® at the project site shall be permitted.

B. Maintain adequate moisture content during the mixing process. Soils and mix components shall easily shred and break down without clumping. Soil clods shall easily break down into a fine crumbly texture. Soils shall not be overly wet or dry. The licensed producer shall measure and monitor the amount of soil moisture at the mixing site periodically during the mixing process.

C. Raw materials shall be mixed off-site, only at the licensed producer's facility, on a flat asphalt or concrete paved surface to avoid soil contamination.

D. Should the independent laboratory test results of the clay loam reveal a need to amend it, to meet specifications, the amending materials should be added to the clay loam following the rates and recommendations provided by Amereq.

3.02 UNDERGROUND UTILITIES AND SUBSURFACE CONDITIONS

A. The installing contractor shall notify the engineer of any subsurface conditions which will affect the contractor's ability to install the CU-Soil™.

B. The installing contractor shall locate and confirm the location of all underground utility lines and structures prior to the start of any excavation.

C. The installing contractor shall repair any underground utilities or foundations damaged during the progress of this work.

3.03 SITE PREPARATION

A. Do not proceed with the installation of the CU-Structural Soil® material until all walls, curb footings and utility work in the area have been installed. For site elements dependent on CU-Structural Soil® for foundation support, postpone installation of such elements until immediately after the installation of CU-Structural Soil®.

B. Install subsurface drain lines as shown on the plan drawings prior to installation of CU-Structural Soil® material.

C. Excavate and compact the proposed subgrade to depths, slopes and widths as shown on the drawings. Maintain all required angles of repose of the adjacent materials as shown on the drawings. Do not over excavate compacted subgrades of adjacent pavement or structures.

D. Confirm that the subgrade is at the proper elevation and compacted as required. Subgrade elevations shall slope parallel to the finished grade and/or toward the subsurface drain lines as shown on the drawings.

E. Clear the excavation of all construction debris, trash, rubble and any foreign material. In the event that fuels, oils, concrete washout silts or other material harmful to plants have been spilled into the subgrade material, excavate the soil sufficiently to remove the harmful material. Fill any over excavation with approved fill and compact to the required subgrade compaction.

F. Do not proceed with the installation of CU-Structural Soil® until all utility work in the area has been installed. All subsurface drainage systems shall be operational prior to installation of CU-Structural Soil®.

G. Protect adjacent walls, walks and utilities from damage. Use ½" plywood and/or plastic sheeting as directed to cover existing concrete, metal and masonry work and other items as directed during the progress of the work.
1. Clean up all trash and any soil or dirt spilled on any paved surface at the end of each working day.
2. Any damage to the paving or architectural work caused by the installing contractor shall be repaired, as directed by the engineer.

H. Maintain all silt and sediment control devices required by applicable regulations. Provide adequate methods to assure that trucks and other equipment do not track soil from the site onto adjacent property and the public right of way.

3.04 INSTALLATION OF CU-STRUCTURAL SOIL® MATERIAL

A. Install CU-Structural Soil® in 6 inch lifts and compact each lift.

B. Compact all materials to at least 95% Proctor Density from a standard compaction curve AASHTO T 99 (ASTM D 698). No compaction shall occur when moisture content exceeds maximum as listed herein. Delay compaction if moisture content exceeds maximum allowable and protect CU-Structural Soil® during delays in compaction with plastic or plywood as directed by the engineer.

C. Bring CU-Structural Soil® to finished grades as shown on the drawings. Immediately protect the CU-Structural Soil® from contamination by toxic materials, trash, debris, water containing cement, clay, silt or materials that will alter the particle size distribution of the mix with plastic or plywood as directed by the engineer.

D. The engineer may periodically check the material being delivered, prior to installation for color and texture consistency with the approved sample provided by the installing contractor as part of the submittal for CU-Structural Soil®. If the engineer determines that the delivered CU-Soil™ varies significantly from the approved samples, the engineer shall contact the licensed producer.

E. Engineer shall ensure that the delivered structural soil was produced by the approved CU-Soil™ licensee by inspecting weight tickets showing source of material.

F. CU-Soil™ should not be stockpiled long-term. Any CU-Soil™ not installed immediately should be protected by a tarp or other waterproof covering.

3.05 FINE GRADING

A. After the initial placement and rough grading of the CU-Structural Soil® but prior to the start of fine grading, the installing contractor shall request review of the rough grading by the engineer. The installing contractor shall set sufficient grade stakes for checking the finished grades.

B. Adjust the finish grades to meet field conditions as directed.

1. Provide smooth transitions between slopes of different gradients and direction.
2. Fill all dips with CU-Soil™ and remove any bumps in the overall plane of the slope.
3. The tolerance for dips and bumps in CU-Structural Soil® areas shall be a 3" deviation from the plane in 10'.
4. All fine grading shall be inspected and approved by the engineer prior to the installation of other items to be placed on the CU-Structural Soil®.

C. The engineer will inspect the work upon the request of the installing contractor. Request for inspection shall be received by the engineer at least 10 days before the anticipated date of inspection.

3.06 ACCEPTANCE STANDARDS

A. The engineer will inspect the work upon the request of the installing contractor. Request for inspection shall be received by the Architect at least 10 days before the anticipated date of inspection.

3.07 CLEAN-UP

A. Upon completion of the CU-Structural Soil® installation operations, clean areas within the contract limits. Remove all excess fills, soils and mix stockpiles and legally dispose of all waste materials, trash and debris. Remove all tools and equipment and provide a clean, clear site. Sweep, do not wash, all paving and other exposed surfaces of dirt and mud until the paving has been installed over the CU-Structural Soil® material. Do no washing until finished materials covering CU-Structural Soil® material are in place.

END OF SECTION

SECTION 329300 - PLANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Trees.
2. Shrubs.
3. Ground cover.
4. Plants.
5. Mulches.
6. Flush Tree Pit Porous Pavement.

B. Related Sections:
1. Division 31 Section "Site Excavation, Backfilling and Compacting".
2. Division 31 Section "Earth Moving"
3. Division 32 Section “Planting Soils” for soil mixes to be used in planting beds.

1.3 DEFINITIONS

A. Backfill: The earth used to replace or the act of replacing earth in an excavation.

B. Balled and Burlapped Stock: Exterior plants dug with firm, natural balls of earth in which they are grown, with ball size not less than diameter and depth recommended by ANSI Z60.1 for type and size of tree or shrub required; wrapped, tied, rigidly supported, and drum laced as recommended by ANSI Z60.1.

C. Clump: Where three or more young trees were planted in a group and have grown together as a single tree having three or more main stems or trunks.

D. Container-Grown Stock: Healthy, vigorous, well-rooted exterior plants grown in a container with well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of exterior plant required.

E. Finish Grade: Elevation of finished surface of planting soil.

F. Multi-Stem: Where three or more main stems arise from the ground from a single root crown or at a point right above the root crown.

G. Planting and Turf Soil Mix: Native or imported topsoil, manufactured topsoil, or surface soil modified to become topsoil; mixed with soil amendments.

H. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill, before placing planting soil.

I. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

J. Initial Acceptance: Completion of plantings, with adequacy determined by Landscape Architect. Maintenance period shall commence for 1-year after initial acceptance, until Final Acceptance.

K. Final Acceptance: At the end of Maintenance Period, Landscape Architect shall reinspect all plantings to determine adequacy. Warranty shall be complete at Final Acceptance.

1.4 SUBMITTALS

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

B. Samples for Verification: For each of the following:

1. 1 lb of shredded bark mulch in labeled plastic bags.
2. Sample of Addapave showing selected color mix

C. Qualification Data: For qualified landscape Installer.

D. Product Certificates: For each type of manufactured product, from manufacturer, and complying with the following:

1. Manufacturer's certified analysis for 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.

E. Planting Schedule: Indicating anticipated planting dates for exterior plants.

F. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of exterior plants during a calendar year. Submit before expiration of required maintenance periods.

G. Warranty: Sample of special warranty.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape installer who has completed ten or more landscaping projects similar in material, design, value, and extent to that indicated for this Project and with a record of successful grass and landscape establishment has resulted in successful establishment of exterior plants.

1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when planting is in progress. Field supervisor shall have had a supervisory role on a minimum of three projects of comparable scope.

B. Provide quality, size, genus, species, and variety of exterior plants indicated, complying with applicable requirements in ANSI Z60.1, "American Standard for Nursery Stock."

1. Selection of exterior plants purchased under allowances will be made by Architect, who will tag plants at their place of growth before they are prepared for transplanting.

C. Tree and Shrub Measurements: Measure according to ANSI Z60.1 with branches and trunks or canes in their normal position. Do not prune to obtain required sizes. Take caliper measurements 6 inches (150 mm) above the ground for trees up to 4-inch (100-mm) caliper size, and 12 inches (300 mm) above the ground for larger sizes. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip-to-tip.

D. Observation: Landscape Architect may observe trees and shrubs either at place of growth or at site before planting for compliance with requirements for genus, species, variety, size, and quality. Landscape Architect retains right to observe trees and shrubs further for size and condition of balls and root systems, insects, injuries, and latent defects and to reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.

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

E. Preinstallation Conference: Conduct conference at Project site.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver exterior plants freshly dug.

B. Do not prune trees and shrubs before delivery except as approved by Landscape Architect. Protect bark, branches, and root systems from sun scald, drying, 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 exterior plants during delivery. Do not drop exterior plants during delivery and handling.

C. Handle planting stock by root ball.

D. Deliver exterior plants after preparations for planting have been completed and install immediately. If planting is delayed more than six hours after delivery, set exterior plants and trees in shade, protect from weather and mechanical damage, and keep roots moist.

1. Heel-in bare-root stock. Soak roots that are in dry condition in water for two hours. Reject dried-out plants.
2. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
3. Do not remove container-grown stock from containers before time of planting.
4. Water root systems of exterior plants stored on-site with a fine-mist spray. Water as often as necessary to maintain root systems in a moist condition.

