

SECTION 011100

SUMMARY OF WORK

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Permits and Fees: Apply for, obtain, and pay for trade permits, fees, and utility company back charges required to perform the work. Submit copies to Architect.
- B. Codes: Comply with applicable codes and regulations of authorities having jurisdiction. Submit copies of inspection reports, notices and similar communications to Architect.
- C. Dimensions: Verify dimensions indicated on drawings with field dimensions before fabrication or ordering of materials. Do not scale drawings.
- D. Existing Conditions: Notify Architect of existing site conditions differing from those indicated on the drawings. Do not remove or alter structural components without prior written approval.
- E. Coordination
  - 1. Coordinate the work of all trades.
  - 2. Prepare coordination drawings for areas above ceilings where close tolerances are required between building elements and mechanical and electrical work.
  - 3. Verify location of utilities and existing conditions.
- F. Installation Requirements, General
  - 1. Inspect substrates and report unsatisfactory conditions in writing.
  - 2. Do not proceed until unsatisfactory conditions have been corrected.
  - 3. Take field measurements prior to fabrication where practical. Form to required shapes and sizes with true edges, lines, and angles. Provide inserts and templates as needed for work of other trades.
  - 4. Install materials in accordance with manufacturer's instructions and approved submittals.
  - 5. Install materials in proper relation with adjacent construction and with proper appearance.
  - 6. Restore units damaged during installation. Replace units which cannot be restored, with no additional expense to the Owner.
  - 7. Refer to additional installation requirements and tolerances specified under individual specification sections.
- G. Repair damage caused by construction operations.

PART 2 PRODUCTS

(Not Applicable)

PART 3 EXECUTION

(Not Applicable)

END OF SECTION

## SECTION 013113

## PROJECT COORDINATION

## PART 1 GENERAL

## 1.1 GENERAL REQUIREMENTS

- A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

## 1.2 SECTION INCLUDES

- A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the project coordination as specified herein, including, but not limited to, the following:
  - 1. General project coordination procedures.
  - 2. Conservation.
  - 3. Coordination drawings.
  - 4. Requests for Information (RFIs).
  - 5. Administrative and supervisory personnel.
  - 6. Cleaning and protection.

## 1.3 RELATED SECTIONS

- A. Project Meetings - Section 013119.
- B. Submittal Procedures - Section 013300.
- C. Product Requirements - Section 016000.
- D. Closeout Procedures - Section 017700.

## 1.4 COORDINATION

- A. Coordinate construction operations included in various sections of these specifications to ensure efficient and orderly installation of each part of the work. Coordinate construction operations included under different sections that depend on each other for proper installation, connection, and operation.
  - 1. Schedule construction operations in the sequence required to obtain the best results where installation of one part of the work depends on installation of other components, before or after its own installation.
  - 2. Coordinate installation of different components to ensure maximum accessibility for required maintenance, service, and repair.
  - 3. Make provisions to accommodate items scheduled for later installation.
- B. Conservation: Coordinate construction operations to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.

1. Salvage materials and equipment involved in performance of, but not actually incorporated in, the work.

#### 1.5 REQUESTS FOR INFORMATION (RFI)

- A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
  1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
  2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
  1. Project name.
  2. Project number.
  3. Date.
  4. Name of Contractor.
  5. Name of Architect.
  6. RFI number, numbered sequentially.
  7. RFI subject.
  8. Specification Section number and title and related paragraphs, as appropriate.
  9. Drawing number and detail references, as appropriate.
  10. Field dimensions and conditions, as appropriate.
  11. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the Change Order Requests.
  12. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
    - a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.
- C. RFI Forms per Project Management Software: AIA Document G716 or software-generated form with substantially the same content as indicated above and acceptable to Architect.
  1. Attachments shall be electronic files in Adobe Acrobat PDF format.
- D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven working days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.
  1. The following Contractor-generated RFIs will be returned without action:

- a. Requests for approval of submittals.
  - b. Requests for approval of substitutions.
  - c. Requests for approval of Contractor's means and methods.
  - d. Requests for coordination information already indicated in the Contract Documents.
  - e. Requests for adjustments in the Contract Time or the Contract Sum.
  - f. Requests for interpretation of Architect's actions on submittals.
  - g. Incomplete RFIs or inaccurately prepared RFIs.
2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
  3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Owner/Contractor Agreement.
    - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response.
- E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Use CSI Log Form 13.2B or software-generated form with substantially the same content and acceptable to Architect. Include the following:
1. Project name.
  2. Name and address of Contractor.
  3. Name and address of Architect.
  4. RFI number including RFIs that were returned without action or withdrawn.
  5. RFI description.
  6. Date the RFI was submitted.
  7. Date Architect's response was received.
- F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response.
1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.

## PART 2 PRODUCTS

(Not Applicable)

## PART 3 EXECUTION

### 3.1 GENERAL COORDINATION PROVISIONS

- A. Inspection of Conditions: Require the installer of each major component to inspect both the substrate and conditions under which work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in a manner acceptable to the Architect.

- B. Coordinate temporary enclosures with required inspections and tests to minimize the necessity of uncovering completed construction for that purpose.

3.2 CLEANING AND PROTECTION

- A. Clean and protect construction in progress and adjoining materials in place, during handling and installation. Apply protective covering where required to assure protection from damage or deterioration at substantial completion.
- B. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to assure operability without damaging effects.

END OF SECTION

SECTION 013119

PROJECT MEETINGS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

- A. Work of this section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

- A. To enable orderly review of progress during construction and to provide for systematic discussions of problems, the Architect will conduct project meetings throughout the construction period.
- B. In general, project meetings will be held at the job site in accordance with a mutually acceptable schedule.
- C. The purpose of the project meetings is analysis of problems that might arise relative to execution of the work.

1.3 RELATED SECTIONS

- A. The Contractor's relations with his subcontractors and materials suppliers, and discussions relative thereto, are the Contractor's responsibility as described in the General Conditions, and are not part of the agenda of project meetings.

1.4 QUALITY ASSURANCE

- A. Persons designated by the Contractor to attend and participate in project meetings shall have all required authority to commit the Contractor to solutions as agreed upon in the project meetings.

1.5 SUBMITTALS

- A. Agenda Items: To the maximum extent possible, advise the Architect at least twenty-four (24) hours in advance of the project meeting regarding all items to be added to the agenda.
- B. Minimum Agenda
  1. Review work progress since last meeting.
  2. Note field observations, problems and decisions.
  3. Identify problems which impede planned progress.
  4. Review off-site fabrication problems.
  5. Develop corrective measures and procedures to regain schedule.
  6. Coordinate projected progress with other prime contractors.
  7. Review submittal schedules, expedite as required to maintain schedule.

- C. Minutes: The Contractor shall compile minutes of each project meeting and shall distribute copies to the Owner and the Architect. The Contractor shall make and distribute such other copies as he wishes. The Architect and/or Owner may issue amendments to the minutes as necessary. Contractor shall issue same to other interested parties.

## PART 2 PRODUCTS

(Not Applicable)

## PART 3 EXECUTION

### 3.1 MEETING SCHEDULE

- A. Coordinate with the Architect as required to establish a mutually acceptable schedule for project meetings.

### 3.2 MEETING LOCATION

- A. To the maximum extent practicable, project meetings shall be held at the job site.

### 3.3 ATTENDANCE

- A. To the maximum extent practicable, assign the same person or persons to represent the Contractor at project meetings throughout the construction period. Subcontractors, materials suppliers, and others may be invited to attend those project meetings in which their aspects of the work are involved.

END OF SECTION

SECTION 013300

SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

- A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

- A. Work of this Section includes all labor, materials, equipment, and services necessary to complete submittal requirements as specified herein, including, but not limited to, the following:
  - 1. Shop drawings and samples.
  - 2. Integrated drawings.

1.3 RELATED SECTIONS

- A. Construction Progress Documentation - Section 013200.

PART 2 PRODUCTS

2.1 SHOP DRAWINGS AND SAMPLES

- A. General
  - 1. The Contractor shall be responsible for coordinating the schedule for submittal of shop drawings and samples with his progress schedule and the requirements of the Contract Schedule, and submit a coordinated schedule of submission of all shop drawings and samples to the Architect.
  - 2. Failure of the Contractor to schedule and submit shop drawings and samples in ample time for checking, correction, and rechecking will not justify any delay in the Contract Schedule. Allow ample time for items to be tested, including time for retesting if the tests or mock-ups fail.
  - 3. Samples, shop drawings, manufacturers' literature, and other required information shall be submitted in sufficient time to permit proper consideration and action on same before any materials and items are delivered on the work. Stagger submissions so that the Architect can review the documents in an orderly and timely manner. All samples of materials requiring laboratory tests shall be submitted to the laboratory for testing not less than 90 days before such materials are required to be used in the work. All other samples, manufacturers' literature, and other sample information shall be submitted for approval not less than 30 days before such materials are required to be used in the work.
  - 4. Shop drawings for each Section of the work shall be numbered consecutively, and the numbering system shall be retained throughout all revisions. Each drawings shall have a clear space for the stamps of the Contractor, Architect, and one of the Architect's consultants.

5. All shop drawings shall be thoroughly checked by the Contractor for compliance with the Contract Documents before submitting them to the Architect and shall bear the Contractor's stamp of approval certifying that they have been so checked. Any shop drawings submitted without this stamp of approval and certification, and shop drawings which, in the Architect's opinion, are incomplete, contain errors or have not been checked, or only checked superficially, will be returned unchecked by the Architect for re-submission by the Contractor.
6. In checking shop drawings, the Contractor shall verify all dimensions and field conditions and shall check and coordinate the shop drawings of any Section or trade with the requirements of all other Sections or trades whose work is related thereto, as required for proper and complete installation of the work. The Architect will review shop drawings. The Architect's acceptance of shop drawings is for design only and not method of assembly or erection. Acceptance shall in no way be construed as (1) permitting any departure whatsoever from the Contract Documents; (2) relieving the Contractor of full responsibility for any error in details, dimensions, omissions, or otherwise that may exist; (3) relieving the Contractor of full responsibility for adequate field connections, erection techniques, bracing, or deficiencies in strength; (4) relieving the Contractor of full responsibility for satisfactory performance of all work and coordination with the work of all subcontractors and other contractors; or (5) permitting departure from additional details or instructions previously furnished by the Architect. Acceptance of such drawings shall not be construed as a complete check, nor shall it relieve the Contractor from responsibility for proper fitting of the work, nor from the necessity of furnishing any work which may not be indicated on shop drawings when approved. The Contractor shall be solely responsible for any quantities which may be shown on the shop drawings.
7. No work shall be fabricated, manufactured, or installed from shop drawings stamped "Revise and Resubmit" or "Rejected," and such shop drawings shall be corrected and resubmitted by the Contractor until accepted by the Architect. At least one complete set of "No Exceptions Taken and/or Make Corrections Noted" shop drawings shall be kept at the site in the Contractor's field office for reference at all times. "Revise and Resubmit" or "Rejected" shop drawings shall not be permitted at the site.
8. Submittals Marked "No Exceptions Taken": Submittals which require no corrections by the Architect will be marked "No Exceptions Taken."
9. Submittals Marked "Make Corrections Noted": Submittals which require only a minor amount of correcting shall be marked "Make Corrections Noted." This mark shall mean that checking is complete and all corrections are obvious without ambiguity. Fabrication will be allowed on work marked "Make Corrections Noted" provided such action will expedite construction and noted corrections are adhered to. If fabrication is not made strictly in accordance with corrections noted, the item shall be rejected in the field, and the Contractor will be required to replace such work in accordance with corrected submittals.
10. Submittals Marked "Revise and Resubmit" or "Rejected": When submittals are contrary to contract requirements or too many corrections are required, they shall be marked "Revise and Resubmit" or "Rejected." No work shall be fabricated under this mark. The Architect shall list his reasons for rejection on the submittals or in the transmittal letter accompanying their return. The submittals must be corrected and resubmitted for approval.
11. All shop drawings and samples shall be identified as follows:
  - a. Date of submittal.
  - b. Title of project.
  - c. Name of Contractor and date of his approval.

- d. Name of subcontractor or supplier and date of submittal to Contractor.
  - e. Number of submission.
  - f. Any qualification, departure, or deviation from the requirements of the Contract.
  - g. Federal Specification or ASTM number where required.
  - h. Such additional information as may be required by the Specifications for the particular material being furnished.
12. If the Contractor wishes to deviate from the materials or details as shown in Specifications or Drawings, he shall submit the proposed deviation with shop drawings and/or samples stating the extent and the materials or details being replaced. The Contractor shall also submit information on the allowed credit or extra cost required for the proposed deviation, and also all information relating to the work of other Sections revised by the proposed deviation.
  13. Incomplete shop drawings will be returned without checking for proper submission, and this shall not be considered as cause for delay of the work or extra compensation to the Contractor.
  14. The Contractor shall submit appropriate transmittal forms with every submittal of shop drawings, manufacturer's literature, and samples. All reproducibles shall be rolled on cardboard tubes for resubmittal. The Contractor shall submit all required shop drawings, manufacturer's literature and samples in accordance with the procedures specified herein.
  15. Unless otherwise specifically directed by the Architect, make all shop drawings accurately to a scale sufficiently large to show all pertinent features of the item and its method of connection to the work.
  16. Submit newly prepared information drawn accurately to scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not a Shop Drawing.
- B. Submission of Shop Drawings
1. Architectural Work: Submit pdf of each shop drawing to the Architect for approval. If approved, the Architect will return pdf stamped "No Exceptions Taken" or "Make Corrections Noted," and the Contractor shall print the required number of copies. In the event the Architect returns pdf stamped "Revise and Resubmit" or "Rejected," the Contractor shall make indicated changes and resubmit pdf to the Architect.
  2. Structural Work and Mechanical Work: Submit pdf of each shop drawing to the Engineer, with pdf to the Architect. If accepted, the Architect shall return pdf stamped "No Exceptions Taken" or "Make Corrections Noted," and the Contractor shall print the required number of copies. In the event the Architect returns pdf stamped "Revise and Resubmit" or "Rejected," the Contractor shall make indicated changes and resubmit pdf to the Engineer and the Architect.
- C. Submission of Manufacturer's Literature, Including Catalog, Catalog Cuts, Brochures, Charts, Test Data, and Similar Information
1. Manufacturer's literature will receive consideration only when accompanied by the transmittal form properly filled out, as indicated, and listing each item of literature, as well as the Specification Section and paragraph numbers describing such materials. Any deviations from contract requirements shall be stated on the above form or attached to it.