E. Take all precautions customary in good trade practice in preparing plants for moving. Workmanship that fails to meet the highest standards will be rejected. Summer dug materials

will not be accepted. Spring (dormant) dug materials which are shipped “in-leaf” shall be sprayed with an antidessicant. Dig, pack, transport, and handle plants with care to ensure protection against injury. Inspection certificates required by law shall accompany each shipment invoice or order, and on arrival the certificate shall be filed with the Landscape Architect.

F. If plants cannot be planted immediately upon delivery, Contractor shall establish suitable holding area for plants. Holding area shall be shaded, protected from weather and mechanical damage. All roots must be kept moist. Properly protect them with soil, wet peat moss, or in a manner acceptable to the Landscape Architect. Protect all plants from drying out. Water root systems of trees and shrubs. Water as often as necessary to maintain root systems in a moist condition. No plant shall be bound with rope or wire in a manner that could damage or break the branches.
   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 trees and shrubs stored on site with a fine-mist spray. Water as often as necessary to maintain root systems in a moist condition.

G. Deliver trees and shrubs to the site after preparations for planting have been completed and plant immediately. If planting is delayed more than 6 hours after delivery, set trees and shrubs in shade, protect from weather and mechanical damage, and keep roots moist as described above. Under no circumstances shall plants be set on pavement or left lying on their sides. Plants found in such conditions shall be rejected and contractor shall remove the plants from the site and provide replacements.

1.7 PROJECT CONDITIONS

A. Utilities: Determine location of above grade and underground utilities and perform work in a manner which will avoid damage. Hand excavate as required. Maintain grade stakes until removal is mutually agreed upon by parties concerned.

B. Excavation: When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions, notify Landscape Architect before planting.

C. Protection:
   1. Protect existing utilities, paving, and other facilities from damage caused by seeding operations.
   2. Perform seeding work only after planting and other work affecting ground surface has been completed or as otherwise approved by Landscape Architect.
   3. Restrict traffic from lawn areas until grass is established. Erect signs and barriers as directed.

D. 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: March 15 to June 30.
   2. Fall Planting: September 1 to November 15.

E. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed according to manufacturer's written instructions and warranty requirements.

F. Coordination with Lawns: Plant trees and shrubs after finish grades are established and before planting lawns unless otherwise acceptable to Landscape Architect.

1. When planting trees and shrubs after lawns, protect lawn areas and promptly repair damage caused by planting operations.

1.8 WARRANTY

A. Special Warranty: Installer's standard form in which Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Death and unsatisfactory growth, except for defects resulting from lack of adequate maintenance, neglect, abuse by Owner, or incidents that are beyond Contractor's control.
b. Structural failures including plantings falling or blowing over.
c. Faulty operation of tree stabilization.

2. Warranty Periods from Date of Initial Acceptance:

a. Trees and Shrubs: One year.
b. Ground Cover and Plants: One year.

3. Include the following remedial actions as a minimum:

a. Remove dead exterior plants immediately. Replace immediately unless required to plant in the succeeding planting season.
b. Replace exterior plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.
c. A limit of one replacement of each exterior plant will be required except for losses or replacements due to failure to comply with requirements.
d. Provide extended warranty for replaced plant materials; warranty period equal to original warranty period.

B. Contractor shall bear the cost of complete replacement(s).

C. If after replacement a plant fails, the Owner will receive a credit based upon the original planted value (approximately three times the wholesale price). All areas damaged by tree or shrub replacement operations are to be fully restored to the project final acceptance condition, as originally specified.

1.9 MAINTENANCE SERVICE

A. Initial Maintenance Service for All Trees and Plants: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after each area is planted and continue until plantings are acceptably healthy and well established, but for not less than maintenance period below.

1. Maintenance Period: One Year from date of planting completion.

a. If planted areas are subject to partial acceptance, maintenance shall continue for one year from date of partial acceptance.

PART 2 - PRODUCTS

2.1 TREE AND SHRUB MATERIAL

A. General: Furnish nursery-grown trees and shrubs complying with ANSI Z60.1, with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock free of disease, insects, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

B. Provide trees and shrubs of sizes, grades, and ball or container sizes complying with ANSI Z60.1 for types and form of trees and shrubs required. Trees and shrubs 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 shall begin at root flare according to ANSI Z60.1. Root flare shall be visible before planting.

D. Label each tree and shrub with securely attached, waterproof tag bearing legible designation of botanical and common name.

E. Label at least one tree and one shrub of each variety and caliper with a securely attached, waterproof tag bearing legible designation of botanical and common name.

F. If formal arrangements or consecutive order of trees or shrubs is shown, select stock for uniform height and spread, and number label to assure symmetry in planting.

2.2 SHADE AND FLOWERING TREES

A. Shade Trees: Single-stem trees with straight trunk, well-balanced crown, and intact leader, of height and caliper indicated, complying with ANSI Z60.1 for type of trees required.

1. Branching Height: One-third to one-half of tree height.

B. Small Upright Trees: Branched or pruned naturally according to species and type, with relationship of caliper, height, and branching according to ANSI Z60.1; stem form as indicated.

C. Small Spreading Trees: Branched or pruned naturally according to species and type, with relationship of caliper, height, and branching according to ANSI Z60.1; stem form as indicated.

2.3 DECIDUOUS SHRUBS

A. Form and Size: Shrubs with not less than the minimum number of canes required by and measured according to ANSI Z60.1 for type, shape, and height of shrub.

1. Shrub sizes indicated are sizes after pruning.

2.4 CONIFEROUS EVERGREENS

A. Form and Size: Normal-quality, well-balanced, coniferous evergreens, of type, height, spread, and shape required, complying with ANSI Z60.1.

1. Shearing Designation: Natural, never sheared (N).

2.5 BROADLEAF EVERGREENS

A. Form and Size: Normal-quality, well-balanced, broadleaf evergreens, of type, height, spread, and shape required, complying with ANSI Z60.1.

1. Shearing Designation: Natural, never sheared.

2.6 PLANTS

A. Perennials: Provide healthy, field-grown plants from a commercial nursery, of species and variety shown or listed, complying with requirements in ANSI Z60.1.

B. Vines: Provide vines of species indicated complying with requirements in ANSI Z60.1 as follows:

1. Two-year plants with heavy, well-branched tops, with not less than 3 runners 18 inches (450 mm) or more in length, and with a vigorous well-developed root system.
2. Provide field-grown vines. Vines grown in pots or other containers of adequate size and acclimated to outside conditions will also be acceptable.

2.7 MULCHES

A. Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following:

1. Type: Ground or shredded bark.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive exterior plants for compliance with requirements and conditions affecting installation and performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities, and lawns and existing exterior plants from damage caused by planting operations.

B. Provide 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 Landscape Architect's acceptance of layout before planting. Make minor adjustments as required.

D. Lay out exterior plants at locations directed by Landscape Architect. Stake locations of individual trees and shrubs and outline areas for multiple plantings.

E. 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.

3.3 EXCAVATION FOR TREES AND SHRUBS

A. As per planting pit details.

B. Planting pits shall be approved by the Landscape Architect before start of planting work.

C. Drainage: Notify Architect if subsoil conditions evidence unexpected water seepage or retention in tree or shrub pits.

D. Fill excavations with water and allow to percolate away before positioning trees and shrubs.

3.4 BACKFILLING OF SOIL LAYERS

A. Placement of Planting Soil:

1. Placement of planting soil and plant stock shall be carried out simultaneously to prevent excessive traffic over soil lifts and the final grade so as to prevent the creation of undesirable soil compaction.
2. Planting soils shall never be moved or worked when wet or frozen.
3. The Contractor shall place barricades as required to prevent any unnecessary compaction of planting soil from vehicles, equipment, or pedestrian traffic.

3.5 FINE GRADING

A. Prior to fine grading, Contractor shall verify that the rough grading, any underdrainage system, and planting soil mixes have been accepted.

B. Fine Grading: Set sufficient grade stakes for checking the finished grades. Confer with Landscape Architect to assure that finish grades will meet the design intent and gradient requirements. Review grades on site with Landscape Architect. Stakes must be set at the bottom and top of slopes and the centers of plant beds. Grades shall be established which are accurate to 1/10th of a foot either way. Connect contours and spot elevations with an even slope. All grading will insure drainage away from structures.

1. After planting soil mix has been spread, it shall be carefully prepared by scarifying and hand raking. All large stiff clods, lumps, brush, roots, stumps, litter and other foreign matter, and stones over one inch in diameter shall be removed from the planting soil.

Planting soil shall also be free of smaller stones in excessive quantities as determined by the Landscape Architect.

2. Fine grade planted areas to smooth, free draining, even surfaces with fine texture. Rake and drag areas to flatten ridges and fill depressions, except as select areas shown on drawings. Control moisture content to maintain optimum conditions, but do not create a muddy condition.
3. Maintenance and Restoration: Restore prepared areas to specified condition if eroded, settled, or otherwise disturbed after fine grading and prior to lawn planting.

3.6 PROTECTION

A. Protect newly graded areas from traffic, freezing and erosion. Keep free of trash, debris or construction materials from other work.

B. Repair and re-establish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or compaction due to subsequent construction operations or weather conditions. Scarify or remove and replace material to a depth as directed by the Landscape Architect; reshape and re-compact at optimum moisture content to the required density.

C. Where settling occurs, before final acceptance or during the warranty period, remove finish surfacing, backfill with additional approved material, compact to specified rates, and restore any disturbed areas to a condition acceptable to the Owner.

3.7 TREE AND SHRUB PLANTING

A. Before planting, verify that root flare is visible at top of root ball according to ANSI Z60.1.

B. Set balled and burlapped and container grown stock plumb and in center of pit or trench with top of root ball 1 inch (25 mm) above adjacent finish grades.

1. Remove burlap and wire baskets from tops of root balls and partially 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.
2. Place planting soil mix around root ball in layers, tamping to settle mix and eliminate voids and air pockets. When pit is approximately one-half backfilled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed. Water again after placing and tamping final layer of planting soil mix.

C. Organic Mulching: Apply 4 inch average thickness of organic mulch extending 12 inches (300 mm) beyond edge of planting pit or trench. Do not place mulch within 3 inches (75 mm) of trunks or stems.

D. Inspect tree trunks for injury, improper pruning, and insect infestation; take corrective measures required before wrapping. Wrap trees of 2-inch (50-mm) caliper and larger with trunk-wrap tape. Start at base of trunk and spiral cover trunk to height of first branches. Overlap wrap, exposing half the width, and securely attach without causing girdling.

E. Dish top of backfill to allow mulching. Provide 5’ mulch ring for all trees in lawn.

F. Apply granular weed suppressant according to strict manufacturer’s specifications to soil surface prior to placing mulch to all mulched areas.

G. Fertilizer:

1. Evenly spread fertilizer at rates specified in soils analysis.

3.8 TREE AND SHRUB PRUNING

A. Remove only dead, dying, or broken branches. Do not prune for shape.

B. Prune remaining trees affected by temporary and new construction or as noted on drawings.

C. Pruning Standards: Prune trees according to ANSI A300 as follows.

1. Type of Pruning: Crown cleaning and thinning, to remove dead, dying or diseased branches, weak branches and watersprouts, as well as selective removal of branches to increase light penetration, air movement and to reduce weight.

D. Prune, thin, and shape trees and shrubs as directed by Landscape Architect.

E. Prune, thin, and shape trees and shrubs according to standard horticultural practice. Prune trees to retain required height and spread. Unless otherwise indicated by Landscape Architect, do not cut tree leaders; remove only injured or dead branches from flowering trees. Prune shrubs to retain natural character.

1. Cut branches with sharp pruning instruments; do not break or chop.

3.9 PLANTING BED MULCHING

A. Mulch backfilled surfaces of planting beds and other areas indicated. Provide mulch ring around trees in lawn areas.

1. Organic Mulch: Apply 4-inch average thickness of organic mulch, and finish level with adjacent finish grades. Do not place mulch against plant stems.

3.10 PLANT MAINTENANCE

A. All planted areas shall be maintained for one year to achieve healthy, viable plantings in weed-free and freshly-mulched beds at the end of the 1-year warranty period.

B. Tree and Shrub Maintenance: Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, restoring planting saucers, adjusting and repairing stakes and guy supports and resetting to proper grades or vertical position, as required to establish healthy, viable plantings. Spray or treat as required to keep trees and shrubs free of insects and disease. Restore or replace damaged tree wrappings.

C. Ground Cover and Plant Maintenance: Maintain and establish plantings by watering, weeding, fertilizing, mulching, and other operations as required to establish healthy, viable plantings.

D. Watering of Trees and Shrubs: Watering shall be accomplished by either natural or artificial means. During the growing season (approximately April 1 to October 31), the minimum application shall be equal to five (5) gallons per square yard or one inch layer of water per plant pit over bed areas per week.

E. Control of Insects, Fungus and Other Diseases: Control of insects, fungus and other diseases shall be accomplished by means of spraying with an insecticide or fungicide, specifically formulated for the pest or disease present and through a comprehensive, defined program. Products and application rates must be approved by Landscape Architect prior to application.

F. Adjustment of Plants: If any tree, shrub or plant moves from its proper elevation or position, it shall be shifted or raised to its proper level and not filled in with additional topsoil.

G. Pruning: Pruning as required for common maintenance is to be performed by a trained horticulturalist in accordance with the specifications or the direction of the Architect.

H. Watering Saucers and Mulch: Watering saucers and mulch will be maintained for the duration of the maintenance period and then saucers are to be removed. =

I. Refertilization: Refertilization is to be Ra-Pid-Gro or approved equal, at the rate of one pound of fertilizer to 30 gallons of water per tree 3" caliper and larger, or smaller trees at the rate of one-third pound of fertilizer to 10 gallons of water per tree applied early in the spring (before May 15) after the first growing season. Shrubs and perennials are to be fertilized with the same mixture at the rate of 1 gallon per shrub and 1 pint per perennial, and applied during the same period. Fertilizer is to be approved brand, completely water soluble and containing not less than 23% nitrogen, 21% phosphorus, and 17% potassium.

J. Weeding: The complete removal of weeds from within the mulched area around each tree and within each planting bed shall be done every two weeks during the growing season and once immediately prior to the completion of the warranty period and final acceptance.

3.11 CLEANUP AND PROTECTION

A. During planting, keep adjacent paving and construction clean and work area in an orderly condition.

B. Protect exterior plants from damage due to landscape operations, operations by other contractors and trades, and others. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.

3.12 INSPECTION AND ACCEPTANCE

A. Planted areas will be inspected at completion of installation and accepted subject to compliance with specified materials and installation requirements.

B. Inspection to determine Initial Acceptance of planted areas will be made by the Landscape Architect upon Contractor's request. Provide notification at least 10 working days before requested inspection date.

1. Landscape work may be inspected for acceptance in parts agreeable to Landscape Architect, provided work offered for inspection is complete, including maintenance.

C. Where inspected landscape work does not comply with requirements, replace rejected work and continue specified maintenance until re-inspected by Landscape Architect and found to be acceptable. Remove rejected plants and materials promptly from project site.

D. Final inspection of the entire project will be done at the end of the 1-year warranty period to establish date of Final Acceptance.

E. Upon Final Acceptance, and within one week of such acceptance, Landscape Architect will notify the Director of the Grounds Department, in writing, before final turn over.

3.13 DISPOSAL

A. Disposal: Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 329300

SECTION 329313 – PLANTING SOILS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. All of the Contract Documents, including General and Supplementary Conditions and Division 1 General Requirements, apply to the work of this Section and are hereby made a part of this Section.

B. Examine all Drawings and other Sections of the Specifications for requirements therein affecting the work of this trade.

1.2 SCOPE OF WORK

A. This Section specifies administrative and procedural requirements for planting soil including, but not limited to the following:

1. Planting soil material acquisition.
2. Preparation of soil mixes and testing for conformance.
3. Installation and placement of soils.

B. Related Sections: The following Sections contain requirements that relate to this Section:
1. Division 31 Section "Site Excavation, Backfilling and Compacting".
2. Division 31 Section "Earth Moving"
3. Section 329300 “Plants” for all planting materials and installation.
4. Section 329115 “Structural Soil’.

1.3 REFERENCES

A. ANSI: American National Standards Institute.

B. AOAC: Association of Official Agricultural Chemists.

C. ASTM: American Society for Testing Materials.

1.4 DEFINITIONS

A. Backfill: The earth used to replace or the act of replacing earth in an excavation.

B. Finish Grade: Elevation of finished surface of planting soil.

C. Planting Soil: Stockpiled or imported topsoil modified to become planting mix and mixed with soil amendments for planting trees, shrubs and ground covers.

D. Turf Soil: Stockpiled or imported topsoil modified to become turf mix and mixed with soil amendments for establishing seed or sod.

E. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill, before placing planting soil.

F. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

1.5 APPLICABLE STANDARDS

A. American Society for Testing Material (ASTM).

B. All standards shall include the latest additions and amendments as of the date of advertisement for bids.

1.6 DEFINITIONS

A. ASA: American Society of Agronomy.

1.7 SUBMITTALS

A. Certificates: Provide certificates required by authorities having jurisdiction, especially for any composted materials containing sewage sludge. Approval as EPA Type 1 “exceptional quality” is required as well as that of the State of New York.

B. Product Data: For each type of product indicated, including source.

1. Compost.
2. Coarse sand.
3. All amendments.

1.8 QUALITY ASSURANCE

A. Source Limitations for Topsoil and Planting Soil Mix: Obtain all topsoil and/or planting soil mix, through one source that has been tested according to the requirements below. Any additional proposed sources must provide additional topsoil analysis and testing as described below.

B. Soil-Testing Laboratory Qualifications: The Contractor shall engage an independent laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.

1. Testing Agencies: The following firms are acceptable testing agencies for the various components.

a. Hummel & Co.: 35 King Street , P.O. Box 606, Trumansburg, New York 14886. tel: 607.387.5694, fax: 607.387.9499.
b. Biosolids/Biological Testing: Soil Foods Web New York, 555 Hallock Avenue, Rte. 25A, Suite #7, Port Jefferson Station, NY, 11776, tel: 631.474.8848, fax: 631.474.8847.
c. Biosolids/Stability Test and Pathogens/ Metals/ Vector Attraction: Woods End Research Laboratory, P.O. Box 297, Mt. Vernon, ME, 04352, tel: 201.293.2457, fax: 201.293.2488.

C. Soil Scientist: The Contractor shall engage a Soil Scientist, subject to approval by Landscape Architect, to review all test reports and to establish percent of components for planting soil mix.

1. Acceptable Soil Scientist:
   a. Hummel & Co.: 35 King Street , P.O. Box 606, Trumansburg, New York 14886. tel: 607.387.5694, fax: 607.387.9499.

D. Topsoil Analysis: For both stockpiled topsoil and additional imported topsoil (if necessary), furnish soil analysis by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity; deleterious material; pH; and mineral and plant-nutrient content of topsoil.

1. Particle Size Analysis: Include sand, silt and clay, sand size distribution, sand particle shape, pH, uniformity coefficient by hydrometer method (ASTM D-422-63).
2. Organic Matter: Percent organic matter by combustion (ASTM F-1647, Method 1).
3. Report of suitability of topsoil for plant growth. State recommended quantities of nitrogen, phosphorus and potassium nutrients and soil amendments to be added to produce satisfactory topsoil.

E. Planting and Turf Soil Mixes: The following testing is required at the following intervals to verify soil mix design:

1. Particle Size Analysis: Include sand, silt and clay, sand size distribution, sand particle shape, pH, uniformity coefficient by hydrometer method (ASTM D-422-63).
2. Organic Matter: Percent organic matter by combustion (ASTM F-1647, Method 1).
3. Report suitability of planting soil mixes for plant growth. Verify compliance with recommended quantities of nitrogen, phosphorus and potassium nutrients and soil amendments to be added to produce satisfactory topsoil.