2. Architectural Work: Submit pdf of manufacturer's literature to the Architect for acceptance. If accepted, the Architect will return pdf stamped "No Exceptions Taken" or "Make Corrections Noted." The Contractor shall resubmit pdf of correct or corrected literature of all submissions stamped by the Architect "Revise and Resubmit" or "Rejected."
3. Structural Work and Mechanical Work: Submit pdf of manufacturer's literature to the Engineer and the Architect. If accepted, the Architect will return pdf stamped "No Exceptions Taken" or "Make Corrections Noted." The Contractor shall resubmit pdf of correct or corrected literature to the Engineer for all submissions stamped "Revise and Resubmit" or "Rejected" by the Engineer.
4. All copies of manufacturer's literature required to be resubmitted hereunder shall be original printed material. Reproductions of printed material will not receive consideration.

D. Submission of Samples

1. All samples shall be submitted in triplicate unless otherwise indicated in the Specifications.
2. Samples will receive consideration only when accompanied by the transmittal form properly filled out, as indicated, and listing each sample, as well as the listing of any ASTM, Federal or other standard references specified or applicable and such additional information as may be required by the Specifications for the materials being submitted. Any deviation from the contract requirements shall be so stated on the above form or attached to it.
3. The Architect shall have the right to require submission of samples of any materials, whether or not specifically indicated in the various Sections of the Specifications.
4. Unless otherwise specified, samples of sufficient size to indicate general visual effect shall be submitted. Where samples must show a range of color, texture, finish, graining, or other similar property, the Contractor shall submit sets of pairs illustrating the full scope of the range.
5. One (1) sample of each submission will be returned to the Contractor. Samples stamped "Revise and Resubmit" or "Rejected" by the Architect shall be resubmitted in triplicate by the Contractor.
6. All samples stamped "No Exceptions Taken" or "Make Corrections Noted" shall be kept at the site in the Contractor's field office facilities for reference at all times. "Revise and Resubmit" or "Rejected" samples shall not be kept at the site.

2.2 INTEGRATED DRAWINGS

- A. The HVAC subcontractor shall prepare a Drawing or Drawings showing duct work, heating and sprinkler piping. This Drawing shall include location of grilles, registers, etc., and access doors in hung ceilings. Locations shall be fixed by elevations and dimensions from column center lines and/or walls.
- B. The HVAC subcontractor shall prepare and distribute to the Plumbing and Electrical subcontractors, the General Contractor, and to the Architect a reproducible of the above.
- C. The HVAC subcontractor shall lay out on his reproducible the reflected ceiling plan, beam soffit elevations, ceiling heights, roof openings, etc.

- D. The Plumbing subcontractor shall lay out on his reproducible the piping, valves, clean-outs, etc., indicating locations and elevations and shall indicate the necessary access doors.
- E. The Electrical subcontractor shall indicate on his reproducible the fixtures, large conduit runs, clearances, pull boxes, junction boxes, sound system speakers, etc.
- F. The General Contractor shall indicate on his reproducible any structural framing, ceiling hangers, etc.
- G. The General Contractor shall call as many meetings with the subcontractors as are necessary to resolve any conflicts that become apparent. He will call on the services of the Consultant Engineer or Architect where necessary. The General Contractor is responsible for the coordination of the Drawing or Drawings.
- H. On resolution of the conflicts, each subcontractor shall enter his own work on the HVAC subcontractor's reproducible, which shall become the master or integrated Drawings. The master reproducible shall be signed by each contributing subcontractor to indicate his acceptance of the arrangement of the work.
- I. A reproducible copy of the master integrated Drawing will be prepared by the HVAC subcontractor. The General Contractor will make distribution.
- J. Each subcontractor shall prepare his Shop Drawings in accordance with the integrated Drawings. No work will be permitted without approved Shop Drawings. It is therefore essential that this procedure be instituted as quickly as possible.

### PART 3 EXECUTION

#### 3.1 COORDINATION OF SUBMITTALS

- A. Prior to submittal for Architect's review, use all means necessary to fully coordinate all material, including the following procedures:
  - 1. Determine and verify all field dimensions and conditions, materials, catalog numbers and similar data.
  - 2. Coordinate as required with all trades and with public agencies involved.
  - 3. Secure all necessary approvals from public agencies and others and signify by stamp, or other means, that they have been secured.
  - 4. Clearly indicate all deviations from the Contract Documents.
- B. Unless otherwise specifically permitted by the Architect, make all submittals in groups containing all associated items; the Architect may reject partial submittals as not complying with the provisions of the Contract Documents.

END OF SECTION

## SECTION 014000

## QUALITY REQUIREMENTS

## PART 1 GENERAL

## 1.1 GENERAL REQUIREMENTS

- A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

## 1.2 SECTION INCLUDES

- A. This Section includes administrative and procedural requirements for quality assurance and quality control.

## 1.3 RELATED SECTIONS

- A. Project Coordination - Section 013113.
- B. Testing and Inspection - Section 014523.
- C. Divisions 2 through 32 Sections for specific test and inspection requirements.

## 1.4 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and ensure that proposed construction complies with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that completed construction complies with requirements. Services do not include contract enforcement activities performed by Architect.
- C. Mockups: Full-size, physical example assemblies to illustrate finishes and materials. Mockups are used to verify selections made under Sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples. Mockups establish the standard by which the Work will be judged.
- D. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

## 1.5 DELEGATED DESIGN

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
  - 1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

## 1.6 SUBMITTALS

- A. Qualification Data: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- B. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.
- C. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
  - 1. Specification Section number and title.
  - 2. Description of test and inspection.
  - 3. Identification of applicable standards.
  - 4. Identification of test and inspection methods.
  - 5. Number of tests and inspections required.
  - 6. Time schedule or time span for tests and inspections.
  - 7. Entity responsible for performing tests and inspections.
  - 8. Requirements for obtaining samples.
  - 9. Unique characteristics of each quality-control service.
- D. Reports: Prepare and submit certified written reports that include the following:
  - 1. Date of issue.
  - 2. Project title and number.
  - 3. Name, address, and telephone number of testing agency.
  - 4. Dates and locations of samples and tests or inspections.
  - 5. Names of individuals making tests and inspections.
  - 6. Description of the Work and test and inspection method.
  - 7. Identification of product and Specification Section.
  - 8. Complete test or inspection data.
  - 9. Test and inspection results and an interpretation of test results.
  - 10. Ambient conditions at time of sample taking and testing and inspecting.
  - 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
  - 12. Name and signature of laboratory inspector.

## 13. Recommendations on retesting and reinspecting.

- E. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

## 1.7 QUALITY ASSURANCE

- A. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- B. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- C. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- D. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the State of New York and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.
- F. Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
  - 1. Requirement for specialists shall not supersede building codes and similar regulations governing the Work, nor interfere with local trade-union jurisdictional settlements and similar conventions.
- G. Testing Agency Qualifications: An agency with the experience and capability to conduct testing and inspecting indicated, as documented by ASTM E 548, and that specializes in types of tests and inspections to be performed.
- H. Preconstruction Testing: Testing agency shall perform preconstruction testing for compliance with specified requirements for performance and test methods.
  - 1. Contractor responsibilities include the following:
    - a. Provide test specimens and assemblies representative of proposed materials and construction. Provide sizes and configurations of assemblies to adequately demonstrate capability of product to comply with performance requirements.
    - b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
    - c. Fabricate and install test assemblies using installers who will perform the same tasks for Project.

- d. When testing is complete, remove assemblies; do not reuse materials on Project.
2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
- I. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
  1. Build mockups in location and of 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 work, fabrication, or construction.
  5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
  6. Demolish and remove mockups, unless otherwise directed by the Architect.

## PART 2 PRODUCTS

(Not Applicable)

## PART 3 EXECUTION

### 3.1 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
  1. Provide materials and comply with installation requirements specified in other Sections of these Specifications. Restore patched areas and extend restoration into adjoining areas in a manner that eliminates evidence of patching.
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION

## SECTION 014339

## MOCK-UPS

**1.1 GENERAL MOCK-UP REQUIREMENTS**

- A. Unless otherwise indicated, approved mock-ups establish the standard by which the Work will be judged.
  - 1. Approval of mock-ups does not constitute approval of deviations from the Contract Documents contained in mock-ups unless Architect specifically approves such deviations in writing.
- B. Schedule/Program mock-up at the outset to allow sufficient time for review and approval prior to commencement of main works procurement
- C. Build mock-ups in location and of the size indicated or, if not indicated, as directed by the Architect. Provide BIM integrated model as shop drawings of intended mock-up as well as all submittals, samples, and datasheets for approval prior to installation.
  - 1. Where applicable, mock-ups shall be viewable from the interior side as well as the exterior, under natural daylight conditions.
- D. Notify the Architect seven days in advance of dates and times when mock-ups will be constructed.
- E. Demonstrate the proposed range of aesthetic effects and workmanship.
- F. Obtain Architect's approval of mock-ups before starting installation.
- G. Maintain mock-ups during construction in an undisturbed condition as a standard for judging the completed Work.
- H. Demolish and remove mock-ups when directed.

**1.2 SCHEDULE OF FULL-SCALE MOCK-UP ASSEMBLIES (BUILDINGS)**

- A. Welcome Pavilions
  - 1. Ticketing Pavilion
    - a. Ticket Pavilion Counter 6' Length including operable/fixed window Jamb, sill, and head conditions; GFRC full depth counter.
    - b. Ticket Pavilion Canopy 4' width minimum including fascia and all related attachments/fasteners, signage sample install, and roofing termination detailing at edge.
    - c. Ticket Pavilion Enclosure- 6' width minimum
    - d. Cladding/All enclosure conditions including full corner representing north and west façade, base detail, north and west standing seam roof edge with gutter.
    - e. Provide mock-up of primary structural HSS within enclosure assembly.
    - f. Provide all necessary cladding attachments and fasteners as documented in contract drawings.
    - g. Build mock-up surface representing design conditions providing all necessary structure engineered to support mock-up safely for visual evaluation.
  - 2. Restroom Pavilion
    - a. Rest Room Pavilion GFRC Basin with Post/Pivot Panel full width 6' length including all visible supports, openings, operable portions, and plumbing fixtures
    - b. Rest Room Pavilion Enclosure- 6' width minimum

- c. including full wall corner, base detail, door threshold, door header, parapet, and thru-wall scupper
    - d. Provide mock-up of primary wall framing in order to understand the curvature of the walls and its relation to cladding detailing.
    - e. Provide all necessary cladding attachments and fasteners as documented in contract drawings.
    - f. Build mock-up surface representing design conditions providing all necessary structure engineered to support mock-up safely for visual evaluation.
  3. Group Canopy
    - a. Roof Edge Assembly 8' length with supports
- B. Conservation, Fabrication and Maintenance Building
  1. Enclosure 8' Width minimum
  2. Cladding/All enclosure conditions: base detail, windowsill, window header, parapet, wall corner, downspout, and any typical cladding panel seams.
  3. Provide mock-up of primary structural HSS within enclosure assembly.
  4. Provide all necessary cladding attachments and fasteners as documented in contract drawings.
  5. Build mock-up surface representing design conditions providing all necessary structure engineered to support mock-up safely for visual evaluation.
  6. Steel Open Stair - Railing and Tread (3' length minimum full width)
  7. Door Canopy - 3' width minimum
- C. Administration Building
  1. *{schedule of mock-ups for Administration Building to be determined at a later date}*
- D. Pond Pavilion
  1. *{schedule of mock-ups for Pond Pavilion to be determined at a later date}*

### 1.3 SCHEDULE OF FULL-SCALE MOCK-UP ASSEMBLIES (LANDSCAPE)

Provide mock-ups for all critical site and paving elements including:

- A. Welcome Pavilions
  1. light pole base and light pole
  2. mountable and flush granite curb
  3. chip and seal (sample areas must be larger than preliminary mock-ups provided)
  4. ground exposed aggregate concrete paving (provide test grinding and jointing)
  5. pea stone tree pits
  6. bluestone paths and terrace
  7. concrete tire stop
  8. timber fence and boom gate

9. steel mesh fence
  10. plastic mesh fence
  11. splash pads at group canopy
  12. granite steps
  13. handrail
- B. Conservation, Fabrication and Maintenance Building
1. chain link fence and rolling gate
  2. concrete apron
- C. Administration Building
1. *{schedule of mock-ups for Administration Building to be determined at a later date}*
- D. Pond Pavilion
1. *{schedule of mock-ups for Pond Pavilion to be determined at a later date}*

SECTION 014523

TESTING AND INSPECTION

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

- A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.
- B. As part of the GMP, the CM in consultation with project architect and engineers, will provide the owner with a list of all required testing and inspections.

1.2 SECTION INCLUDES

- A. Work of this Section includes all labor, materials, equipment and services necessary to complete the testing and inspection requirements as specified herein.

1.3 RELATED SECTIONS

- A. Requirements for testing and inspection shall be described in various Sections of these Specifications. Where no testing and inspection requirements are described herein but the Owner decides that testing should be performed, the Owner may proceed with additional testing and inspection to be performed at his own expense.
- B. Work Not Included
  - 1. Unless otherwise noted in this Section or other Section of work, the Owner will select a pre-qualified independent testing laboratory and inspection professional.
  - 2. Unless otherwise noted in this Section or other Sections of work, the Owner will pay for all initial services of the testing laboratory and inspection professionals as further described in Article 2.1 of this Section of these Specifications.

1.4 QUALITY ASSURANCE

- A. The testing laboratory will be qualified to the Owner's approval in accordance with ASTM E 329-20 "Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection."
- B. Testing, when required, will be in accordance with all pertinent codes and regulations and with selected standards of the American Society for Testing and Materials.

1.5 PRODUCT HANDLING

- A. Promptly process and distribute all required copies of test reports and related instructions to ensure all necessary retesting and/or replacement of materials with the least possible delay in progress of the work.

PART 2 PRODUCTS

2.1 PAYMENTS FOR TESTING AND INSPECTION SERVICES

- A. Initial Services: The Owner will pay for all initial testing and inspection services.

- B. Retesting: When initial tests and inspections indicate non-compliance with local Codes and the Contract Documents, all subsequent retesting occasioned by the non-compliance shall be performed by the same testing laboratory and inspectors and the costs thereof will be deducted by the Owner from the Contract Sum.

## 2.2 CODE COMPLIANCE TESTING AND INSPECTION

- A. Inspections and tests required by Codes or Ordinances, or by a plan approval authority, shall be paid for by the Owner unless otherwise noted in this Section or other Sections of work. Retesting or inspection as required shall conform to the requirements of Article 2.1 B of this Section.

## 2.3 CONTRACTOR'S TESTING

- A. Inspection or testing performed exclusively for the Contractor's convenience shall be the sole responsibility of the Contractor.
- B. Where operating tests are specified, the Contractor shall test his work as it progresses, on his own account, and shall make satisfactory preliminary tests in all cases before applying for official tests.
- C. Tests shall be made in the manner specified, for the different branches of the work. Each test shall be made on the entire system for which such test is required, wherever practical. In case it is necessary to test portions of the work independently, the Contractor shall do so without extra compensation. The Contractor shall furnish all labor, material and apparatus, make corrections and conduct the official test. The test will be conducted in the presence of a representative of the Architect.
- D. All parts of the mechanical and electrical work and associated equipment shall be tested and adjusted to work properly and be left in perfect operating condition. All defects disclosed by these tests shall be corrected to the satisfaction of the Architect and Engineer without any additional cost to the Owner. Tests shall be repeated on this repaired or replaced work if deemed necessary by the Architect. The Architect shall be notified at least forty-eight (48) hours in advance of all tests, and shall be represented at tests that he deems necessary. The Contractor shall furnish all necessary instruments, other equipment, and personnel required for such tests.
- E. Required certificates of inspection, testing or approval shall be secured by the Contractor and promptly delivered by him to the Architect.
- F. If the Architect or Engineer is to observe the inspections, tests or approvals required by the Contract Documents, he will endeavor to do so promptly and, where practicable, at the source of supply.

## PART 3 EXECUTION

### 3.1 COOPERATION WITH TESTING LABORATORY AND INSPECTORS

- A. Representatives of the testing laboratory and inspectors shall have access to the work at all times. Provide facilities for such access in order that they may properly perform their functions.

### 3.2 SCHEDULES

- A. Establishing Schedule: By advance discussions with the inspection service and testing laboratory selected by the Owner, determine the time required to perform inspections and tests and to issue each of its findings. Provide all required time within the construction schedule.

- B. Revising Schedule: When changes of construction schedule are necessary during construction, coordinate all such changes of schedule with the inspectors and testing laboratory as required.
- C. Adherence to Schedule: When the testing laboratory is ready to test according to the determined schedule but is prevented from testing or taking specimens due to incompleteness of the work, all extra costs for testing attributable to the delay will be back-charged to the Contractor.

### 3.3 TAKING SPECIMENS

- A. All specimens and samples for testing, unless otherwise provided in these Contract Documents, will be taken by the testing laboratory; all sampling equipment and personnel will be provided by the testing laboratory; and all deliveries of specimens and samples to the testing laboratory will be performed by the testing laboratory.

END OF SECTION

SECTION 015000

TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

- A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

- A. Work of this Section includes all labor, materials, equipment and services necessary to complete the temporary facilities and controls as shown on the drawings and specified herein, including but not limited to, the following:

1. Field office.
2. Hoists, stairs, and ladders.
3. Rodent control.
4. Construction fence.
5. Fire protection.
6. Temporary utilities.
7. Temporary toilets.
8. Temporary site access.
9. Water and snow control.
10. Environmental controls.
11. Site access.
12. Site Work expectations.
13. Personal site behavior.

1.3 RELATED SECTIONS

- A. Product Requirements - Section 016000.
- B. Execution Requirements - Section 017300 for cleaning.

PART 2 PRODUCTS

2.1 GENERAL

- A. Arrange for and provide temporary facilities and controls as specified herein and as required for the proper and expeditious prosecution of the work. Pay all costs, except as otherwise specified, until final acceptance of the work unless the Owner makes arrangements for the use of completed portions of the work after substantial completion.

- B. Make all temporary connections to utilities and services in locations acceptable to the local authorities having jurisdiction thereof; furnish all necessary labor and materials, and make all installations in a manner subject to the acceptance of such authorities; maintain such connections; remove the temporary installation and connections when no longer required; restore the services and sources of supply to proper operating condition.
- C. Unless otherwise noted, pay all costs for temporary electrical power, temporary water, and temporary heating; provide metering as necessary.
- D. A Staging Plan shall be submitted by the Contractor for approval by the Owner. The Staging Plan shall locate all temporary facilities and services, including parking for the Contractor's employees, within the limits of the staging areas, and shall allot ground space to Subcontractors for storage of materials, and the erection of sheds and tool houses. Materials and equipment can only be stored in the staging area. No parking for Contractor's or Subcontractors' employees' vehicles will be allowed in undesignated parking areas. The staging area shall be maintained in good repair, free of mud and standing water, and passable at all times. All materials stored within the project site are the responsibility of the Contractor. At the completion of the work, the staging areas shall be restored to their original condition, gravel removed, topsoil replaced and graded and re-seeded.

## 2.2 TEMPORARY FIELD OFFICES

- A. Provide and maintain a field office with a telephone and internet at the job site with not less than 200 square feet of space. The office shall be complete with light, heat, air conditioning, toilet facilities, electric water cooler, plan racks, four-drawer metal file with lock, shelves for samples, tables, chairs, and janitor service. When it becomes possible to establish an office in the building, office accommodation of approximately the same size as those in the field offices, including the services above, shall be provided and maintained until the issuance of a certificate of substantial completion. Temporary offices shall be removed when no longer required. Provide a telephone and internet line and pay all charges for installation and calls, including long distance calls.

## 2.3 RODENT CONTROL

- A. Institute an effective program of rodent control for the entire site within the construction limits. Cooperate with local authorities and provide the regular services of an experienced exterminator who shall visit the site at least once a month for the entire construction period. Provide marked metal containers for all edible rubbish and enforce their use by all employees. Containers shall be emptied and the contents removed from the site as often as required to maintain an adequate rodent control program. If the program of rodent control used is not effective, take whatever steps are necessary to rid the project of rodents, and such action shall not be the basis of a claim for additional compensation or damages.

## 2.4 TEMPORARY CONSTRUCTION OPENINGS

- A. Provide openings in slabs, walls, and partitions where required for moving in large pieces of equipment of all types. Close and/or restore all openings and finish them after the equipment is in place. Structural modification, if required, shall be subject to review by the Architect.

## 2.5 TEMPORARY FENCE

- A. Provide and maintain an 8 foot high temporary fence to enclose the area at the job site and to guard and close effectively the designated area. Provide gates at locations where required for access to the enclosed area. Gates shall be cross-braced, hung on heavy strap hinges, and shall have hasps and padlocks. Submit shop drawings of fence and gates for review of Architect and Owner. Paint the fence with two coats of an approved paint.

- B. Remove the fence upon completion of the work or at such time before final completion as directed by the Owner.

## 2.6 FIRE PROTECTION

- A. Provide and maintain adequate fire protection, ready for instant use, distributed around the project. Fire extinguishers per OSHA guidelines.
- B. Make arrangements for periodical inspection by local fire protection authorities and insurance underwriters inspections. Cooperate with said authorities and promptly carry out their recommendations.
- C. Open fire will not be permitted within the building enclosure or on the project site.

## 2.7 TEMPORARY HEAT AND VENTILATION

- A. Provide temporary heat as required during construction to protect the work from freezing or frost damage, and as necessary to ensure suitable working conditions for the construction operations of all trades. In areas of the building where work is being conducted, the temperature shall be maintained as specified in the various sections of the Specifications, but not less than 45 degrees Fahrenheit. Under no circumstances shall the temperature be allowed to reach a level that will cause damage to any portion of the work which may be subject to damage by low temperatures.
- B. Until the building, or any major portion thereof, is enclosed, temporary heating shall be by smokeless portable unit heaters of type listed by Underwriter's Laboratories and the Fire Marshall. Pay for fuel, maintenance, and attendants required in connection with the portable unit heaters. Interior or exterior surfaces damaged by the use of these space heaters shall be replaced by new materials or be refinished.
- C. The building shall be considered enclosed when it has reached the stage when exterior walls have been erected, the roof substantially completed, exterior openings closed up either by the permanently glazed windows and doors, or by adequate temporary closing, and the building is ready for interior masonry and plastering operations.
- D. After the building, or any major portion thereof, has been enclosed, the permanent heating system as specified below may be used for temporary heat.
- E. When the permanent heating system, or a suitable portion thereof, is in operating condition, the system may be used for temporary heating, provided that the Contractor assumes full responsibility for the entire heating system, and pays all costs for fuel, operation, maintenance, and restoration of the system.
- F. Provide adequate ventilation as required to keep the temperature of the building within 10 degrees Fahrenheit of the ambient outdoor temperature when such ambient temperature exceeds 70 degrees Fahrenheit, and to prevent accumulation of excess moisture or to prevent excess thermal movement in the building.
- G. When the permanent air circulation system, or a suitable portion thereof, is in operating condition, it may be used without refrigeration or chilling, provided that the Contractor assumes full responsibility for the system which he is using, and pays costs for power, operation, maintenance, and restoration of the system. Provide temporary filters to adequately filter air being distributed through the duct work to the supply outlets; disposable filters shall be placed in front of all exhaust registers to keep construction dirt out of exhaust duct work. The Contractor shall thoroughly clean the interior of the air handling units and duct work prior to acceptance of the work.

- H. Upon conclusion of the temporary heating period, remove all temporary piping, temporary heating units, or other equipment and pay all costs in connection with repairing any damage caused by the installation or removal of temporary heating equipment. Thoroughly clean and recondition those parts of permanent heating and air circulation systems used for temporary service.

## 2.8 TEMPORARY LIGHT AND POWER

- A. Make all arrangements with the local electric company for temporary electrical service to the construction site; provide all equipment necessary for temporary power and lighting; and pay all charges for this equipment, the installation thereof, and for current used. The electrical service shall be of 120v and 240v for single phase loads up to 30 amps for all construction tools and equipment without overloading the temporary facilities and shall be made available for power, lighting, and construction operations of all trades.
- B. In addition to the electrical service, provide power distribution as required throughout structure. The terminations of power distribution shall be at convenient locations in the building. Terminations shall be provided for each voltage supply complete with circuit breakers, disconnect switches, and other electrical devices as required to protect the power supply system.
  - 1. Provide double duplex outlets at not more than 200' o.c. both directions throughout this building.
- C. A temporary lighting system shall be furnished, installed, and maintained as required to satisfy minimum requirements of safety and security. The temporary lighting system shall afford general illumination in all building areas and shall supply not less than 150 watt lamps on 30' centers both directions of floor area for illumination in the areas of the building where work is being performed.
- D. All temporary equipment and wiring for power and lighting shall be in accordance with the applicable provisions of the governing codes. All temporary wiring shall be maintained in a safe manner and used so as not to constitute a hazard to persons or property.
- E. When the permanent electrical power and lighting systems are in operating condition, they may be used for temporary power and lighting for construction purposes, provided that the Contractor assumes full responsibility for the entire power and lighting system, and pays costs for power, operations, maintenance, and restoration of the system.

## 2.9 TEMPORARY ACCESS TO SITE

- A. Construct and maintain in good usable condition all required temporary access to site, and, when no longer required, remove all temporary construction and restore the site.
- B. Where streets now in use are within or adjacent to the work, keep the passageways of such streets open to vehicular and pedestrian traffic to building fronting thereon. Maintain constant access for police, fire and ambulance service.
- C. Mud carried off the site and into public roads shall be removed immediately by the Contractor.
- D. Access to the site for delivery of construction material or equipment shall be made only from locations designated by the Architect.

## 2.10 TEMPORARY STAIRS, LADDERS, RAMPS, SIDEWALK BRIDGING AND RUNWAYS

- A. Provide and maintain all equipment such as temporary stairs, ladders, ramps, runways, and chutes as required for the proper execution of the work.

- B. All such apparatus, equipment, and construction shall meet all requirements of the Labor Law and other state or local laws applicable thereto.
- C. As soon as permanent stairs are erected, provide temporary protective treads, handrails, and shaft protection.
- D. Covered Walkway: Erect a structurally adequate, protective, covered walkway for passage of persons along adjacent public street. Coordinate with entrance gates, other facilities, and obstructions. Comply with regulations of authorities having jurisdiction.
  - 1. Construct covered walkways using scaffold or shoring framing.
  - 2. Provide wood plank overhead decking, protective plywood enclosure walls, handrails, barricades, warning signs, lights, safe and well drained walkways, and similar provisions for protection and safe passage.
  - 3. Extend back wall beyond the structure to complete enclosure fence.
  - 4. Paint and maintain in a manner approved by Owner and Architect.
  - 5. For safety barriers, sidewalk bridges, and similar uses, provide minimum 5/8" thick exterior plywood.
  - 6. Every effort should be made to schedule deliveries and movement of large vehicles either to the south of the site or when the Art Center is closed to the public. Necessary exceptions to this requirement must be scheduled with CM and coordinated with the owner. G. Construction personnel must log in and out with CM when on site for work. H. Construction personnel must park in designated construction parking when on site for work.

#### 2.11 TEMPORARY TOILETS

- A. Provide and maintain in a sanitary condition enclosed weathertight toilets for the use of all construction personnel at a location within the contract limits. Upon completion of the work, toilets shall be removed. Installation shall be in accordance with all applicable codes and regulations of authorities having jurisdiction. The number of toilet rooms required shall be in accordance with the ANSI Standard Safety Code for Building Construction or other local authorities.

#### 2.12 TEMPORARY WATER SERVICE

- A. When the permanent water supply and distribution system has been installed, it may be used as a source of water for construction purposes, provided that the Contractor assumes full responsibility for the entire water distribution system, and pays costs for operation, maintenance, and restoration of the system including the cost of water used.
- B. At the completion of the construction work or at such time after the Contractor makes use of the permanent water installation, all temporary water service equipment and piping shall be removed, and all worn or damaged parts of the permanent system shall be replaced and equipment placed in first class condition equal to new.

#### 2.13 WATER AND SNOW CONTROL

- A. From the commencement of the construction to the completion of the work, keep all parts of the site and the project free from accumulation of water, and supply, maintain, and operate all necessary pumping and bailing equipment.

- B. Remove snow and ice as necessary for the protection and prosecution of the work, and protect the work against weather damage within construction fence only.
- C. The Contractor shall take over responsibility for site drainage upon entering the premises and shall maintain such drainage until completion of the work so as not to adversely affect the adjacent areas.

#### 2.14 ENVIRONMENTAL CONTROLS

- A. The Contractor shall comply with all applicable Federal, State and local laws, regulations, ordinances, codes and standards concerning environment control. Particular attention shall be given, without limitations, to:
  - 1. Minimization of dust, containment of chemical vapors, control of engine exhaust gases, and control of smoke from temporary heaters.
  - 2. Reduction of water pollution by control of sanitary facilities, proper storage of fuels and other potential contaminants, and prevention of siltation from land erosion.
  - 3. Minimization of noise levels.
  - 4. Proper and legal disposal, off site unless otherwise provided, of waste and spoil resulting from construction activities.

#### 2.15 SITE ACCESS (EX: ONLY ENTER FROM THE SOUTH OF THE SITE)

- A. Every effort should be made to schedule deliveries and movement of large vehicles either to the south of the site or when the Art Center is closed to the public.
- B. Necessary exceptions to this requirement must be scheduled with Whiting-Turner (who will then schedule with Storm King).
- C. Construction personnel must log in and out with Whiting-Turner when on site for work.
- D. Construction personnel must park in designated construction parking when on site for work. To be worked out with Whiting-Turner: Is all construction parking within the fence line or will construction personnel park in visitor parking areas? If so, we will need to limit hours and issue passes.
- E. To be worked out with Whiting-Turner: How construction personnel enter and leave the site in personal vehicles when Storm King is open to the public.
- F. To be worked out with Whiting-Turner: How construction-related vehicles move through the site when Storm King is open to the public.