F. Material Certification and Testing of Subgrade: Prior to placement of the planting soil, test the subgrade as described in this Section. Coordinate the testing of the subgrade with the Sitework Contractor, Soil Scientist, and Landscape Architect.

G. Samples: Prior to ordering the below listed materials, submit representative samples to the Landscape Architect, Owner’s Representative and Soil Scientist for selection and approval. Do not order materials until Landscape Architect’s and Soil Scientist's approval has been obtained.

H. Sources for Soil Components and Planting Soil Mixes: Submit information identifying sources for all soil components and the firm responsible for mixing of planting soil mixes.
1. Landscape Architect and Soil Scientist shall have the right to reject any soil supplier.
2. Soil mix supplier shall have a minimum of five years experience at supplying custom planting soil mixes.
3. Submit supplier name, address, telephone and fax numbers and contact name.
4. Submit certification that accepted supplier is able to provide sufficient quantities of materials and mixes for the entire project.

1.9 DELIVERY, STORAGE AND HANDLING

A. Material should not be handled or hauled, placed or compacted when it is wet as after a heavy rainfall or is frozen. Soil should be handled only when the moisture content is less than at field

capacity. The Landscape Architect and the Soil Scientist shall be consulted to determine if the soil is too wet to handle.

B. Store and handle packaged materials in strict compliance with manufacturer's instructions and recommendations. Protect all materials from weather, damage, injury and theft.

C. Sequence deliveries to avoid delay. On-site storage space is permissible only with written notice from Construction Manager. Deliver materials only after preparations for placement of planting soil have been completed.

D. Prohibit vehicular and pedestrian traffic on or around stockpiled planting soil.

E. Soil that is to be stockpiled longer than two weeks, whether on or off site, shall be placed in mounds less than six feet high. If soil stockpiles greater than six feet high are present longer than two weeks then the contractor shall break down and disperse soil so that mounds do not exceed the six foot height restriction for longer than two weeks.
   1. Provide silt fencing around topsoil mounds, and/or as directed in the Storm Water Pollution Prevention Plan (SWPPP).

F. Vehicular access to the site is restricted. Before construction, the Contractor shall submit for approval a plan showing proposed routing for deliveries and site access.

G. Soil materials shall not be handled or hauled, placed or compacted when it is wet, as after a heavy rain, nor when frozen. Soil shall be handled only when the moisture content is less than field capacity.

PART 2 - PRODUCTS

2.1 TOPSOIL

A. Topsoil: ASTM D 5268, pH range of 5.5 to 7, a minimum of 4 percent organic material content; clean and screened free of deleterious materials and weeds, including but not limited to any plant listed by NYSDEC or other authority as invasive, nuisance or noxious weed species; and free of stones 1 inch (25 mm) or larger in any dimension and other extraneous materials harmful to plant growth.

   1. Topsoil Source: Reuse surface soil stockpiled on-site. Verify suitability of stockpiled surface soil to produce topsoil. Clean surface soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.

      a. Supplement with imported or manufactured topsoil from off-site sources when quantities are insufficient. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches (100 mm) deep; do not obtain from agricultural land, bogs or marshes.

   2. Topsoil Source: Import topsoil or manufactured topsoil from off-site sources. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches (100 mm) deep; do not obtain from agricultural land, bogs or marshes.

B. Imported topsoil shall be tested per requirements listed above. Recommendations for amendment shall be provided by approved Soil Scientist.

2.2 ORGANIC SOIL AMENDMENTS

A. Compost: Well-composted, stable, and weed-free organic matter not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings. The compost shall be a dark brown to black color and be capable of supporting plant growth with appropriate management practices in conjunction with addition of fertilizer and other amendments as applicable, with no visible free water or dust, with no unpleasant odor, and meeting the following criteria as reported by laboratory tests. **Debris such as metal, glass, plastic, wood (other than residual chips), asphalt or masonry shall not be visible and shall not exceed one percent dry weight**.

1. Organic Matter Content: **50 to 60** percent of dry weight. (ASTM F-1647, Method 1).
2. The ratio of carbon to nitrogen shall be in the range of 10:1 to 25:1.
3. One hundred percent of the material shall pass a 3/8-inch (or smaller) screen. (ASTM D-422-63).
4. pH: The pH shall be between 5.5 to 7.5 as determined from a 1:1 soil-distilled water suspension using a glass electrode pH meter. (American Society of Agronomy *Methods of Soil Analysis*, Part 2, 1986).
5. Salinity: Electrical conductivity of a one to two soil to water ratio extract shall not exceed 4.0 mmhos/cm (dS/m).
6. Heavy metal contents shall conform to state and federal regulations.
7. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.

B. Compost may be obtained at one of the following sources, provided that the test requirements are met:

1. WeCare Compost by We Care Organics, Jordan, New York, 315-689-1937
2. Cayuga Compost (fine) by P&S Excavating, Trumansburg, New York, 607-387-6826
3. Cornell Farm Services, Ithaca, NY: 607-257-2235

2.3 DRY SCREENED SAND

A. Dry Screened Sand: Sand for amending loam shall be uniformly graded coarse sand consisting of clean, inert, rounded grains of quartz or other durable rock free from loam or clay, surface coatings, mica, and other deleterious materials with the following particle size distribution as determined by ASTM F1632:

U.S. Sieve Size No.	% Passing Minimum	% Passing Maximum
4	100	
8	90	100
16	80	100
30	25	60
50	0	25
100	0	5
270	0	3

1. Maximum size shall be one half-inch largest dimension. The maximum retained on the #4 sieve shall be 5% by weight of the total sample. The ratio of the particle size for 80% passing (D_{80}) to the particle size for 30% passing (D_{30}) shall be 3.0 or less. ($D_{80}/D_{30} < 3.0$) Tests shall be by combined hydrometer and wet sieving in compliance with ASTM D422.

2.4 FERTILIZER

A. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 4 percent nitrogen and 10 percent phosphoric acid.

B. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.

C. 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. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.

D. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.

2.5 PLANTING SOIL MIX

A. Planting Bed Soil Mix: Mix topsoil with the following soil amendments and fertilizers in the following quantities:
1. Sand: 65 – 75% by weight.
2. Organic Matter: 5 – 8% by weight.
3. Topsoil: 20 – 40% by weight. Silt content must be less than 3 times the clay content.

B. Approximate Ratio of Loose Compost to Coarse Sand to Topsoil by Volume, to be confirmed by tests described in Section 1.8 E: 1:1:1

C. Weight of Slow-Release Fertilizer per 1000 Sq. Ft. (92.9 Sq. m): As recommended by manufacturer, based on rates supplied by Soil Scientist.

2.6 TURF SOIL MIX

A. Approximate Ratio of Loose Compost to Coarse Sand to Topsoil by Volume, to be confirmed by tests described in Section 1.8 E: 1 part compost : 3 parts sand : 2 parts topsoil.

PART 3 - EXECUTION

3.1 COORDINATION

A. Coordinate activities with other project contractors so that there is no soil disturbance from traffic or other construction activities subsequent to placement.

B. Pre-Installation Examination Required: The Contractor shall examine previous work, related work, and conditions under which this work is to be performed and shall notify Landscape Architect in writing of all deficiencies and conditions detrimental to the proper completion of this work. Beginning work means Contractor accepts substrates, previous work, and conditions. The Contractor shall not place any planting soil until all work in adjacent areas is complete and approved by the Landscape Architect and Soil Scientist.

C. Examination of Subgrade

1. The subgrade shall be inspected prior to the start of soil placement for conformance with the Drawings for elevations of subgrade relative to finish grade. Subgrade shall be graded smooth and parallel to the finish grades.
2. Percolation tests shall be performed on a minimum of 10% of tree pits and 20% of shrub beds, and on any areas of questionable drainage or as required by Landscape Architect. Contact Landscape Architect and Soil Scientist and conduct percolation tests in their presence. Percolation tests shall be measured in inches per hour of drainage at the base of the plant root level.

    a. Should any planting areas yield a percolation test result of less than 4” of drainage per hour, stop work on these areas obtain direction from Soil Scientist.

D. Soil Mix Preparation: Examine soil and remove foreign materials, stones over 1/2”, and organic debris over 2” in length. Mix-in fertilizers and amendments as required by tests and as approved by the Landscape Architect. All preparation and mixing shall be accomplished when the soil moisture content is less than field capacity. If lime is to be added, it shall be mixed with dry soil before fertilizer is added and mixed.

3.2 EXCAVATION AND REMOVAL

A. Refer to Section 312000 Earth Moving.

B. Dispose of all excess materials legally off Owner’s property.

3.3 MIXING OF SOIL MIXES

A. Adequate quantities of mixed planting soil materials shall be provided to attain, after compaction and natural settlement, all design finish grades.

B. Soil mixes shall be produced with equipment that blends together each component in a thorough and uniform manner.

C. Uniformly mix ingredients by windrowing/tilling on an approved hard surface area. Organic matter shall be maintained moist, not wet, during mixing.

1. Test all soil components prior to mixing. After soil component tests have been accepted, planting soil may be mixed.
2. Amendments shall not be added unless approved to extent and quantity by the owner and additional tests have been conducted to verify type and quantity of amendment is acceptable.
3. Percentages of components, unless otherwise noted, will be established upon completion of individual test results for components of the various mixes.

D. After component percentages are determined by the Soil Scientist, each planting soil mix shall be tested for physical and chemical analysis.

1. Retest soil mixes and adjust mix as necessary to meet project requirements.

3.4 COORDINATION AND EXCESS MATERIALS

A. Coordinate activities with other project contractors so that there is no soil disturbance from traffic or other construction activities subsequent to placement.

B. Excess Planting Soil Mixture and Materials: Remove the excess planting soil mixture and materials from the site at no additional cost to the Owner unless other wise requested.

3.5 POST-INSTALLATION TESTING

A. In-place density testing is required in all areas. The standard test for surface and subsurface density shall be ASTM D-1556.