#### 2.16 WORK EXPECTATIONS

- A. Contractors may not work on site without a signed contract and insurance form on file with Storm King.
- B. Contractors must have appropriate OSHA certification and follow OSHA rules and regulations
- C. No signage may be placed or affixed on construction fences or other public areas except as required by law or approved by Storm King. This includes Company Names, Logos/Marks, Phone Numbers.
- D. All sanitation, rentals, garbage, etc. must remain within the construction fences.

- E. No driving on grass or in areas marked "authorized vehicle only," outside the construction fence areas, without prior permission from Storm King.
- F. Construction personnel may not use Storm King vehicles, equipment, or tools.
- G. Construction personnel may not use Storm King dumpsters or sanitation facilities.

2.17 BEHAVIORAL EXPECTATIONS (EX: NO SMOKING ON SITE),

- A. No use of drugs or alcohol is permitted on the job site.
- B. No smoking is permitted at Storm King.
- C. No amplified music may be played while Storm King is open to the public or for a program or event.
- D. To be worked out with Whiting Turner: Requirements re respectful language and behavior, including zero tolerance for harassment, on the construction site. This should include clothing and political speech.
- E. Except as otherwise permitted, contractors may not make recordings (including photographs and video) of the worksite for personal use or public dissemination, including on social media.
- F. Construction personnel who choose to visit Storm King Art Center during a break or before or after a shift when they are already onsite may do so when Storm King is open to the public and must abide by all visitor rules.
- G. Construction personnel who choose to visit Storm King Art Center must be courteous, professional, and respectful to all visitors and employees.
- H. Storm King will work with Whiting-Turner to develop a system of contractor family visit days and/or contractor passes so that construction personnel can visit Storm King with their families.

PART 3 EXECUTION

3.1 REMOVAL

- A. Maintain all temporary facilities and controls as long as needed for the safe and proper completion of the work. Remove all such temporary facilities and controls as rapidly as progress of the work will permit or as directed by the Architect.

END OF SECTION

SECTION 015639  
TEMPORARY TREE AND PLANT PROTECTION

## PART 1 GENERAL

## 1.1 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.

## 1.2 DESCRIPTION OF WORK

- A. Protection of existing trees and plants from damage as a result of the Contractor's operations including, but not limited to:
  - 1. Protection of existing natural woodlands.
  - 2. Marking of clearing limits.
  - 3. Tree protection fencing.
  - 4. Tree armor.
  - 5. Root pruning, construction pruning and vista pruning to improve views from the new building.
  - 6. Root invigoration to promote root growth.

## 1.3 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 310000, EARTHWORK; Excavation and backfill; Establishment of subgrade elevation.
  - 2. Section 311000, ~~SITE~~ CLEARING AND GRUBBING Clearing and grubbing.
  - 3. Section 329300, PLANTING: New plant material.

## 1.4 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):
    - Z133.1 Safety Requirements for Pruning, Trimming, Repairing, Maintaining and Removing Trees, and for Cutting Brush.

## 2. International Society of Arboriculture (ISA):

Guide	Guide for Establishing Values of Trees and Other Plants
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## 3. National Arborist Association (NAA):

Ref. 1	Pruning Standards for Shade Trees
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## 1.5 SUBMITTALS

- A. Proposed methods, and schedule for effecting tree and plant protection shall be submitted for approval.
- B. Proposed methods, materials, and schedule for root pruning, construction pruning, and tree fertilization shall be submitted for approval.

## 1.6 DAMAGE PENALTIES

- A. Certain specimen trees adjacent to construction areas and in other key locations will be identified by the Owner and the Architect, and marked with red tags. Loss of any of these trees will result in fines assessed at \$5,000 per tree. Damage to all other trees on the property will be assessed at the rate of \$200 per inch caliper of the tree.
- B. A fine of \$1,000 will be levied against the Contractor for each incident of construction inside tree protection areas.
- C. Damages to trees, shrubs, and other vegetation will be assessed by the Architect and Owner in accordance with the ISA Guide.
- D. Trees or roots visibly damaged will cause the Owner to withhold 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. The Contractor shall not be liable for any loss or damage which occurs while the Contractor is complying with instructions given by the Owner, Architect, or arborist working on the Project.

## 1.7 QUALITY ASSURANCE

- A. Selective pruning and feeding methods shall conform to the applicable requirements of ANSI Z133.1.

- B. 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](mailto:isa@isa-arbor.com).
- C. Arborist shall have the following minimum qualifications:
1. Membership in:
    - a. NAA – National Arborist Association
    - b. ISA – International Society of Arborists
  2. Meet state requirements for insurance.
  3. Licenses for application and use of pesticides.

## PART 2 PRODUCTS

### 2.1 TREE PROTECTION FENCING

- A. Tree protection fencing shall be the following:
1. Galvanized chain link fencing, 6 ft. high.
  2. Fabric shall be a good commercial quality of steel wire of 2 in. mesh and 11 gage.
  3. Fittings shall be malleable iron casting, wrought iron forgings, or pressed steel and provided with pin connections. Equipment shall be designed to carry 100% overload.
  4. Piping shall be steel conforming to ASTM A 120 except that pipe shall be unthreaded and untested for water pressure.
- B. Stakes for fencing shall be 9 ft. galvanized steel posts, driven a minimum of 3 ft. into the ground, except above steam tunnel and vault locations where surface anchors shall be used. Posts shall be spaced 10 ft. o.c. maximum.
- C. For fencing within the drip line of trees, surface mounted post anchors may be acceptable. Review with Architect and arborist and obtain written approval prior to installing. Post installation shall not damage tree root systems.

### 2.2 ACCESSORY MATERIALS

- A. Mulch: Pine bark mulch
- B. Tree Wound Paint: Bituminous based paint of standard manufacture specifically formulated for protection of tree wounds from moisture and insect invasion.
- C. Tree Armor:
1. Wood: SPFA utility grade, 2x4.
  2. Wire: Annealed steel wire, 16 gage minimum.
- D. Critical root zones shall be protected with AlturnaMats, 1/2" thick recycled polyethylene mats capable of supporting vehicles and equipment weighing up to 60 tons, manufactured by AlturnaMats, Inc., 701 E. Spring Street, Mailbox #9, Titusville, PA 16354 • Phone: 888.544.6287 • Fax: 866-723-2903 , or approved equal.

PLANTING

2.3 ROOT PRUNING

- A. Mulch materials shall be as specified under Section 329300, ~~TREES PLANTS, AND GROUND COVERS.~~
- B. Liquid fertilizer to be applied to root pruned and construction pruned trees shall be PetersM 77 Sequestered-Chelated Soluble Fertilizer manufactured by W.R. Grace and Co., Cambridge, MA 02140, Gold Start Liquid Fertilizer, manufactured by Nutra-Flo Company, 1919 Grand Ave, Sioux City, IA 51106-5708; Phone: 712-277-2011; 800-831- 4815; Fax: 712-279-1946; Agro- Culture Liquid Fertilizer, manufactured by Agro-Culture Liquid Fertilizers, 3055 W. M-21, P.O. Box 150, St. Johns, Michigan 48879; 1-800-678- 9029, or approved equal. Liquid fertilizer shall be approved by Certified Arborist.
- C. Dormant oil spray shall be a dormant miscible spray equal to Sunspray Scalecide or Volck Oil.
- D. Insecticide shall be Isotox manufactured by Ortho; QuickPRO, manufactured by Monsanto; LESCO Sevin Brand SL, #019106, manufactured by LESCO, or approved equal. Insecticide shall be approved by Certified Arborist.

PART 3 EXECUTION

3.1 INSTALLATION OF FENCING

- A. Prior to start of demolition work and clearing and grubbing operations, tree protection fencing shall be installed in accordance with the following:
  - 1. Fencing shall be installed at the tree protection areas indicated on the Drawings.
  - 2. Fencing shall be installed at the drip line of trees to be protected, unless otherwise approved by the Architect.
- B. Post installation must avoid underground utilities. Fencing located over steam tunnel/vault locations shall be installed using surface anchors. No poles or stakes shall be driven into the ground at these locations.

a minimum of 15'  
beyond

3.2 PROTECTION FOR EXISTING TREES TO BE PRESERVED:

- A. All trees to be preserved on the property shall be protected against damage from construction operations.
  - 1. Includes associated understory.

- B. Only those trees located within the limits of improvements to be constructed as indicated, shall be removed.
1. All trees to remain shall be flagged for review after the location of improvements to be constructed are staked in the field.
  2. Any tree to be removed shall be reviewed by the Architect and Owner for approval prior to removal.
  3. Trees to be preserved, removed or newly planted are represented graphically and differentiated from existing trees.
  4. Obtain approval of installation of tree barricade fencing from Owner and Architect prior to the initiation of any removal of vegetation and construction.
- C. Erect fencing and armor protection prior to beginning any clearing, demolition or construction activity, and unless otherwise instructed, maintain in place until construction is completed.
1. Obtain approval of installation of tree barricade fencing from Owner and Architect prior to the initiation of any removal of vegetation and construction.
  2. Tree protection barricade shall be erected at the dripline; in extreme circumstances and with the approval of the Architect, fencing may be located at the edge of the root protection zone.
  3. Trees immediately adjacent to and within one hundred feet (100) of any construction activities are to be protected by barricade fencing; subject to approval of the Architect and Owner.
  4. Trees exposed to construction activity within the dripline or within twenty-five (25) feet of any construction activity are to have trunks protected with tree armor in addition to barricade fencing.
  5. The tree protection barricade shall be placed before any excavating or grading is begun and maintained in repair for the duration of the construction work unless otherwise directed.
  6. No material shall be stored or construction operation shall be carried on within the tree protection barricade.
  7. Tree protection barricade shall remain until all work is completed.
  8. Remove tree protection barricade at commencement of finish grading.
  9. Remove tree armor immediately prior to Substantial Completion.
- D. Protect tree trunk with tree armor to a height of 8' or to the limits of lower branching (when exposed to construction activity within the drip line) with 2x4's butted side to side completely around trunk.
1. Wire wrap, do not nail, around trees.
- E. Protect trees that are to remain, whether within barricade fencing or not, from the following:
1. Compaction of root area by equipment or material storage; construction materials shall not be stored closer to trees than the farthest extension of their limbs (dripline).

2. The proposed finished grade within the root protection zone of any preserved tree shall not be raised or lowered more than three (3) inches.
    - a. Retaining methods can be used to protect and/or provide lateral support to the area outside the root protection zone.
  3. Trunk damage by moving equipment, material storage, nailing or bolting.
  4. Strangling by tying ropes or guy wires to trunks or large branches.
  5. Poisoning by pouring solvents, gas, paint, etc., on or around trees and roots.
  6. Cutting on roots by excavating, ditching, etc.
    - a. Prior to excavation within the tree drip lines or the removal of trees adjacent to other trees that are to remain, make a clean cut between the disturbed and undisturbed root zones with a rock saw or similar equipment to minimize root damage.
    - b. Refer to EXCAVATION AROUND TREES paragraph for additional information.
  7. Damage of branches by improper pruning.
  8. Drought from failure to water or by cutting or changing normal drainage pattern past roots. Contractor shall provide means as necessary to ensure positive drainage.
  9. Changes of soil pH factor by disposal of lime base materials such as concrete, plaster, lime treatment at pavement subgrade, etc. When installing concrete adjacent to the root zone of a tree, use a minimum 6 mil. plastic vapor barrier behind the concrete to prohibit leaching of lime into the soil.
  10. Do not cut roots 3/4" in diameter or over without approval of Owner's Representative. All excavation and earthwork within the RPZ of trees shall be done by hand.
  11. Protect all existing trees near areas to be stabilized from underground contaminations by placing a 6 mil. Plastic film barrier along exposed vertical cut extending a minimum 12" into undisturbed subgrade below depth of stabilization.
  12. No vehicular traffic shall occur within the drip line of any tree; including parking of vehicles.
  13. No soil shall be spread, spoiled or otherwise disposed of under any tree within the RPZ.
- F. Any damage done to existing tree crowns or root systems shall be repaired by the Arborist to the satisfaction of the Architect and Owner's Representative.
1. Broken branches shall be cut cleanly.
  2. Any roots cut shall be cut cleanly with a saw other means approved by the Architect and Owner's Representative.
- G. Damages to trees caused through negligence of Contractor or his employees will be assessed by Owner and Project Arborist as described in Paragraph 1.05.
- 3.3 ROOT PROTECTION ZONE:
- A. The root protection zone (RPZ) is measured with a radius from the trunk 10'.
1. No disturbance shall occur closer to the tree than one-half the radius of the RPZ or within five (5) feet of the tree whichever is greater.

### 3.4 ROOT PROTECTION ZONE IMPACTS:

- A. Those trees to remain which have some encroachment on their root protection zone shall have the following maximum allowable impacts:
1. Minimum Protection Criteria 'A': No disturbance of natural grade, e.g. trenching or excavation, can occur closer to the tree than one-half the radius of the RPZ or within five (5) feet of the tree whichever is greater.
  2. Minimum Protection Criteria 'B': No cut or fill greater than three (3) inches will be located closer to the tree trunk than  $\frac{1}{2}$  the RPZ radius distance.
- B. Trees impacted shall have a minimum of a six (6) inch layer of mulch placed and maintained over the root protection zone and the undisturbed area within the dripline.
1. Immediate pruning and fertilization shall occur per the pruning and fertilization sections of this specification.
  2. Provide water in a slow drip manner to impacted trees as approved by the Architect and Owner's Representative.
  3. Provide water to apply equivalent to 1 inch once per week to deeply soak in over the area within the dripline of the tree during periods of hot, dry weather.
  4. Spray tree crowns periodically to reduce dust accumulation on the leaves.

### 3.5 EXCAVATING AROUND TREES

- A. Excavate within the dripline of trees only where required and when absolutely necessary.
1. Any excavation within the RPZ of trees shall be under the direction of the Arborist.
  2. Arborist shall be at site at all times while excavation is occurring within the RPZ.
  3. Air spade all removals within the RPZ.
  4. Refer to ROOT PROTECTION ZONE (RPZ).
- B. When excavating for new construction is required within the RPZ, air spade and hand excavate to minimize damage to root systems.
1. Use narrow tine spading forks and comb soil to expose roots.
  2. Relocate roots back into backfill areas wherever possible.
  3. If large main lateral roots are encountered, expose beyond excavation limits as required to bend and relocate without breaking.
  4. If root relocation is not practical, clean cut roots using sharp ax approximately three (3) inches back from new construction.
- C. Where existing grade is above new finish grade, carefully excavate within the dripline to the new finish grade.
1. Carefully hand excavate an additional six (6) inches below the finish grade.
  2. Use narrow tine spading forks to comb the soil to expose the roots, and prune the exposed root structure as recommended by the Arborist.