END OF SECTION 329313

SECTION 329449

GREEN SCREEN

PART 1 GENERAL

1.00 GENERAL PROVISIONS

A. Attention is directed to the PROCUREMENT AND CONTRACTING REQUIREMENTS and all Sections within DIVISION 01, GENERAL REQUIREMENTS, which are made a part of this Section of the Specifications.

1.01 WORK INCLUDED

A. Furnish and install steel green screen system assemblies including.

1. Panels
2. Trim
3. Clips
4. Spans
5. Posts

1.02 RELATED WORK

A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:

1. Section 014000, QUALITY REQUIREMENTS; Inspection and testing.
2. Section 329300, PLANTS.

1.03 REFERENCES

1. American Society for Testing and Materials (ASTM):

A 500	Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

1.04 DESIGN / PERFORMANCE REQUIREMENTS

A. Structural Requirements: Provide steel green screen system capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated on the Drawings:

1. Components: Design and size to withstand dead and live loads of components, plants, rain, snow and ice and loads caused by positive and negative wind pressure acting normal to plane of trellis as calculated in accordance with applicable code.

B. System shall be designed, fabricated, and installed to accommodate expansion and contraction of metal components without causing undue stress, buckling, opening of joints, and distortion.

C. Design supports and hardware to withstand loads encountered without excessive deflection or distortion when cables are tensioned to required amounts required to conform to applicable building codes.

1.05 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog data for specified products demonstrating compliance with referenced standards. Provide list of fittings being provided with descriptions, load capabilities, and either photographs or drawings for each type.

B. Shop Drawings: Submit Shop Drawings for fabrication and installation. Include the following:

1. Plans, elevations, and detail sections.
2. Indicate materials, methods, finishes, fittings, fasteners, anchorages, and accessory items.
3. Provide setting diagrams and templates for anchorages, sleeves, and bolts to be installed by others.
4. Where materials or fabrications are indicated to comply with design loadings, include material and safety factor properties, and other information needed for structural analysis.

C. Verification Samples: Two samples representing actual products and finishes as follows:

1. Welded wire grid panel, 12 in. x 12 in.
2. Channel trim section and steel edge trim section, each 12 inches (300 mm) long.
3. Standard post, 3 in. diameter x 18 in. long.

D. Installation Instructions: Manufacturer's printed installation instructions.

E. Operation and Maintenance Data: Include methods for maintaining installed products and precautions against cleaning materials and methods detrimental to finishes and performance.

F. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturer of galvanized welded aire panel, trim and posts with 10 years minimum successful experience.

B. Installer Qualifications: Experienced in performing work of this section that has specialized in installation of work similar to that required for this project.

C. Mock-Up: Provide a mock-up for evaluation of preparation techniques and installation workmanship.

1. Locate in areas designated by Architect.
2. Size: Minimum of 10 SF (1 sm).

3. Do not proceed with remaining work until workmanship is approved by Architect.
4. Rework mock-up as required to produce acceptable work.
5. Retain mock-up during construction as quality standard.
6. Remove and legally dispose of mock-up when no longer needed.
7. Incorporation: Incorporate mock-up into final construction.

D. Preinstallation Meetings: Conduct meetings including Contractor, Architect, fabricator, installer and other subcontractors whose work involves cable trellis system to verify project requirements, framing and support conditions, mounting surfaces and manufacturer's installation. Comply with Division 1 requirements.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Handle and store products according to manufacturer's recommendations. Leave products wrapped or otherwise protected and under clean and dry storage conditions until required for installation.

C. Exercise care not to scratch, mark, dent, or bend metal components during delivery, storage, and installation.

1.08 PROJECT CONDITIONS

A. Verify actual openings by field measurements before fabrication; show recorded measurements on shop drawings.

B. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

PART 2 GENERAL

2.01 GREEN SCREEN

A. Green Screen shall be “Freestandiing Trellis Fence”, manufactured by GreenScreen; 1743 La Cienega Blvd. Los Angeles CA 90035 T - 800.450.3494; www greenscreen.com, or approved equal.

1. Height: 6 ft.
2. Steel Channel Trim: #5104.
3. Finish: Custom powdercoat; Color: RAL 8019.

B. Requests for substitutions will be considered in accordance with provisions of Division 1, GENERAL REQUIREMENTS.

C. Provide all components from a single manufacturer.

2.02 COMPONENTS

A. PANELS : All panels are comprised of a rigid, three dimensional welded wire grid consisting of 14 gauge galvanized steel wire welded at each intersection to form a 2" x 2" grid on the front and back face of the panel, separated by bent wire trusses. All bent wire trusses are placed at 2” centers running the length of the panel and are welded to the top and bottom face grids at each truss apex. All panels are available in any width up to 48" and any length up to 168" in even 2" increments in either 2" or 3" depths. 2” thick panels are recommended for wall mounted applications only. 3” thick panels are recommended for wall mounted or freestanding applications. Panel tolerance is ±1/8” in width and ±1/4” in length.

B. TRIM : All 3" x 1/2" x 1/2" #5104 Channel Trim and 1/2" x 1/2" #5105 Steel Edge Trim shall be 20 gauge galvanized steel sheet welded to the wire frame panels with all exterior surfaces ground smooth prior to powder coat finish.

C. CLIPS : All mounting clips shall be fabricated from 14 gauge or thicker, galvanized steel sheet stock. All bending, forming and drilling shall be done prior to powder coat finish. All (2) piece mounting clips are to be joined with minimum 1/4” diameter stainless steel bolt with washers and nut.

D. SPANS: For freestanding fences and screens, span between structural supports should not exceed 8’ for 3” thick panels without thorough review of specific site conditions and mounting details. For overhead horizontal or inclined panels span between structural supports should not exceed 4’. All curved panel spans should be reviewed based on specific panel radius and center to center of proposed structural support spacing.

E. CURVING: All curved panels shall be fabricated in the factory using approved “Cut-to-Curve” or “Crimped-to-Curve” procedures prior to application of powder coat finish to ensure that all wire edges are coated and protected. The use of “Cut-to-Curve” or “Crimped-to-Curve” fabrication technique is dependent on the specific radius and the direction of the curve relative to the flat panel layout.

F. POSTS: Standard posts shall be 3” diameter ASTM A-500 or 3” square x 3/16” thick tube steel with commercial grade finish to match panels. Overall post length should be verified based on panel size, post spacing, wind load requirements and soil conditions.

G. FINISH : Commercial Grade Finish - all panels, trim, posts, caps + miscellaneous clips shall be fabricated, cut, bent and drilled prior to receiving a multigrade phosphate wash, a thermally-set epoxy primer and a thermally-set powder paint finish color coat in custom RAL 8019 color.

PART 3 EXECUTION

3.01 EXAMINATION

A. Before beginning installation, verify that conditions installed under other sections are acceptable for installation of green screen system in accordance with manufacturer's installation instructions.

B. Supply items required to be cast into concrete or embedded in masonry with setting templates, to appropriate Sections.

C. If conditions are the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Verify alignment, support dimensions, and tolerances are correct.

B. Inventory components to ensure all required items are available for installation. Inspect components for damage. Remove damaged components from site and replace.

3.03 INSTALLATION

A. Install green screen system in accordance with manufacturer's instructions and the approved shop drawings.

B. Provide anchorage devices and fittings to secure to in-place construction.

C. Install infill plumb, level, square, and rigid without kinks or sags.

D. Anchor system to mounting surfaces as indicated on the Drawings.

E. Separate dissimilar materials with bushings, grommets or washers to prevent electrolytic corrosion.

3.04 ADJUSTING AND CLEANING

A. Remove temporary coverings and protection of adjacent work areas. Clean installed products in accordance with manufacturer's instructions before owner's acceptance.

B. Do not use abrasive cleaners.

C. Remove from project site and legally dispose of construction debris associated with this work.

3.05 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

C. Protect installed products and finished surfaces from damage during construction.

D. Replace defective or damaged components as directed by Architect.

END OF SECTION

SECTION 330513

PRECAST MANHOLES

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. Attention is directed to the PROCUREMENT AND CONTRACTING REQUIREMENTS and all Sections within DIVISION 01, GENERAL REQUIREMENTS, which are made a part of this Section of the Specifications.

1.02 SUMMARY

A. Procurement of all necessary adjustment rings for storm, sanitary, and telcom manholes.

B. Installation of adjustment rings, frames, and covers on all storm, sanitary, and telcom manholes.

C. Related Sections:
   1. Division 22 Section "Facility Sanitary Sewers"
   2. Division 26 Section “Underground Ducts and Raceways for Electrical Systems”
   3. Division 31 Section “Earth Moving”
   4. Division 33 Section "Storm Utility Drainage Piping"

1.03 QUALITY ASSURANCE

A. All precast concrete sections and structures, and all castings must each be the product of a single manufacturer who can furnish evidence of satisfactory experience in the product of high quality products of the type indicated and specified.

B. All structures and castings must be of good quality and free from defects that would make it unfit for the use intended.

1.04 SUBMITTALS

A. Submit manufacturer’s data shop drawings and/or cut sheets for adjustment rings.

B. Submit manufacturer’s certification of compliance for precast concrete sections and castings.

1.05 PRODUCT HANDLING

A. All material must be delivered to the job site intact and in good condition.

B. Carefully handle precast sections and all castings when loading and unloading to avoid damage.

C. The Architect/Engineer must approve all repairs and replacements to materials damaged either in delivery or installation.

PART 2 – MATERIALS

2.01 GRADE/ADJUSTMENT RINGS

A. Use only precast concrete grade rings.

B. Precast grade rings must conform to ASTM C-478 construction and minimum dimension criteria and be circular in shape. All concrete must be made with Type II Portland Cement. Do not use brick for grade adjustments.

2.02 WATERPROOF MORTAR

A. Portland Cement mortar conforming to ASTM C-270, Type M, with waterproofing admixture.

2.03 COATINGS

A. Bituminous coating shall be Midland Asphalt RC-30, Hydrocide 700B by BASF, or Polyguard CA-14.

PART 3 – EXECUTION

3.01 GENERAL

A. It is the intent of this specification to finalize construction of all manholes so they are soundly constructed and watertight in accordance with the Contact Drawings.