3. Keep the exposed roots damp.
  4. Treat the cut roots as specified and as recommended by the Arborist.
  5. After pruning and treatment of the root structure is complete, backfill to finish grade with eight (8) inches of approved plant mix, or structural soil.
- D. Where noted on plan, use airspade to expose roots for required cutting to accommodate hardscape elements. Architect to verify all cuts prior to proceeding.
- E. Temporarily support and protect roots against damage until permanently relocated and covered with recommended landscape material.

3.6 ROOT PRUNING

A. ~~Where construction will be in close proximity to existing trees designated to remain, roots shall be~~  
**3.6 ROOT PRUNING**  
 A. Where construction will be in close proximity to existing trees designated to remain, roots shall be pruned in advance of proposed excavation. Proximity shall be as determined in the field by the Architect. Root pruning shall be conducted by professional certified arborist.

B. ~~F~~  
**B. All root pruning shall be done by hand. Trenching, vibrating plow, and stump grinding are NOT suitable**  
~~S~~  
**means for root pruning.**

C. ~~w~~  
**C. Tree to be root pruned shall be root pruned to a depth of 24 in. by means of a hand saw, or other approved**  
~~T~~  
**means which results in a sharp clean cut.**

D. ~~a~~  
**D. Backfill root pruning trench with existing soil mixed with peat moss or well-rotted sawdust to a mixture of**  
~~E~~  
**approximately 75% soil and 25% humus. Tamp lightly to set soil**

E. ~~n~~  
**E. Apply mulch to a depth of 6 in. at minimum 10 ft. to 15 ft. radius around tree to reduce compaction and**  
~~E.~~  
**increase moisture retention.**

E. ~~Apply mulch to a depth of 4 in. to 6 in. at minimum 10 ft. to 15 ft. radius around tree to reduce~~  
~~compaction of roots.~~

3.7 GOVERNING STANDARDS:

- A. Work procedures will be guided by the current provisions of the American National Standard Institute. Complete detail of the provisions are to be found in the references listed. The two basic objectives of the pruning operation shall include:
1. Hazard Reduction Pruning: Hazard reduction pruning shall be completed to remove visible hazards in a tree. Hazard pruning shall consist of one or more of the maintenance pruning types.
  2. Maintenance Pruning: Maintenance pruning shall be completed to maintain and improve tree health and structure and includes hazard reduction pruning.

3.8 MAINTENANCE PRUNING TYPES:

- A. Both hazard reduction pruning and maintenance pruning shall consist of one or more of the following pruning types:
1. Crown Cleaning: Crown cleaning shall consist of the selective removal of one or more of the following items: dead, dying, or diseased branches, weak branches, water sprouts and stubbed branches.
  2. Crown Thinning: Crown thinning shall consist of the selective removal of branches to increase light penetration, air movement, and reduce weight.
  3. Crown Raising: Crown raising shall consist of the removal of the lower branches of a tree to provide clearance.
  4. Crown Reduction, or Crown Shaping: Crown reduction shall consist of decreasing the height and/or spread of a tree.
  5. Vista Pruning: Vista pruning shall consist of selective thinning of framework limbs or specific areas of the crown.
  6. Crown Restoration: Crown restoration pruning shall improve the structure, form and appearance of a tree which has been severely headed, vandalized, storm damaged or improperly pruned.

3.9 UTILITY PRUNING:

- A. Utility pruning shall consist of one or more of the following items:
1. Trees Underneath: Pruning trees growing directly under and growing into the facility/utility space.
  2. Trees Along Side: Pruning of trees growing directly along side and growing into or toward the facility/utility space.

3.10 SCHEDULE

- A. All of the pruning type(s) as applicable are required at each tree. All pruning shall be completed to remove branches/laterals 1/8 inch and greater. All pruning to be completed before commencement of demolition.
1. Height clearance:
    - a. Pedestrian Areas: 8 feet height clearance from grade unless directed otherwise by Architect and Owner.
    - b. Vehicular Areas: 13'-6" height clearance from top of paving unless directed otherwise by Architect and Owner.

All pruning to be directed on site by Landscape Architect

### 3.11 CROWN IMPACTS

- A. Trees impacted by construction shall be limited to a maximum of 30 percent of the viable portion of a tree's crown removed as approved by the Architect and Owner's Representative. Removal of more than 30 percent of the viable portion of a tree's crown will necessitate the tree's removal and replacement at the Contractor's expense.
  - 1. Replacement shall be governed at the ratio of 1 inch of new tree per inch of tree removed up to trees of size less than 24" caliper. For trees 24" caliper and greater the ratio shall be 3 inches per new tree per inch of tree removed.
  - 2. Replacement trees are to have a one (1) year warranty; refer to Section 329300, TREES, PLANTS, AND GROUND COVER.

### 3.12 APPROVAL

- A. No major limbs or structure will be cut or removed without prior approval of the Architect and Owner's Representative.

### 3.13 STERILIZATION

- A. All tools used will be sterilized with Clorox Bleach, or approved equal, prior to use and between each tree.
- B. Residue from sterilization operation shall be diluted so as not to damage any vegetation.
- C. At trees known to be diseased and where there is danger of transmitting that disease, tools are to be disinfected after each cut.

### 3.14 PAINT CUTS:

- A. Paint cuts more than 1 inch in diameter with an approved tree wound paint on trees.
  - 1. Paint cuts within 30 minutes after cutting.

### 3.15 FERTILIZATION OF PRESERVED TREES

- A. All existing trees to be preserved impacted by construction activities taking place within the dripline, including but not limited to trenching and grading, shall be fertilized.
- B. Feeding of existing trees to be impacted by construction shall be accomplished in accordance with the following specifications:
  - 1. Feeding shall be completed prior to construction of permanent improvements adjacent to all trees including site fill or paving including trenching operations.
  - 2. Liquid tree fertilizer applied with a standard hydrant sprayer at a pressure of 100 to 200 psi shall be injected in slightly slanted holes approximately twelve (12) inches in depth.

3. Concentration of suspension to be forty (40) pounds of fertilizer for trees in each 100 gallons of water. Application rate: six (6) pounds of actual nitrogen per 1,000 square feet of area under drip-line.
4. Holes are to be made in concentric circles and 3' on center around the tree with the last ring located at the dripline of the foliage of the trees.
5. Area beneath the dripline of the trees is to be well watered after the fertilization is placed.

### 3.16 ROOT INVIGORATION

- A. Trees with root zones displaying deteriorating soil conditions due to turf management practices, soil compaction, lack of organic matter in the soil, and lack of nutrients shall be identified by the Project Arborist and receive a root invigoration program. Root invigoration incorporates organic matter, fertilizer, and mycorrhizal fungi while reducing soil compaction and aerating the soil, promoting root growth.
- B. Root invigoration shall be accomplished by implementing the Bartlett Root Invigoration Program as follows:
  1. Site evaluation, tree evaluation and soil sampling. The landscape and affected trees are examined to make certain that they are suitable candidates for the service. Not all declining trees will respond to this treatment. Soil analysis provides information on the current nutrient, pH and organic matter levels as well as soil penetrability/density.
  2. Program recommendations. Either Basic or Complete Root Invigoration Program may be recommended depending on results of the diagnostic tests, tree condition and your landscape goals. A Basic Root Invigoration (Figure 1) includes soil conditioning only around the trunk of the tree. A Complete Root Invigoration (Figure 2) conditions the soil around the trunk and in segments throughout the critical root zone.
  3. Irrigation. Irrigation is required prior to and after treatment during periods of drought.
  4. Fertilizer Application. Bartlett's unique Soil Rx Prescription Fertilization matches fertilizer to your soil and tree needs and provides the greatest benefits with the least environmental impact.
  5. Soil Conditioning. On the day of treatment a crew of one or two will arrive with a large air compressor and the materials that will be incorporated into the soil. They will cultivate the soil using an air spade, designed to till the soil without disturbing the roots. Following this operation, organic matter, fertilizer and mycorrhizal fungi will be incorporated into the treatment zone.
  6. Mulching. The work area will be covered with mulch at the end of the process. Mulch depth should be maintained at 2 to 4 inches for optimum response. If it is not desirable to mulch the area, it can be seeded in ground cover, planting grass is not recommended. Turf will inhibit tree root development and make the treatment much less beneficial.
  7. Root Diseases. If root disease is suspected of playing a role in the tree decline, a root sample will be collected for additional diagnostic testing. Treatment recommendations can be provided at a later date, if required.

3.17 MULCH

- A. Mulch base of all existing trees four (4') feet radius with 3 " deep mulch layer.
  - 1. If existing trees are grouped, the entire area is to be mulched in between the trees.
- B. Mulch base of all existing trees impacted by construction activities within RPZ with 3" deep mulch layer.
  - 1. If existing trees are grouped, the entire area is to be mulched in between the trees.

3.18 CLEANUP

- A. Wood and debris shall become property of the Contractor and shall be removed from the site. Cost of disposal to be paid by Contractor.
- B. If acceptable to Owner, wood from tree removal and pruning activities can be double shredded/grinded and used on site as mulch at locations as approved by Architect and Owner.

3.19 REMOVAL OF PROTECTION

- A. All protection shall remain in place throughout the construction period. Remove protection devices only after written permission has been granted by the Architect.

END OF SECTION 015639

SECTION 016000

PRODUCT REQUIREMENTS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

- A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

- A. Work of this Section includes all labor, materials, equipment, and services necessary to complete product requirements as specified herein, including, but not limited to, the following:
  - 1. Product delivery, storage and handling.
  - 2. Storage and protection.
  - 3. Identifying markings.
  - 4. Substitution requirements.
  - 5. Temporary use of equipment.
  - 6. General standards.

1.3 RELATED SECTIONS

- A. Execution Requirements - Section 017300.

1.4 TRANSPORTATION AND HANDLING

- A. Materials, products, and equipment shall be properly containerized, packaged, boxed, and protected to prevent damage during transportation and handling.
- B. More detailed requirements for transportation and handling are specified under the technical Sections.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.
- B. Delivery and Handling
  - 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
  - 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.

3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. Storage

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Store foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.
7. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.6 IDENTIFYING MARKINGS

- A. Name plates and other identifying markings shall not be affixed on exposed surfaces of manufactured items installed in finished spaces.

1.7 PRODUCT APPROVAL STANDARDS

- A. Where the words "or approved equal" or other synonymous terms are used, it is expressly understood that they shall mean that the approval of any such submission is vested in the Architect, whose decision shall be final and binding upon all concerned. All submissions are subject to such approval and shall conform to the requirements of Article 1.8 herein.

1.8 SUBSTITUTIONS

- A. After the contract has been executed, the Architect will consider a formal request for the substitution of products in place of those specified, under the following conditions:
1. The request is accompanied by complete data on the proposed substitution substantiating compliance with the Contract Documents including product identification and description, performance and test data, references and samples where applicable, and an itemized comparison of the proposed substitution with the products specified or named by Addenda, with data relating to Contract time schedule, design and artistic effect where applicable, and its relationship to separate contracts.
  2. The request is accompanied by accurate cost data on the proposed substitution in comparison with the product specified, whether or not modification of the Contract Sum is to be a consideration.
- B. Requests for substitution based on Para (1) above, when forwarded by the Contractor to the Architect for review are understood to mean that the Contractor:

1. represents that he has personally investigated the proposed substitute product and determined that it is equal or superior in all respects to that specified:
  2. will provide the same guarantee for the substitution that he would for that specified;
  3. certifies that the cost data presented is complete and includes all related costs under this Contract, but excludes costs under separate contracts and the Architect's redesign costs, and that he waives all claims for additional costs related to the substitution which subsequently become apparent; and
  4. will coordinate the installation of the accepted substitute, making such changes as may be required for the Work to be complete in all respects, at no additional cost to the Owner and at no extension of the contract completion date.
- C. Substitutions will not be considered if:
1. they are indicated or implied on shop drawings submissions without the formal request required in Para (1) above; or
  2. for their implementation they require a substantial revision of the Contract Documents in order to accommodate their use.
  3. The Architect will examine, with reasonable promptness, such substitution submittals, and return of submittals to the Contractor shall not relieve the Contractor from responsibility for deviations and alternatives from the contract plans and specifications, nor shall it relieve him from responsibility for errors in the submittals. A failure by the Contractor to identify in his letter of transmittal material deviations from the plans and specifications shall void the submittals and any action taken thereon by the Architect. When specifically requested by the Architect, the Contractor shall resubmit such shop drawings, descriptive data and samples as may be required to evaluate substitutions.
- D. If any mechanical, electrical, structural, or other changes are required for the proper installation and fit of alternative materials, articles, or equipment, or because of deviations from the contract plans and specifications, such changes shall not be made without the consent of the Architect and shall be made without additional cost to the Owner.
- 1.9 TEMPORARY USE OF EQUIPMENT
- A. No equipment intended for permanent installation shall be operated for temporary purposes without the written permission of the Architect.
- B. The temporary or trial usage by the Owner of any mechanical device, machinery, apparatus, equipment or any work or materials supplied under this Contract before final completion and written acceptance by the Architect, shall not be construed as evidence of the acceptance of same by the Owner. The Owner shall have the privilege of such temporary and trial usage, for such reasonable length of time as and when the Architect shall deem to be proper for making a complete and thorough test of same and no claim for damage shall be made by the Contractor for the injury to or breaking of parts of such work which may be caused by weakness or inaccuracy of structural parts or by defective material or workmanship. If the Contractor so elects, he may at his own expense, place a competent person or persons to make such trial usage; such trial usage shall be under the supervision of the Contractor.
- 1.10 GENERAL REQUIREMENTS
- A. In the event that it is necessary for the Contractor to store any materials offsite, he shall first obtain the approval of the Architect. The Contractor shall be responsible for insurance and warehousing charges of any materials stored offsite. The Contractor shall also be

responsible for the cost of delivery to the job site of any materials that have been stored offsite.

- B. Materials delivered to the job site shall be carefully stored and protected from damage. Damaged material shall not be used in the work. The Contractor shall provide, where directed temporary storage facilities as may be required for the storage of all materials which might be damaged by weather.
- C. Manufactured articles, materials and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned as directed by the representative manufacturers, unless otherwise specified.
- D. Equipment, plant, and appliances, such as hoists, centering, concrete lifts, construction elevators, cranes, rigging, towers, derricks, walks, ramps, chutes, scaffolding, implements, transportation, cartage and other things necessary and required for the adequate execution of the work and as required by law and applicable Union rules shall be provided and shall be maintained in good and safe mechanical working order, be responsible for their safe use, and remove them when no longer required. Applicable requirements of OSHA shall become and form a part of this document.
- E. During handling and installation of work at project site clean and protect work in progress and adjoining work on a basis of perpetual maintenance. Apply suitable protective covering on newly installed work where reasonably required to ensure freedom from damage or deterioration at time of substantial completion; otherwise, clean and perform maintenance on newly installed work as frequently as necessary through remainder of construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- F. To extent possible through reasonable control and protection methods, supervise performance of work in a manner and by means which will ensure that none of the work whether completed or in progress, will be subjected to harmful, dangerous, damaging, or otherwise deleterious exposures during construction period. Such exposures include (where applicable, but not by way of limitation) static loading, dynamic loading, internal pressures, external pressures, high or low temperatures, thermal shock, high or low humidity, air contamination or pollution, water, ice, solvents, chemicals, light, radiation, puncture, abrasion, heavy traffic, soiling, bacteria, insect infestation, combustion, electrical current, high speed operation, improper lubrication, unusual wear, misuse, incompatible interface, destructive testing, misalignment, excessive weathering, unprotected storage, improper shipping/handling, theft and vandalism.
- G. Require installer of each major unit of work to inspect substrate to receive the work, and conditions under which the work will be performed, and to report (in writing to Contractor) unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.
- H. Where installations include manufactured products, comply with manufacturer's applicable instructions and recommendations for installation to whatever extent these are more explicit or more stringent than applicable requirements indicated in the Contract Documents.
- I. Inspect each item of materials or equipment immediately prior to installation and reject damaged and defective items.
- J. Provide attachment and connection devices and methods for securing work properly as it is installed; true to line and level, and within recognized industry tolerance if not otherwise indicated. Allow for expansions and building movements. Provide uniform joint widths in exposed work, organized for best possible visual effect. Refer questionable visual-effect choices to Architect for final decision.

- K. Recheck measurements and dimensions of the work as an integral step of starting each installation.
- L. Install work during conditions of temperature, humidity, exposure, forecasted weather, and status of project completion which will ensure best possible results for each unit of work in coordination with entire work. Isolate each unit of work from non-compatible work, as required to prevent deterioration.
- M. Coordinate enclosure (closing-in) of work with required inspections and tests, so as to avoid necessity of uncovering work for that purpose.
- N. Mounting Heights: Except as otherwise indicated, mount individual units of work at industry-recognized standard mounting heights, for applications indicated. In CMU walls mount units at height closest to manufacturer's recommendation so as to minimize cutting of block coursings. Refer questionable mounting height choices to Architect for final decision.

END OF SECTION

SECTION 017300

EXECUTION REQUIREMENTS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

- A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

- A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:
  - 1. General installation of products.
  - 2. Progress cleaning.
  - 3. Starting and adjusting.
  - 4. Protection of installed construction.
  - 5. Correction of the Work.

1.3 RELATED SECTIONS

- A. Cutting and Patching - Section 017329.
- B. Closeout Procedures - Section 017700.

PART 2 PRODUCTS

(Not Applicable)

PART 3 EXECUTION

3.1 EXAMINATION

- A. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
  - 1. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
    - a. Description of the Work.
    - b. List of detrimental conditions, including substrates.
    - c. List of unacceptable installation tolerances.
    - d. Recommended corrections.
  - 2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

3. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
4. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
5. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

### 3.2 PREPARATION

- A. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- B. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- C. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents.

### 3.3 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
  1. Make vertical work plumb and make horizontal work level.
  2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
  3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.
- F. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
- G. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- H. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

## 3.4 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.
  - 1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
  - 2. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg. F.
  - 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
- B. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
  - 1. Remove liquid spills promptly.
  - 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- C. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- D. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- E. Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- F. Cutting and Patching: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.
- G. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- H. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- I. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

## 3.5 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.6 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.

3.7 CORRECTION OF THE WORK

- A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Division 1 Section "Cutting and Patching."
  - 1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.
- B. Restore permanent facilities used during construction to their specified condition.
- C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.
- D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.
- E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION

## SECTION 017329

## CUTTING AND PATCHING

## PART 1 GENERAL

## 1.1 GENERAL REQUIREMENTS

- A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

## 1.2 SECTION INCLUDES

- A. This Section includes procedural requirements for cutting and patching.

## 1.3 RELATED SECTIONS

- A. Refer to Divisions 3 through 26 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.
  - 1. Requirements in this Section apply to mechanical and electrical installations. Refer to Divisions 22, 23 and 26 Sections for other requirements and limitations applicable to cutting and patching mechanical and electrical installations.

## 1.4 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of other Work.
- B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

## 1.5 SUBMITTALS

- A. Cutting and Patching: Submit a method describing procedures at least 10 days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:
  - 1. Extent: Describe cutting and patching, show how they will be performed, and indicate why they cannot be avoided.
  - 2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building's appearance and other significant visual elements.
  - 3. Products: List products to be used and firms or entities that will perform the Work.
  - 4. Dates: Indicate when cutting and patching will be performed.
  - 5. Utilities: List utilities that cutting and patching procedures will disturb or affect. List utilities that will be relocated and those that will be temporarily out of service. Indicate how long service will be disrupted.
  - 6. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.

7. Architect's Approval: Obtain approval of cutting and patching before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

## 1.6 QUALITY ASSURANCE

- A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.
  1. Provide a list of additional elements that are structural elements and that require Architect's or Construction Manager's approval of a cutting and patching proposal.
- B. Operational Elements: Do not cut and patch the following operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
  1. Primary operational systems and equipment.
  2. Air or smoke barriers.
  3. Fire-protection systems.
  4. Control systems.
  5. Communication systems.
  6. Conveying systems.
  7. Electrical wiring systems.
- C. Miscellaneous Elements: Do not cut and patch the following elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.
  1. Water, moisture, or vapor barriers.
  2. Membranes and flashings.
  3. Exterior wall construction.
  4. Equipment supports.
  5. Piping, ductwork, vessels, and equipment.
  6. Noise- and vibration-control elements and systems.
- D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
- E. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

## 1.7 WARRANTY

- A. Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void warranties.

## PART 2 PRODUCTS

## 2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections of these Specifications.
- B. In-Place Materials: Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
  - 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of in-place materials.

## PART 3 EXECUTION

## 3.1 EXAMINATION

- A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.
  - 1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
  - 2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

## 3.2 PERFORMANCE

- A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
  - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
  - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
  - 2. In-Place Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
  - 3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
  - 4. Excavating and Backfilling: Comply with requirements in applicable Division 2 Sections where required by cutting and patching operations.

5. Proceed with patching after construction operations requiring cutting are complete.
- C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.
1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
  2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
  3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
    - a. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
  4. Ceilings: Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.
  5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.

END OF SECTION

## SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
1. Waste Management Goals
  2. Diversion and disposal of nonhazardous demolition and construction waste.
  3. Waste Management Plan
  4. Waste Management Plan implementation
- B. Related Requirements:
1. Section 018113.14 "Sustainable Design Requirements" for sustainable design goals and submittals.

#### 1.2 DEFINITIONS

- A. Alternative Daily Cover (ADC): Cover material other than soil placed on the surface of a municipal solid waste landfill at the end of each operating day to control vectors, fires, odors, blowing litter, and scavenging.
- B. Commingled Waste: Single-stream recycling of material waste, considered as one material waste stream unless diversion rates can be provided by the recycling facility for specific materials.
- C. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- D. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.
- E. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
- F. Diversion: To remove, or have removed, from the site for recycling, reuse, or salvage, materials that might otherwise be sent to a landfill. Diversion from landfill does not include burning, incinerating, thermally destroying waste, or waste-to-energy processes.

- G. Recyclable: The ability of a product or materials to be recovered at the end of its life cycle and remanufactured into a new product.
- H. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
- I. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
- J. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.
- K. Segregation: To place similar waste materials together for collection in a designated site area, trash bin, or roll-off container.
- L. Waste Management Plan: A project-specific plan for the collection, separation, handling, transportation, and disposal of waste generated at the construction site, to reduce the amount of waste sent to landfill or incineration.
- M. Waste Material Stream: A flow of materials from a job site into markets for building materials, comprised of a material category (or mixture of several material categories) combined with a diversion method. A material stream must constitute at least five percent (by weight or volume) of total diverted materials for the Project. Examples include source separated materials sent to specific recycling facilities, commingled waste sent to a mixed-waste recycling facility, deconstructed materials sent back to a manufacturer as part of a take-back program, or salvaged materials reused on site.
- N. Waste-To-Energy: The conversion of non-recyclable waste materials into usable heat and/or fuel through a variety of processes such as combustion, not including the combustion of wood into wood-derived fuel.

### 1.3 PERFORMANCE REQUIREMENTS

- A. General: Achieve end-of-Project rates for salvage/recycling of 75 percent by weight of total non-hazardous solid waste generated by the Work, including at least three (3) identified waste material streams. -OR- Limit generation of waste on site to maximum 2.5 pounds of construction waste per square foot of the Project building floor area.
- B. General: Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials.
- C. Diversion Requirements: Salvage, recycle, or reuse as much non-hazardous construction waste as possible. Diversion shall include, but not be limited to, the following waste categories as applicable to the Project:
  - 1. Demolition Waste:
    - a. Asphalt paving.

- b. Concrete.
- c. Concrete reinforcing steel.
- d. Brick.
- e. Concrete masonry units.
- f. Clean dimensional wood, trim, paneling, plywood, and oriented strand board.
- g. Structural and miscellaneous steel.
- h. Rough hardware.
- i. Roofing materials.
- j. Insulation.
- k. Doors and frames.
- l. Door hardware.
- m. Windows.
- n. Glass and Glazing.
- o. Metal studs.
- p. Gypsum board.
- q. Acoustical tile and panels.
- r. Carpet and Carpet pad.
- s. Flooring materials.
- t. Demountable partitions.
- u. Casework.
- v. Plumbing fixtures.
- w. Piping.
- x. Supports and hangers.
- y. Electrical conduit.
- z. Supports and hangers.

- aa. Valves.
  - bb. Sprinklers.
  - cc. Mechanical equipment.
  - dd. Refrigerants.
  - ee. Electrical conduit.
  - ff. Copper wiring.
  - gg. Lighting fixtures.
  - hh. Lamps.
  - ii. Ballasts.
  - jj. Electrical devices.
  - kk. Switchgear and panelboards.
  - ll. Transformers.
2. Construction Waste:
- a. Masonry and CMU.
  - b. Lumber.
  - c. Wood sheet materials.
  - d. Wood trim.
  - e. Metals.
  - f. Roofing.
  - g. Insulation.
  - h. Carpet and pad.
  - i. Gypsum board.
  - j. Piping.
  - k. Electrical conduit.
  - l. Packaging: Regardless of diversion goal indicated in "General" Paragraph above,

salvage or recycle 100 percent of the following uncontaminated packaging materials:

- 1) Paper.
  - 2) Cardboard.
  - 3) Boxes.
  - 4) Plastic sheet and film.
  - 5) Polystyrene packaging.
  - 6) Wood crates.
  - 7) Plastic pails.
3. Waste generated by on-site workers, such as plastic and metal beverage containers.
  4. All fluorescent lamps, HID lamps, and mercury-containing thermostats removed from the site shall be recycled.
- D. Alternative Daily Cover: Alternative Daily Cover (ADC) may not be included in calculations used to meet diversion rate goals.

#### 1.4 SUBMITTALS

- A. General: Submit the following according to Conditions of the Construction Contract and Division 01 Specification Sections.
- B. Waste Management Plan: Submit plan within 30 days of Notice of Award.
- C. Provide final approved Waste Management Plan and summary table indicating site-separated waste, by diverted material type, that indicates the total percentage of construction waste diverted from landfill and the identified waste material streams prior to request for Substantial Completion.
- D. Waste Diversion Tracking: The Contractor shall track demolition and construction waste diversion throughout the project and shall maintain documentation of materials and disposal methods. A sample USGBC Construction and Waste Management Calculator for this project is included in Appendix A-017419 of this Section.
- E. Waste Diversion Calculations: Submit calculated diversion rates as a percentage of total waste generated by the Work on a monthly basis, which shall be based on the USGBC Construction and Waste Management Calculator and provided in Waste Reduction Progress Reports.

1. Exclude excavation soil, land clearing debris, and hazardous material from calculations.
  2. Calculations may be performed using either weight (lbs. or tons) or volume (cubic yards), however the method shall be consistent throughout the duration of the Project. For LEED projects, where exact materials weights or volumes are not available, use the following solid waste conversion factors:
    - a. Cardboard: 100 lbs./cu.yd.
    - b. Gypsum wallboard: 500 lbs./cu.yd.
    - c. Mixed waste: 350 lbs./cu.yd.
    - d. Rubble: 1,400 lbs./cu.yd.
    - e. Steel: 1,000 lbs./cu.yd.
    - f. Wood: 300 lbs./cu.yd.
- F. Waste Management Progress Reports shall be submitted monthly and shall include a current USGBC Construction and Demolition Waste Management Calculator.
1. Cumulative Progress Reports shall be submitted at the time of Application for Payment.
- G. Waste Management Progress Reports shall include the following information:
1. Gross Total quantity of waste generated during the period.
  2. Quantity of materials disposed of in landfills or incineration facilities as a percentage of total waste.
  3. Quantity of materials diverted by methods of recycling, reuse, and/or salvage. Include a breakdown of diverted waste for each of the identified waste material streams and major material categories as follows:
    - a. Concrete
    - b. Steel or Metals
    - c. Wood
    - d. Gypsum Wallboard
    - e. Crushed Asphalt
    - f. Masonry
    - g. Cardboard

4. Quantity of average Alternative Daily Cover (ADC) produced by sorting facilities as a percentage of commingled waste
  5. Quantity of land clearing debris and excavation soil. Note that these categories do not qualify as diverted waste for LEED projects.
  6. Name and location of the recycling or disposal facility that accepted the material.
  7. Percentage of diverted waste as a percentage of total waste for current period and project-to-date.
- H. Waste Management Final Report: Submit final report prior to the final Application for Payment.
- I. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and charitable organizations. Indicate whether organization is tax exempt.
- J. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.
- K. Recycling and Processing Facility Records: Document receipt and acceptance of recyclable waste by licensed recycling and processing facilities. Include legible copies of on-site logs, manifests, weight tickets, receipts, and invoices.
- L. Commingled Waste: If mixed construction and demolition (C&D) waste will be commingled on-site and diverted off-site, provide monthly summaries of diversion rates from Recycler/Processor. If Recycler/Processor provides facility-wide aggregated, annual averaged diversion rates in lieu of project-specific diversion rates, provide documentation that the Recycler/Processor's method of recording and calculating these rates is regulated by a local or state government authority.
- M. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include legible copies of manifests, weight tickets, receipts, and invoices.
- N. Qualification Data: For Waste Management Coordinator, submit within 30 days of date established for the Notice to Proceed.
- O. Statement of Refrigerant Recovery: Submit as refrigerant recovery activities are completed on site, if applicable. Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.5 QUALITY ASSURANCE

- A. Waste Management Coordinator Qualifications: Experienced firm, with a record of successful waste management coordination of projects with similar requirements, that employs a LEED-Accredited Professional, certified by the USGBC, as waste management coordinator. Waste management coordinator may also serve as the Contractor's LEED coordinator.
- B. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.
- C. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.
- D. Waste Management Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:
  - 1. Review and discuss waste management plan including responsibilities of Waste Management Coordinator.
  - 2. Review requirements for documenting quantities of each type of waste and its disposition.
  - 3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
  - 4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
  - 5. Review waste management requirements for each trade.
- E. Project Meetings: Waste management plans and implementation shall be discussed at the following meetings:
  - 1. Pre-demolition meeting.
  - 2. Pre-construction meeting.
  - 3. Regular job-site meetings.
  - 4. Sub-contractor job-site coordination meetings.