3.02 ADJUSTMENT RINGS AND FRAME/COVER

A. Frames and covers for each manhole were furnished as part of the previous contract, and left in an unsecured condition atop each manhole. Contractor is responsible for determining finished grade elevations per the proposed drawings and finished surfaces and procuring necessary adjustment rings.

B. Excavate around the manhole structures as necessary to remove frame and cover, and for installation of the adjustment rings.

C. Install adjustment rings and frame/cover per the manufacturer recommendations and per this specification using no less than 1/2” bed of mortar between all sections, inclusive of frame/cover.

D. Coat both the interior and exterior of the sections utilizing a bituminous coating.

E. Backfill excavation utilizing methods described in spec section 312000.

3.03 REJECTION AND REPAIR

A. Installation of adjustment rings and frame/cover will be subject to rejection because of failure to conform to any of the specification requirements in addition to the following: fractures or cracks passing through the rings, defects that indicate imperfect proportioning, mixing, and molding, surface defects indicating honeycombed or open texture, and improper waterproofing.

PART 4 – METHOD OF MEASUREMENT

4.01 ALL ITEMS

A. The quantity to be measured for payment is the number of units installed, adjusted, relocated, replaced or removed as noted under Basis of Payment.

4.02 ADJUST EXISTING MANHOLE FRAME AND COVER

A. The quantity to be paid for under these items shall be the number of manhole frame and covers adjusted.

PART 5 – BASIS OF PAYMENT

5.01 ALL ITEMS

A. The unit price bid for all items shall include the cost of all labor, material, and equipment necessary to complete the work. Excavation, bedding, and backfill is included in the unit price bid. Removal of existing abandoned utilities or structures, as required to complete the work, is included in the unit price bid. Surface restoration, where applicable, will be paid for separately under their appropriate item.

5.02 ADJUST EXISTING MANHOLE FRAME AND COVER

A. Unit price bid includes the cost of determining top of manhole elevation, procuring adjustment rings, permanent installation of adjustment rings, removing and resetting existing frame and cover (frame and cover provided in previous contract), concrete encasement, masonry, and necessary coatings.

Payment will be made under:

ITEM NO.	ITEM	PAY UNIT
330513.03	Adjust Existing Sanitary, Storm, or Telcom Manhole Frame and Cover (Including Excavation and Backfill)	Each

END OF SECTION

SECTION 334100

STORM UTILITY DRAINAGE PIPING

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. Attention is directed to the PROCUREMENT AND CONTRACTING REQUIREMENTS and all Sections within DIVISION 01, GENERAL REQUIREMENTS, which are made a part of this Section of the Specifications.

1.02 SUMMARY

A. Extent of storm sewer system work includes, but is not limited to the following:
   1. Furnish and install new storm sewer drainage, fittings, and accessories
   2. Furnish and install new catch basins
   3. Install top section, frame and grate of catch basin installed in previous contract
   4. Complete connections to existing piping
   5. Adjust the height of sewer piping riser and clean out frame and cover

B. Maintain flow through existing storm sewer systems by whatever means necessary, including pumping, temporary piping etc. Coordinate with the Architect/Engineer for approval of proposed methods.

C. Related Sections:
   1. Division 22 Section “Facility Sanitary Sewers”
   2. Division 31 Section “Earth Moving”
   3. Division 31 Section “Erosion and Sediment Control”
   4. Division 33 Section “Precast Manholes”

1.03 QUALITY ASSURANCE

A. All precast concrete sections and structures, and all castings must each be the product of a single manufacturer who can furnish evidence of satisfactory experience in the product and of high quality of the type indicated and specified.

B. Pipe and pipe fittings must be produced in a plant of recognized reputation that is regularly engaged in the production of pipe conforming to the specified standards. Pipe and pipe fittings of the same type must be the product of a single manufacturer.

C. Provide pipe and pipe fittings, structures, and castings of good quality and free from defects which would make it unfit for the use intended.

D. Furnish all labor, materials, surveying instruments and tools necessary to establish and maintain all lines and grades.

1.04 SUBMITTALS

A. Submit Material Safety Data Sheet (MSDS) for nonshrink grout.

B. Submit manufacturer's data and shop drawings for precast structures, frames and covers, coatings, pipe connectors, backwater check valves, etc.

C. Submit manufacturer's certifications of compliance for precast concrete sections and castings.

D. Manufacturer's literature and catalog cuts including technical, material specifications, dimensions, tolerances, and installation information for all underdrain products, pipe and pipe fittings, and geotextile fabrics.

E. Submit shop drawings, catalog cuts, and manufacturer's literature for all pipe and pipe fittings, to include coatings and linings, material specifications, dimensions, tolerances, and all related data.

F. Submit manufacturer's certification that pipe supplied meets the required specifications.

G. Pipe manufacturers must furnish Certificates of Compliance on pipe, with each load of pipe supplied. Immediately turn certificates over the Architect/Engineer. Materials delivered to the site without accompanying certificates will be subject to rejection.

H. Submit record drawings indicating actual location of pipe runs, connections, wyes, stubs, structures and associated invert elevations. Record actual vertical separations at all exposed utility crossings. Record invert elevations at all utility crossings.

I. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Each length of pipe delivered to the site must be clearly marked at the factory with the name of the manufacturer, class of pipe, pipe diameter and all else as required by the codes, standards, and specifications referred to under this section. Omission of this information will be cause for rejection of pipe.

B. Store all materials in accordance with manufacturer's approved instructions. Store all materials so they can be easily inspected and so they will not be damaged prior to installation.

C. Carefully handle all pipes and fittings when loading and unloading to avoid damage to pipe, coatings, or linings. Contractor must repair or replacing pipe or fittings with damaged coatings or linings his expense, to the satisfaction of the Architect/Engineer. Lift pipes and fittings by hoists or lower on skid ways in a manner to avoid shock. Lower pipe into trench with derricks, rope, or suitable equipment for the safety and protection of workmen, materials, equipment, property, and the work.

D. Do not dump or drop pipe and fittings. Those that are dumped or dropped are subject to rejection by Architect/Engineer.

E. Carefully handle precast sections and all castings when loading and unloading to avoid damage. In the event of damage, either in delivery or installation, the damaged section must be immediately removed form the project site and replaced at no additional cost to the Owner.

1.06 ABBREVIATIONS

CIP	Cast Iron Pipe
CMP	Corrugated Metal Pipe
CPP	Corrugated Polyethylene Pipe
DIP	Ductile Iron Pipe
PVC	Polyvinyl Chloride Pipe
PCPP	Perforated Corrugated Polyethylene Drain Pipe
RCP	Reinforced Concrete Pipe
SICPP	Smooth Interior Corrugated Polyethylene Pipe
VTP	Vitrified Tile Pipe (clay)

1.07 MATERIAL TESTS

A. Various tests and checks must be performed, as specified herein, to determine compliance with the specifications and drawings. Failure of a test is suitable grounds for the Architect/Engineer to order that portion of the work removed and reconstructed, if necessary, to meet the requirements of the Contract Documents.

1.08 JOB CONDITIONS

A. The drawings indicate the required structure and pipe sizes, and locations of all structures, piping and appurtenances. Verify all locations and immediately notify Architect/Engineer of any discrepancies or conflicts.

B. Verify that survey benchmark and intended elevations for the work are as indicated. Verify existing site conditions.

C. Utilities shown on the Contract Drawings are for the convenience of the Contractor, exact locations are not guaranteed. Verify existing utilities with the proper authorities.

D. Take precautions to protect from harm the work of other contractors on site, existing facilities, as well as adjacent property. The Contractor is responsible for all damage or injury done to pipes, structures, utilities, pavement, buildings, property or person as a result of work to complete this contract. The Contractor at his own expense must repair or replace such property or item to the satisfaction of the property owner, utility owner, public agency having jurisdiction, Architect/Engineer and Owner's Designated Representative.

1.09 PROTECTION OF WATER AND GAS LINES FROM STORM SEWER

A. Refer to water main notes provided on the Contract Plans.

PART 2 – PRODUCTS AND MATERIAL

2.01 GENERAL

A. Caps and Plugs – Water tight, of similar manufacturer and producing the same joint conditions as the pipe on which the cap or plug is placed.

B. Bedding and Backfill Materials: Must be as detailed on the Contract Drawings and as specified in Division 31 Section “Earth Moving”.

C. Pipe Adapters – Join pipes of different materials with adapters specifically manufactured for that purpose and as approved by the Architect/Engineer. Where dissimilar materials join, such that galvanic action may produce corrosion, provide dielectric couplings to preclude damage to the materials.

D. Concrete for Pipe Encasements and Cradles – Class A concrete per NYSDOT Standard Specification Section 501.

E. Flowable concrete fill for sewer abandonment must be Controlled Low Strength Material (CSLM) as specified in Division 31 Section “Earth Moving”.

2.02 POLYVINYL CHLORIDE PIPE (PVC) Lateral or Non-Pressure Piping (Gravity Sewer)

A. Pipe and Pipe Fittings

1. Acceptable Products - As manufactured by J-M Manufacturing, Ipex, or Certainteed.

2. Materials – PVC pipe and fittings to be used for gravity sewer shall fully conform to the requirements of ASTM D3034 for diameters from 4” to 15”, and ASTM F679 for 18” to 48”. Standard dimension ratio (SDR) 35 pipe shall be provided unless otherwise noted on the Contract Drawings.

3. Pipe and fittings shall be made of PVC compounds having a cell classification of 12454 or 12364 as defined in ASTM D1784.

4. Standard laying length shall be 14 or 20 feet. Random lengths of shorter pipe sections may be utilized to make proper connections as approved by the Architect/Engineer.

5. Pipe shall be installed in compliance with ASTM D2321.

B. Joints

1. The pipe shall be joined with an integral bell, bell and spigot type rubber gasketed joint. Each integral bell joint shall consist of a formed bell complete with one or more rubber gaskets. Gaskets shall conform to ASTM F477. The gasket shall be locked securely in place by a groove formed in the bell to prevent displacement during assembly. The “locked-in” rubber seating ring shall also meet or exceed the requirements of ASTM D3212 – Joints for Drain and Sewer Pipes Using Flexible Elastomeric Seals. Pipe with gaskets held in place by only glue will <u>not</u> be acceptable unless approved otherwise by the Architect/Engineer.