1.6 WASTE MANAGEMENT PLAN

- A. General: Develop a waste management plan according to ASTM E 1609 and requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis, identification of responsible parties, method(s) of diversion, and implementation procedures. Waste management plan shall be made for both demolition and construction waste. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.
- B. Waste Identification: Indicate anticipated types and quantities of demolition, site-clearing and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.
- C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
  - 1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
  - 2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
  - 3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
  - 4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
  - 5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
  - 6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

- A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
- B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan. Coordinator shall be present at Project site full time for duration of Project.
- C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.
  - 1. Distribute waste management plan to everyone concerned within three days of submittal return.
  - 2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.
- D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
  - 1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
  - 2. Comply with Section 015000 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 SALVAGING DEMOLITION WASTE

- A. Salvaged Items for Reuse in the Work:
  - 1. Clean salvaged items.
  - 2. Pack or crate items after cleaning. Identify contents of containers.
  - 3. Store items in a secure area until installation.
  - 4. Protect items from damage during transport and storage.

5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.
- B. Salvaged Items for Sale and Donation: Not permitted on Project site.
- C. Salvaged Items for Owner's Use:
1. Clean salvaged items.
  2. Pack or crate items after cleaning. Identify contents of containers.
  3. Store items in a secure area until delivery to Owner.
  4. Transport items to Owner's storage area off-site designated by Owner.
  5. Protect items from damage during transport and storage.

### 3.3 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

- A. General: Recycle paper and beverage containers used by on-site workers.
- B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor.
- C. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.
1. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
  2. Inspect containers and bins for contamination and remove contaminated materials if found.
  3. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
  4. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
  5. Store components off the ground and protect from the weather.
  6. Remove recyclable waste from Owner's property and transport to recycling receiver or processor.

### 3.4 RECYCLING DEMOLITION WASTE

- A. Asphalt Paving: Grind asphalt to maximum 1-1/2-inch size or break up and transport paving to asphalt-recycling facility.
- B. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.
  - 1. Pulverize concrete to maximum 1-1/2-inch size.
- C. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.
  - 1. Pulverize masonry to maximum 3/4-inch size.
  - 2. Clean and stack undamaged, whole masonry units on wood pallets.
- D. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.
- E. Metals: Separate metals by type.
  - 1. Structural Steel: Stack members according to size, type of member, and length.
  - 2. Remove and dispose of bolts, nuts, washers, and other rough hardware.
- F. Asphalt Shingle Roofing: Separate organic and glass-fiber asphalt shingles and felts. Remove and dispose of nails, staples, and accessories.
- G. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.
- H. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.
- I. Metal Suspension System: Separate metal members including trim, and other metals from acoustical panels and tile and sort with other metals.
- J. Carpet and Pad: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.
- K. Store clean, dry carpet and pad in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.
- L. Carpet Tile: Remove debris, trash, and adhesive.
- M. Stack tile on pallet and store clean, dry carpet in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.

- N. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.
- O. Conduit: Reduce conduit to straight lengths and store by type and size.

### 3.5 RECYCLING CONSTRUCTION WASTE

- A. Packaging:
  - 1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
  - 2. Polystyrene Packaging: Separate and bag materials.
  - 3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
  - 4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.
- B. Wood Materials:
  - 1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
  - 2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.
- C. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.
  - 1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.

### 3.6 DISPOSAL OF WASTE

- A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
  - 1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
  - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn waste materials.
- C. Disposal: Remove waste materials from Owner's property and legally dispose of them.



SECTION 017700

CLOSEOUT PROCEDURES

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

- A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

- A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
  - 1. Inspection procedures.
  - 2. Project Record Documents.
  - 3. Warranties.
  - 4. Instruction of Owner's personnel.
  - 5. Final cleaning.

1.3 RELATED SECTIONS

- A. Execution Requirements - Section 017300.

1.4 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.
  - 1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
  - 2. Advise Owner of pending insurance changeover requirements.
  - 3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
  - 4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
  - 5. Prepare and submit Project Record Documents, operation and maintenance manuals, Final Completion construction photographs and photographic negatives, damage or settlement surveys, property surveys, and similar final record information.
  - 6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
  - 7. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.

8. Complete startup testing of systems.
  9. Submit test/adjust/balance records.
  10. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
  11. Advise Owner of changeover in heat and other utilities.
  12. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
  13. Complete final cleaning requirements, including touchup painting.
  14. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
  2. Results of completed inspection will form the basis of requirements for Final Completion.

#### 1.5 FINAL COMPLETION

- A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:
1. Submit a final Application for Payment.
  2. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
  3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
  4. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training videotapes.
- B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will notify Contractor of construction that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

#### 1.6 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Preparation: Submit three copies of list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction

including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:
  - a. Project name.
  - b. Date.
  - c. Name of Architect.
  - d. Name of Contractor.
  - e. Page number.

#### 1.7 PROJECT RECORD DOCUMENTS

- A. General: Do not use Project Record Documents for construction purposes. Protect Project Record Documents from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.
- B. Record Drawings: Maintain and submit one set of blue- or black-line white prints of Contract Drawings and Shop Drawings.
  1. Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.
    - a. Give particular attention to information on concealed elements that cannot be readily identified and recorded later.
    - b. Accurately record information in an understandable drawing technique.
    - c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
    - d. Mark Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. Where Shop Drawings are marked, show cross-reference on Contract Drawings.
  2. Mark record sets digitally. Use other colors to distinguish between changes for different categories of the Work at the same location.
  3. Mark important additional information that was either shown schematically or omitted from original Drawings.
  4. Note Construction Change Directive numbers, Change Order numbers, alternate numbers, and similar identification where applicable.
- C. Record Specifications: Submit one copy of Project's Specifications, including addenda and contract modifications. Mark copy to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
  1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
  2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.

3. Note related Change Orders, Record Drawings and Product Data, where applicable.
- D. Record Product Data: Submit one copy of each Product Data submittal. Mark one set to indicate the actual product installation where installation varies substantially from that indicated in Product Data.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
  2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
  3. Note related Change Orders, Record Drawings and Record Specifications, where applicable.
- E. Miscellaneous Record Submittals: Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

## 1.8 WARRANTIES

- A. Submittal Time: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.
- B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual and submit in electronic format.

## PART 2 PRODUCTS

### 2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

## PART 3 EXECUTION

### 3.1 DEMONSTRATION AND TRAINING

- A. Instruction: Instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
1. Provide instructors experienced in operation and maintenance procedures.
  2. Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at the start of each season.
  3. Schedule training with Owner with at least seven days' advance notice.
  4. Coordinate instructors, including providing notification of dates, times, length of instruction, and course content.

- B. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections. For each training module, develop a learning objective and teaching outline. Include instruction for the following:
1. System design and operational philosophy.
  2. Review of documentation.
  3. Operations.
  4. Adjustments.
  5. Troubleshooting.
  6. Maintenance.
  7. Repair.

### 3.2 FINAL CLEANING

- A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:
    - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
    - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
    - c. Rake grounds that are neither planted nor paved to a smooth, even textured surface.
    - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
    - e. Remove snow and ice to provide safe access to building.
    - f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
    - g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
    - h. Sweep concrete floors broom clean in unoccupied spaces.
    - i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
    - j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
    - k. Remove labels that are not permanent.

- I. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
    - 1). Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
  - m. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
  - n. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
  - o. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
  - p. Clean ducts, blowers, and coils if units were operated without filters during construction.
  - q. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
  - r. Leave Project clean and ready for occupancy.
- C. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

END OF SECTION

## SECTION 017823

## OPERATION AND MAINTENANCE DATA

## PART 1 GENERAL

## 1.1 GENERAL REQUIREMENTS

- A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

## 1.2 SECTION INCLUDES

- A. Work of this Section includes all labor, materials, equipment and services necessary to complete the operation and maintenance data as specified herein.

## 1.3 RELATED SECTIONS

- A. Submittal Procedures - Section 013300.
- B. Closeout Procedures - Section 017700.

## 1.4 GENERAL

- A. Compile product data and related information appropriate for Owner's maintenance and operation of products furnished under the Contract.
  - 1. Subcontractors shall prepare operation and maintenance data as specified in this Section and as referenced in other pertinent sections of Specifications.

## 1.5 FORM OF SUBMITTALS

- A. Prepare data in the form of an instructional manual for use by Owner's personnel.
- B. Format: Submit in electronic format.

## 1.6 MANUAL FOR MATERIALS AND FINISHES

- A. Submit PDF of complete manual in final form.
- B. Content, for architectural products, applied materials and finishes
  - 1. Manufacturer's data, giving full information on products.
    - a. Catalog number, size, composition.
    - b. Color and texture designations.
    - c. Information required for re-ordering special-manufactured products.
  - 2. Instructions for care and maintenance.
    - a. Manufacturer's recommendation for types of cleaning agents and methods.
    - b. Cautions against cleaning agents and methods which are detrimental to the product.
    - c. Recommended schedule for cleaning and maintenance.
- C. Content, for moisture-protection and weather-exposed products

1. Manufacturer's data, giving full information on products.
    - a. Applicable standards.
    - b. Chemical composition.
    - c. Details of installation.
  2. Instructions for inspection, maintenance, and repair.
- 1.7 MANUAL FOR EQUIPMENT AND SYSTEMS
- A. Submit PDF of complete manual in final form.
  - B. Content, for each unit of equipment and system, as appropriate.
    1. Description of unit and component parts.
      - a. Function, normal operating characteristics, and limiting conditions.
      - b. Performance curves, engineering data and tests.
      - c. Complete nomenclature and commercial number of all replaceable parts.
    2. Operating procedures
      - a. Start-up, break-in, routine and normal operating instructions.
      - b. Regulation, control, stopping, shut-down and emergency instructions.
      - c. Summer and winter operating instructions.
      - d. Special operating instructions.
    3. Maintenance procedures
      - a. Routine operations.
      - b. Guide to "trouble-shooting".
      - c. Disassembly, repair and reassembly.
      - d. Alignment, adjusting and checking.
    4. Servicing and lubrication schedule.
      - a. List of lubricants required.
    5. Manufacturer's printed operation and maintenance instructions.
    6. Description of sequence of operation by control manufacturer.
    7. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.
      - a. Predicted life of parts subject to wear.
      - b. Items recommended to be stocked as spare parts.
    8. As-installed control diagrams by controls manufacturer.
    9. Each contractor's coordination drawings.
      - a. As-installed color coded piping diagrams.
    10. Charts of valve tag numbers, with the location and function of each valve.
    11. List of original manufacturer's spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage.

12. Other data as required under pertinent sections of specifications.
- C. Content, for each electric and electronic system, as appropriate:
1. Description of system and component parts.
    - a. Function, normal operating characteristics, and limiting condition.
    - b. Performance curves, engineering data and tests.
    - c. Complete nomenclature and commercial number of replaceable parts.
  2. Circuit directories of panel boards.
    - a. Electrical service.
    - b. Controls.
    - c. Communications.
  3. As-installed color-coded wiring diagrams.
  4. Operating procedures
    - a. Routine and normal operating instructions.
    - b. Sequences required.
    - c. Special operating instructions.
  5. Maintenance procedures
    - a. Routine operations.
    - b. Guide to "trouble-shooting".
    - c. Disassembly, repair and reassembly.
    - d. Adjustment and checking.
  6. Manufacturer's printed operation and maintenance instructions.
  7. List of original manufacturer's spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage.
  8. Other data as required under pertinent sections of specifications.
- D. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel.
- E. Additional requirements for operation and maintenance data: The respective sections of Specifications.

END OF SECTION

SECTION 018113.14 - SUSTAINABLE DESIGN REQUIREMENTS - LEED v4 BD+C

PART 1 - GENERAL

1.1 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.
- B. Section 01 74 19 – Construction and Demolition Waste Management and Disposal
- C. Section 01 81 19 – Construction Indoor Air Quality Requirements
- D. LEED Reference Guide for Building Design and Construction (BD+C), version 4, U.S. Green Building Council

1.2 SUMMARY

- A. Section includes general requirements and procedures for compliance with certain prerequisites and credits needed for the Welcome Sequence to obtain "LEED Version 4 for Building Design and Construction" (LEED v4 BD+C) **Gold** certification based on USGBC's LEED v4 BD+C and additionally apply to any additional building and/or site pursuing LEED v4 certification. Section 018113.14 language may be amended to incorporate or remove LEED v4 credits pursued by additional buildings or sites if certification level or strategy is different from the Welcome Sequence.
  - 1. Specific requirements for LEED are also included in other Sections.
  - 2. Some LEED prerequisites and credits needed to obtain LEED certification depend on product selections and may not be specifically identified as LEED requirements. Compliance with requirements needed to obtain LEED prerequisites and credits may be used as one criterion to evaluate substitution requests and comparable product requests.
  - 3. Some LEED prerequisites and credits needed to obtain the indicated LEED certification depend on Architect's design and other aspects of Project that are not part of the Work of the Contract.
  - 4. Any discrepancies between the LEED Requirements outlined in this Section and those in other Sections require notification of the Architect and the Architect's approval of the resolution.
  - 5. LEEDv4 Gold goals and targeted credits are outlined in the LEED Checklist.

1.3 SUSTAINABLE DESIGN REQUIREMENTS

- A. The Owner requires the Contractor to implement practices and procedures to meet the project's environmental performance goals, which include achieving LEED v4 Gold Certification. Specific project goals that may impact this area of work include: use of recycled-content materials; use of locally-manufactured materials; use of low-emitting materials; construction waste recycling; and the implementation of a construction indoor air quality management plan. The Contractor shall ensure that the requirements related to these goals, as defined in the

Articles below, are implemented to the fullest extent. Substitutions, or other changes to the work proposed by the Contractor or their Subcontractors, shall not be allowed if such changes compromise the aforementioned environmental goals and LEED certification.