2. Each spigot end shall be clearly marked, for the entire circumference, indicating the

proper distance of insertion into the adjoining bell end, such marking being placed so as to adequately allow for expansion and contraction of the pipeline over the full range of temperature fluctuations which may occur in the final installation. The sealing ring shall be the only element depended on to make the joint flexible and water tight.

3. Joint lubricant shall be as recommended by the manufacturer.

2.03 SMOOTH INTERIOR CORRUGATED POLYETHYLENE PIPE (SICPP)

A. Corrugated polyethylene pipe storm sewers must be high-density corrugated polyethylene smooth interior pipe. Four-inch to 10-inch diameter pipe must conform to AASHTO M252 with the addition of smooth interior and 12-inch to 36-inch diameter pipe must conform to AASHTO M294, Type S. Material compounds must conform to ASTM D3350. Pipe must be SureLok ST (bell & spigot) as manufactured by ADS/Hancor, Smooth Flow Pipe (bell & spigot) as manufactured by Haviland Drainage Products, or Inline Bell (bell & spigot) as manufactured by Lane Enterprises.

B. Join pipe using a bell and spigot joint meeting ASSHTO M252 or AASHTO M294. The joint must be soil tight and gaskets must meet the requirements of ASTM F477.

C. Pipe joined with manholes that use flexible connectors (boots) or new pipe connections to existing pipe, must use corrugated pipe adapters to provide a sealing surface for the flexible connector.

D. Pipe joints and fittings must be of the same material as the pipe.

2.04 CATCH BASINS (HEAVY DUTY)

A. Provide precast or cast-in-place concrete structures as shown on the Contract Drawings. Precast concrete strength must meet 4,000 psi at 28 days. Concrete must be made with Type II Portland Cement. Provide structures designed for AASHTO H-20 loading with 30 percent impact.

B. Frame and grate for vehicular roadways must be parallel bar frame and grate, meeting AASHTO H-20 design and in accordance with NYSDOT Standard Sheet 655-02, as indicated on the Contract Drawings.

C. ADA Grate: Grate must be in accordance with ADA requirements (Section 4.5.4) with a maximum slot opening not to exceed ½” in one direction. Place grates with elongated openings so that the long dimension is perpendicular to the dominant direction of pedestrian travel. The minimum clear opening of the frame must be 18” SQ. Subject to compliance with requirements, provide East Jordan Iron Works Model V5620 frame and V5720-80 grate or approved equal.

D. Pipe to Catch Basin Seal: Use non-shrink grout in conformance with NYSDOT Section 701-05. Grout must have a minimum compressive strength of 4,000 psi in 24 hours. Subject to compliance with requirements, provide Euco N.S. Grout by Euclid Chemical Company, Sikagrout 212 by Sika Corporation, or SureGrout by Kaufman Products, Inc.

2.05 MANHOLES

A. Manholes must be as specified in Division 33 Section “Precast Manholes”.

2.06 CONNECTIONS TO EXISTING PIPE LINES

A. For new sewer to existing sewer pipe, make connections using flexible rubber joint connector with stainless steel shear ring and stainless steel shear bands, nuts, and bolts meeting the requirements of ASTM C-425. Use corrugated pipe adapters to provide a sealing surface for the flexible connector. Connectors must be specifically designed to join the new pipe material to the existing pipe material.

B. Connect laterals to new sewer pipe with a manufactured wye fitting on the main with push-on joint. Provide appropriate adapter to connect the lateral pipe material to the main sewer pipe material. The minimum strength classifications of these fittings must be equal to that of the pipe, and the fitting must be compatible with the pipe.

C. Lateral connections to existing sewer must be made with seal-tight strap-on saddles with double stainless steel straps and stainless steel or bronze bolts for sewers up to 14 inches in diameter and bolt-on saddles for sewers greater than 14 inches in diameter, or approved equal.

2.07 DETECTABLE UNDERGROUND MARKING TAPE

A. For all PVC, CPP, SICPP, or DIP sewer pipe or laterals, provide detectable warning tape. Refer to Division 31 Section “Earth Moving”.

PART 3 – EXECUTION

3.01 PREPARATION

A. Thoroughly clean interiors of pipes, fittings, and appurtenances, joint surfaces, and gaskets prior to installation. Maintain pipes and fittings clean.

B. Verify that excavation is in the proper location, that pipes and structures have been installed at the correct elevations, and that the subgrade has been properly prepared.

3.02 PIPE AND STRUCTURE INSTALLATION - GENERAL

A. Complete trenching and related excavation work in accordance with Division 31 Section “Earth Moving” and in a manner as approved by the Architect/Engineer. Remove all boulders, organic or spongy material, and other deleterious matter. Verify that trench excavation is ready to receive work and that excavations, dimensions, and elevations are as indicated on drawings.

Remove large stones or other hard matter, which could damage piping or impede consistent backfilling or compaction.

B. Pipe Foundation: Properly bed all pipes, fittings, or specials in uniformly supported on pipe foundations of the type specified in Division 31 Section “Earth Moving” and indicated on the Contract Drawings.

C. Firmly bed pipe in the required depth of aggregate in such a manner that the pipe barrel is uniformly supported and cradled throughout its length. Provide suitable depressions where

required in the foundation material to permit adequate bedding of the bells or other projections. The total depth of bedding must be constant across the trench width.

D. Install storm structures and pipelines to the required lines and grades indicated on the drawings, or as directed by the Architect Engineer using an approved method of control.

E. Carefully lower pipes, fittings, and structures into the trench. Apply joint lubricant (if required) in accordance with the approved manufacturer's recommendations. Join pipe sections and fittings. Join pipe and structures.

F. Select pipe and fittings so that there will be as small a deviation as possible at the joints and so that inverts present a smooth surface. Pipe and fittings, which do not fit together to form a tight fitting joint, are not permitted.

G. Use only mechanical cutters for cutting pipe.

H. Cut ends of pipe which terminate at catch basins, manholes, or other structures cleanly and trim to a neat, sheared edge, flush with the inside wall of the structure.

I. Maintain cleanliness of installed pipe, fittings, and structure interiors throughout the work. Plug ends when installation is not in progress so that dirt, foreign matter, water, animals, and people do not enter the work. Contractor not permitted to drain construction excavations through installed pipes.

J. Maintain the excavation free of water during the progress of the work. Contractor must not lay pipes or structures in water nor may any joints made up in water. No separate allowance for pumping or otherwise removing water will be made. Contract must remedy all slides or cave-ins of the trenches or cuts at the contractor's expense, and to the satisfaction of the Architect/Engineer.

3.03 ADJUSTMENT OF CATCH BASINS TO FINISHED GRADE

A. For catch basins installed as part of the previous contract, the contractor has left the catch basins complete with the exception of the top section and frame and grate.

B. Contractor is responsible for determining finished grade elevation per the proposed drawings and finished surfaces and procuring the necessary materials to finalize construction of the catch basins.

C. Excavate around the top of the catch basin such that all necessary areas are exposed for addition of materials and features.

D. Install top section utilizing either precast or cast in place concrete, according to the manufacturers recommendations and the included documents.

E. Backfill the excavation utilizing methods described in division 31.

3.04 CLEAN OUTS

A. Where required, adjust the riser piping and frame and cover of clean out to the elevation indicated on the proposed plans.

3.05 TESTING

A. Deflection testing on all 12-inch and smaller storm piping must be completed.

B. Upon completion of construction of the sewer, including trench backfill, the Contractor shall clean and flush all pipes. All water needed to flush the sewer system shall be furnished by the Contractor at no additional cost to the Owner. The system shall be left free of all stones, sand, silt, or mortar. The benches and inverts of manholes and bottoms of inlets shall have all mortar dropping chipped away to leave a smooth, clean surface.

C. All materials flushed from the sewer shall be intercepted and removed to prevent the materials from entering the existing sewer system.

D. The Contractor shall supply all materials, equipment, and labor as required or ordered by the Architect/Engineer, to test the gravity mains, manholes, and appurtenances in accordance with the provisions of these specifications.

E. The Contractor shall be responsible to dewater the sewer and bypass sewage flow where necessary to complete testing.

F. Water used by the Contractor during any testing procedures will be paid by the Contractor. All hydrants for water supply for testing use shall be operated by the appropriate utility owner. Backflow preventer and meters for the hydrants shall be required and provided by the Contractor.

G. Deflection testing of underdrain piping is not required.

3.06 ABANDONMENT OF SEWERS AND APPURTENANCES

A. When the new sewer has successfully passed the specified testing and has been placed in service, the existing sewer and laterals, to limits shown on the Contract Drawings, is to be abandoned.

B. Unless otherwise shown on the plans, sewer piping designated for abandonment shall be filled with Controlled Low Strength Material (CLSM), capped, and abandoned in place. Refer to plans for removals.

C. Short sections of laterals to be abandoned, which are connected to sewers to remain in service, shall not be filled with CLSM (i.e. laterals within a right-of-way). Refer to plans for lateral abandonment.

D. Completely fill sewers to be abandoned by whatever means necessary (pumping, segmental filling, fill tubes, etc.).

E. Structures designated for abandonment shall be removed to within 3 feet of the proposed finished grade and filled with CLSM.

F. All surfaces disturbed as a result of abandonment shall be restored in kind or as shown on plans.

3.07 FIELD QUALITY CONTROL

A. In the presence of the Owner's Designated Representative, inspect each length of pipe and each structure delivered to the job for flaws, cracks, dimensional tolerance and compliance with the applicable specifications. Install in the work only pipes, fittings, and structures accepted and marked by the Owner's Designated Representative.

B. Inspect pipe joints and verify that they a properly installed and made up, and free from sags, high spots, and excessive deflections.

C. The Owner's Designated Representative must inspect each stretch of completed pipeline and structure prior to backfilling to insure compliance with the Contract Documents. The Contractor must not continue with backfilling operations prior to inspection by the Owner's Designated Representative or prior to recording as built information.

D. Afford Architect/Engineer access to the work so that he may spot check the installations or check each length of pipe immediately after it has been installed, or check it at any time after installation.

E. Request Owner's Designated Representative inspection prior to and immediately after placing aggregate cover over pipe.

F. Upon completion of construction of the sewer, including trench backfill, the Contractor must clean and flush all pipes. The system must be left free of all stones, sand, silt, mortar, and debris. The benches and inverts of manholes and bottoms of inlets must have all mortar droppings chipped away to leave a clean and smooth surface.

G. Intercept and removed all materials flushed from the sewer to prevent the materials from entering the existing sewer system.

3.08 DAMAGED FACILITIES

A. Correct any section of piping found to be defective in material, alignment, grade, joint, or otherwise, at no additional cost to the Owner.

B. In the event that dirt, debris, or any other foreign material has entered any portion of the piping or structures, flush the piping or structure with clean water. Continue the flushing process until the piping or structure is clean, as determined by Architect/Engineer.

C. Repair or replace any damage done to existing utility mains or their appurtenances because of work under this Contract to the satisfaction of the Architect/Engineer at no additional cost to the Owner.

PART 4 – METHOD OF MEASUREMENT

4.01 ALL ITEMS

A. The quantity to be measured for payment is the number of units installed, adjusted, relocated, replaced or removed as noted under Basis of Payment.

4.02 SEWER PIPE

A. The quantity paid for will be the total horizontal length in linear feet of sewer pipe as measured parallel with the centerline of the installed sewer from inside face to inside face of manhole or structure bases. Where sewer pipe does not extend to a manhole, horizontal length is measured to the point of connection to existing sewer. The payment length shall include the length of wye branch or tee branch sections.

4.03 LATERAL PIPE

A. The quantity paid for lateral pipe will be the total length measured parallel with the centerline of the installed lateral pipe from the end of the wye branch, tee branch, tee saddle, or other connection point to an existing lateral, to the end of the lateral pipe.

4.04 CLEANOUT

A. The quantity paid for will be the number of cleanouts installed.

4.05 CLEANOUT ADJUSTMENT

B. The quantity paid for will be the number of cleanouts adjusted to grade.

4.06 CATCH BASIN

A. The quantity paid for will be the number of catch basins installed.

4.07 CATCH BASIN ADJUSTMENT

A. The quantity paid for will be the number of catch basins adjusted to grade.

4.08 FRAME AND GRATE/COVER

A. The quantity paid for will be the number of catch basin frames and grates/covers furnished and installed.

4.09 STORM SEWER ABANDONMENT

A. The quantity paid for will be the number of cubic yards of CLSM installed in abandoned storm sewer.

PART 5 – BASIS OF PAYMENT

5.01 ALL ITEMS

A. The unit price bid for all items shall include the cost of all labor, material, and equipment necessary to complete the work. Excavation, bedding, and backfill is included in the unit price

bid. Removal of existing abandoned utilities or structures, as required to complete the work, is included in the unit price bid. Surface restoration, where applicable, will be paid for separately under their appropriate item.

5.02 SEWER PIPE

A. Inclusive to the items outlined in 5.01, the unit price bid shall include the cost for connections to other drainage features, i.e., existing sewers, stubs, manholes, etc. Payment will be made upon successful acceptance of installed features, testing, necessary certifications, and completion of all work.

5.03 LATERAL PIPE

A. The unit price bid per linear foot shall include the cost for procuring and installing bends, piping, plugs, wye's, markers, etc., as required. Additionally payment shall be inclusive of removal of temporary perforated riser, connection to existing lateral and/or trench and slot drains, and elastomeric sleeve.

5.04 CLEANOUT

A. The unit price bid shall include the cost of installation of the wye branch on the lateral, vertical bends, riser pipe, threaded plug, and cast iron frame and cover.

5.05 CLEANOUT ADJUSTMENT

A. The unit price bid shall include the cost of modification of the riser pipe, and raising or lowering the frame and cover as necessary for installation of the finished surface.

5.06 CATCH BASIN

A. The unit price bid shall include installation of precast or cast in place units; coring additional openings into precast basins; connecting lateral or pipe to the catch basin; bar reinforcement; top slab (where applicable); cast in place top section; leveling course; frames and grates; concrete; mortar; epoxy grout; cleaning lateral or pipe; and disposing all debris.

5.07 CATCH BASIN ADJUSTMENT

A. The unit price bid shall include the cost of modification of the catch basin, and raising or lowering the frame and grate as necessary for installation of the finished surface.

5.08 FRAME AND GRATE/COVER

A. The unit price bid shall include the cost of furnishing and installing frame and grate/cover.

5.09 STORM SEWER ABANDONMENT

A. The unit price bid shall include the cost of furnishing and installing CLSM to fill storm sewer to be abandoned.

Payment will be made under:

ITEM NO.	ITEM	PAY UNIT
334100.01XX	SICPP Pipe, Silt Tight, XX" Dia (Including Excavation and Backfill)	Linear Foot
334100.03XX	Polyvinyl Chloride Pipe Storm Lateral, SDR-35, XX" Dia (Including Excavation and Backfill)	Linear Foot
334100.04	4" Storm Cleanout (Including Excavation and Backfill)	Each
334100.0401	Adjust Existing Cleanout Riser, Frame, and Cover to Grade (Including Excavation and Backfill)	Each
334100.0501	Concrete Catch Basin (24" x 24"), Frame, and Grate (Including Excavation and Backfill)	Each
334100.0502	Concrete Catch Basin (24" x 32"-NYSDOT Type S), Frame, and Grate (Including Excavation and Backfill)	Each
334100.06	Adjust Existing Catch Basin Frame and Grate to Grade (Including Excavation and Backfill)	Each
334100.08	Catch Basin Frame and Grate/Cover (Including Excavation and Backfill)	Each
334100.12	Abandon Existing Storm Sewer in Place with CLSM (Including Excavation and Backfill)	CY

END OF SECTION

SECTION 334915

DRAINS, GRATES, AND FRAMES

PART 1 GENERAL

1.00 GENERAL PROVISIONS

A. Attention is directed to the PROCUREMENT AND CONTRACTING REQUIREMENTS and all Sections within DIVISION 01, GENERAL REQUIREMENTS, which are made a part of this Section of the Specifications.

1.01 WORK INCLUDED

A. Provide all equipment and materials, and do all work necessary to furnish and install the drains, grates, and frames as indicated on the Drawings and as specified.

1.02 RELATED WORK

A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:

1. Section 014000, QUALITY REQUIREMENTS; Inspection and testing.
2. Section 312300, SITE EXCAVATING, BACKFILLING AND COMPACTING; Excavation and backfill and establishment of subgrade elevations.
3. Section 321313, PORTLAND CEMENT CONCRETE PAVEMENT.
4. Section 033001, CAST-IN-PLACE CONCRETE - SITEWORK; Concrete
5. Section 321413, CONCRETE UNIT PAVING.
6. Section 321440, GRANITE PAVING.

1.03 REFERENCES

A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.

1. American Society for Testing and Materials (ASTM):

A 36	Structural Steel
A 123	Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strip.

1.04 SUBMITTALS

A. Shop drawings shall be submitted for specified products indicating construction of frame for trench drain grate and methods of installation and connection to grate.

B. Submit manufacturer's product data for specified products.

PART 2 PRODUCTS

2.01 CHANNEL DRAIN

A. Modular system of precast, polymer-concrete channel sections, grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling, shall be ACO “K100S”, manufactured by ACO Polymer Products, Inc., Chardon, OH 44024; Tel. 440-285-7000; 1-800-543-4764, or approved equal. Include number of units required to form total lengths indicated.

B. Sloped-Invert, Polymer-Concrete Systems: Include the following components:

1. Channel Sections: Interlocking-joint, precast, modular units with end caps. Include 4-inch (102-mm) inside width and deep, rounded bottom, with built-in invert slope of 0.6 percent and with outlets in number, sizes, and locations indicated. Include extension sections necessary for required depth.
   a. Frame: Include steel frame for grate.
   b. Wherever the drain is adjacent to a radial condition, channel segment length shall be .5 meter.
2. Grates: Iron longitudinal- An ADA compliant grate with longitudinal slots- same direction as trench. Manufactured from ductile iron with a black coating.

C. Supports, Anchors, and Setting Devices: Manufacturer's standard, unless otherwise indicated.

D. Channel-Section Joining and Fastening Materials: As recommended by system manufacturer.

2.02 BRICKSLOT DRAINAGE SYSTEM

A. The surface drainage system shall be ACO Drain Brickslot, as manufactured by ACO Polymer Products, Inc. or equal approved.

B. The Brickslot top shall be manufactured from 11 gage galvanized steel. The nominal clear opening for Brickslot slot is 3/8” (9.5mm) with overall width of 4.84” (123mm). Slot shall be tapered to prevent debris from being trapped. Brickslot shall be used with KS100 channel system.

C. Brickslot shall be secured by ‘QuickLok’ boltless locking system. Access units shall have frames that fit catch basin or channels with a separate cover unit that can be removed for maintenance.

PART 3 EXECUTION

3.01 EXCAVATION AND BEDDING FOR TRENCH AND SLOT DRAIN SYSTEM

A. Trenching and excavation, including the removal of rock and unstable material, shall be in accordance with Section 312000, EARTHWORK. Bedding material shall be placed in the trench as indicated or as required as replacement materials used in those areas where unstable materials were removed. Compaction of the bedding material shall be as specified in Section 312000.

3.02 INSTALLATION CHANNEL DRAIN

A. Trench drain shall be installed in concrete at required elevation, and as indicated on the Drawings and in strict accordance with manufacturer's printed instructions.

3.03 BRICKSLOT DRAINS

A. The Brickslot system shall be installed in accordance with the manufacturer's installation instructions and recommendations.

END OF SECTION