#### 1.4 REFERENCE STANDARDS

- A. ANSI/ASHRAE/IESNA 90.1-2010 – Energy Standard for Buildings Except Low-Rise Residential Buildings
- B. ANSI/ASHRAE 52.2-2007 – Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size
- C. ANSI/ASHRAE 62.1-2010 – Ventilation for Acceptable Indoor Air Quality
- D. ANSI/ASTM-E779-10 – Determining Air Leakage Rate by Fan Pressurization
- E. ASHRAE 52.2-2007 – Filtration Minimum Efficiency Reporting Value (MERV)
- F. ASHRAE Guideline 0 – 2005, The Commissioning Process
- G. ASHRAE Guideline 1.1-2007, HVAC&R Technical Requirements for the Commissioning Process
- H. ASHRAE 55-2010 – Thermal Comfort Conditions for Human Occupancy
- I. ASTM C1371-04 (R2010) – Determination of Emittance of Materials Near Room Temperature Using Portable Emitters
- J. ASTM C1549-04 – Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer
- K. ASTM D1003-11 – Haze and Luminous Transmittance of Transparent Plastics
- L. ASTM E408-13 – Methods for Total Normal Emittances of Surfaces Using Inspection-Meter Techniques
- M. ASTM E903-12 – Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres
- N. ASTM E1903-11 – Phase II Environmental Site Assessment.
- O. ASTM E1918-06 – Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field
- P. ASTM E1980-11 – Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces

- Q. ATSM/BIFMA Standard Method M7.1-2011, Standard Test Method for Determining Emissions from Office Furniture Systems, Components and Seating – Furniture evaluation standard for VOC emissions
- R. ATSM/BIFMA e3-2011 Furniture Sustainability Standard Section 7.6.1 and 7.6.2 – VOC, TVOC, toluene, formaldehyde, aldehyde, and phenylcyclohexene concentration limits for office furniture, components and seating
- S. California Air Resources Board (CARB) Airborne Toxic Measure to Reduce Formaldehyde Emissions from Composite Wood Products Regulation
- T. CARB Suggested Control Measure for Architectural Coatings, 2007
- U. California Title 24-2013, Part 6 – Building Energy Efficiency Standards
- V. California Department of Health Services – Standard Practice for the Testing of VOC Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda
- W. California Dept. of Public Health Standard Method v1.1-2010, Standard Method for The Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers
- X. California Law AB1953 – No-lead compliant plumbing products
- Y. California (State of) Specification Section 01350
- Z. (The) Carbon Trust – Good Practice Guide (GPG) 237, Natural Ventilation in Non-Domestic Buildings, A Guide for Designers, Developers, and Owners, 1998
- AA. CIBSE – Chartered Institute of Building Services Engineers Applications Manual 10, Natural Ventilation in Non-Domestic Buildings, 2005
- BB. CRI – Carpet and Rug Institute Green Label and Green Label Plus Testing Program
- CC. IgCC/ASHRAE 189.1 – Cooling Tower & Evaporative Condenser Requirements
- DD. EPA ENERGY STAR – Qualified Products
- EE. EPA Construction General Permit (CGP): 2012
- FF. EPA – Brownfields Definition – Sustainable Redevelopment of Brownfields Program
- GG. EPA Clean Air Act, Title VI, Section 608, Compliance with the Section 608 Refrigerant Recycling Rule
- HH. EPA – Energy Policy Act (EPAct) of 1992 (and as amended), Fixture Flow Requirements
- II. EPA – Energy Policy Act (EPAct) of 2005, Fixture Flow Requirements
- JJ. EPA – Energy Star Roofing Guidelines

- KK. EPA 832-R-92-005 – Storm Water Management for Construction Activities, Chapter 3
- LL. LL. EPA 840-B-92-002, Jan 1993 – Guidance Specifying Management Measures for Sources of Non-Point Pollution in Coastal Waters
- MM. EPA PB90200288 – Compendium of Methods for the Determination of Air Pollutants in Indoor Air
- NN. EPA 763-E-C-40-CFR Asbestos Remediation Testing
- OO. FEMA – 100-Year Flood Definition
- PP. Facility Guidelines Institute (FGI) Guidelines for Design and Construction of Health Care Facilities, Section A1.3-4b, Mercury Elimination – Guidelines for the elimination of mercury in equipment
- QQ. FloorScore Program – Resilient Flooring Testing Program
- RR. FSC – Forest Stewardship Council’s Principles and Criteria
- SS. Greenguard Certification Program – Greenguard Environmental Institute
- TT. UU. GS – Green Seal Standards – GS-03 Anti-corrosive Paints, 2nd Edition January 7, 1997; GS-11
- UU. Architectural Paints 1st Edition May 20, 1993; Coatings, and Primers; GS-36 Commercial Adhesives, effective October 19, 2000.
- VV. IAPMO/ ANSI UPC 1-2006 - Uniform Plumbing Code 2006 Section 402.0 Water-Conserving Fixtures and fittings, effective 2006
- WW. ICC – International Plumbing Code 2006, Section 604, Design of Building Water Distribution System, effective 2006
- XX. ISO 14021-1999 – Environmental Labels and Declarations, Self-Declared Environmental Claims (Type II Environmental Labeling)
- YY. New Buildings Institute, Advanced Buildings “Core Performance” Guide
- ZZ. South Coast Air Quality Management District (SCAQMD) Rule #1113 – VOC Limits for Architectural Coatings, effective June 3, 2011
- AAA. SCAQMD Amendment to South Coast Rule #1168 – VOC Limits for Adhesives, Sealant and Sealant Primers, effective July 1, 2005 with a rule amendment date of Jan. 7, 2005
- BBB. SMACNA/ANSI 008-2008 – IAQ Guidelines for Occupied Buildings Under Construction, 2nd Edition 2007
- CCC. Unified Facilities Criteria (UFC) Medical Military Facilities 4-501-01
- DDD. US Code of Federal Regulations – Definition of Prime Agricultural Land, Title 7, Volume 6, Parts 400-699, Section 657.5

EEE. US Code of Federal Regulations – Definition of Wetlands, 40 CFR, Parts 230-233, and Part 22

FFF. USGBC – LEED Version 4 BD&C Reference Guide

## 1.5 DEFINITIONS

A. LEED: USGBC's "LEED Version 4 for Building Design and Construction."

1. Definitions that are a part of "LEED Version 4 for Building Design and Construction" (LEED v4 BD+C) apply to this Section.

B. Brownfield: U.S. EPA Definition of Brownfields – With certain legal exclusions and additions, brownfield site means real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant.

C. Chain-of-Custody Certificates (CoC): Certificates signed by manufacturers certifying that wood used to make products was obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001. Certificates shall include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body. The COC certificate number is listed on invoices for non-labeled products to document that an entity has followed FSC guidelines for product accounting.

D. Chlorofluorocarbons (CFCs): Hydrocarbons that deplete the stratospheric ozone layer.

E. Composite wood: Consists of wood or plant particles or fibers bonded by a synthetic resin or binder. Examples include particleboard, medium-density fiberboard (MDF), plywood, oriented-strandboard (OSB), wheatboard, and strawboard.

F. Forest Stewardship Council (FSC) is an independent, non-governmental, not for profit organization established to promote the responsible management of the world's forests. FSC provides certifications to award forest managers who adopt environmentally and socially responsible forest management practices and to companies that manufacture and sell products that directly support responsible forest management.

G. Hydrochlorofluorocarbons (HCFCs): Refrigerants used in building equipment that deplete the stratospheric ozone layer, but to a lesser extent than CFCs.

H. Point of Harvest/Extraction/Recovery: Location where raw material is gathered for use in production.

I. Point of Manufacturing (Final Assembly): Location where individual components are assembled into a product that is furnished and installed on site.

J. Regional Materials: Materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site. If only a fraction of a product or material is extracted/harvested/recovered and manufactured locally, then only that percentage (by weight) shall contribute to the regional value.

- K. Recycled Content: The recycled content value of a material assembly shall be determined by weight. The recycled fraction of the assembly is then multiplied by the cost of assembly to determine the recycled content value.
  - 1. "Postconsumer" material is defined as waste material generated by households or by commercial, industrial, and institutional facilities in their role as end users of the product, which can no longer be used for its intended purpose.
  - 2. "Preconsumer" material is defined as material diverted from the waste stream during the manufacturing process. Excluded is reutilization of materials, such as rework, regrind, or scrap, generated in a process and capable of being reclaimed within the same process that generated it.
- L. Solar Reflectance Index (SRI): A measure of a material's ability to reject solar heat, as shown by a small temperature rise. It is defined so that a standard black (reflectance 0.05, emittance 0.9) is equal to 0, and a standard white (reflectance 0.80, emittance 0.90) is equal to 100.
- M. Vendor: A Vendor of certified wood is the organization that sells/supplies wood products to contractors or subcontractors. A vendor must have a FSC Chain of Custody (CoC) certificate if it is selling FSC-certified products for which its packaging or form will be modified and/or products that are not individually labeled; this includes most lumber.
- N. Volatile Organic Compounds (VOCs): Carbon compounds that participate in atmospheric photochemical reactions (excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides and carbonates, and ammonium carbonate). The compounds vaporize (become a gas) at normal room temperatures

#### 1.6 ADMINISTRATIVE REQUIREMENTS

- A. Respond to questions and requests from Architect and the USGBC regarding LEED credits that are the responsibility of the Contractor, that depend on product selection or product qualities, or that depend on Contractor's procedures until the USGBC has made its determination on the Project's LEED certification application. Document responses as informational submittals.
- B. Submit documentation to USGBC and respond to questions and requests from USGBC regarding LEED credits that are the responsibility of the Contractor, that depend on product selection or product qualities, or that depend on Contractor's procedures until the USGBC has made its determination on the Project's LEED certification application.
  - 1. Document correspondence with USGBC as informational submittals.

#### 1.7 SUBMITTALS

- A. General: Submit additional sustainable design submittals required by other Specification Sections.

Sustainable design submittals are in addition to other submittals.

If submitted item is identical to that submitted to comply with other requirements, include an additional copy with other submittal as a record copy of compliance with indicated LEED

requirements instead of separate sustainable design submittal. Mark additional copy "Sustainable design submittal."

B. LEED Product Submittals:

1. Projects seeking LEED certification must track and record product, material, and cost information for LEED credit documentation. The contractor shall complete and submit the following forms included with product submittals:
2. Environmental Materials Reporting Form: for all permanently installed products and materials specified in CSI MasterFormat 2012 Edition Divisions 03-12, 31 (Sections relating to Foundations), and 32 (Sections relating to Pavings, Site Improvements, and Planting). The Contractor shall submit:
  - a. Completed Environmental Materials Reporting Form. A sample Form for this project has been included in the Appendix of this Section.
  - b. For each building product and material listed on the Form, provide information and supporting documentation for the product as defined in this Section to support all environmental claims listed on the Form. Submittal requirements for the support documentation can be found in the "LEED Credit-Specific Submittal" part of this Section.
3. Low-Emitting Materials Reporting Form: For all permanently installed products and materials related to the work of any Section installed on the interior of the building (i.e. inside the weatherproofing system) and falling within one of the product categories listed below, the Contractor shall submit:
  - a. Completed Low-Emitting Materials Reporting Form. A sample Form for this project has been included in the Appendix of this Section.
  - b. For each building product and material listed on the Form, provide information and support documentation for the product as defined in this Section to support all environmental claims listed in the Form. Submittal requirements for the support documentation can be found in the "LEED Credit-Specific Submittal" part of this Section.
  - c. Applicable product categories: flooring; composite wood; ceilings, walls, and thermal or acoustic insulation; field-applied adhesives, sealants, paints, and coatings including roofing and waterproofing; and furniture products.

C. LEED Materials Tracking Submittals

1. The contractor shall complete a LEED v4 Building Product Disclosure + Optimization (BPDO) Calculator for products in CSI MasterFormat 2012 Edition Divisions 03-1, 31 (Sections relating to Foundations), and 32 (Sections relating to Pavings, Site Improvements, and Planting) according to the following schedule and requirements:
  - a. A Sample BPDO Calculator has been included in the Appendix of this Section. This sample is provided for reference only as the required file is editable. The BPDO Calculator is available for download at <http://www.usgbc.org/resources/bpdo-calculator> or upon request.
  - b. At the commencement of construction, submit a BPDO Calculator with the Project specification sections shown congruously with the anticipated submittal log and with preliminary materials cost column completed.
  - c. On a monthly basis during construction, update and submit the BPDO Calculator with actual product data and cost information from approved LEED Product Submittals.
  - d. At substantial completion, submit a final and complete BPDO Calculator with required product data and cost data.

2. The Contractor shall complete a LEED v4 Low-Emitting Materials Calculator for permanently installed interior products related to the work of any Section, for the applicable product categories outlined in the LEED Product Submittals of this Section.
    - a. A Sample Low-Emitting Materials Calculator has been included in the Appendix of this Section. This sample is provided for reference only as the required file is editable. The Low-Emitting Materials Calculator is available for download at <http://www.usgbc.org/resources/low-emitting-materials-calculator>, or upon request.
    - b. On a monthly basis during construction, update and submit the Low-Emitting Materials Calculator with actual product data from approved LEED Product Submittals
    - c. At substantial completion, submit a final and complete Low-Emitting Materials Calculator with required product data.
- D. LEED Credit-Specific Submittals
1. General
    - a. For MR Credits Building Product Disclosure and Optimization (BPDO) listed below, submittals apply to permanently installed products and materials specified in CSI MasterFormat 2012 Edition Divisions 3-11, 31 (Sections relating to Foundations), and 32 (Sections relating to Pavings, Site Improvements, and Planting).
    - b. For EQ Credit Low-Emitting Materials, submittals apply to permanently installed products and materials related to the work of any Section on the interior of the building (i.e. inside the weatherproofing systems) and falling within one of the applicable product categories.
      - 1) Applicable product categories are listed under “LEED Product Submittals” under the Submittals part of this Section.
      - 2) Note that LEED v4 publishes a list of approved third-party product certifications and labels, available for download at <http://www.usgbc.org/resources/low-emitting-material-third-party-certification-table>.
    - c. For MR Prerequisite and Credits PBT Source Reduction listed below, submittals apply to permanently installed products and materials containing mercury, lead, or cadmium.
    - d. For further explanation of credit requirements, refer to LEED v4 BD+C Reference Guide.
  2. MR Credit BPDO – Environmental Product Declarations (EPD): submit the following documentation, as described in LEED v4 BD+C Reference Guide.
    - a. Credit Option 1 (EPD): manufacturer’s product specific declarations or Environmental Product Declarations (product-specific or industry-wide)
    - b. Credit Option 2 (Multi-Attribute Optimization): manufacturer’s third-party certified life cycle assessments (LCA), demonstrating the required environmental impact reductions.
  3. MR Credit BDPO – Sourcing of Raw Materials: submit the following documentation as described in LEED v4 BD+C Reference Guide.
    - a. Credit Option 1 (Raw Material Source & Extraction Reporting): manufacturer’s third-party verified corporate sustainability reports (CSR) or self-declared reports.
    - b. Credit Option 2 (Leadership Extraction Practices): submit the following as applicable.
      - 1) Products purchased from a manufacturer (producer) that participates in an extended producer responsibility (i.e., take-back) program: company

- brochure or similar describing the program, including contact information and verification that the product is included in the program.
- 2) Products containing bio-based materials: documentation from the raw-material manufacturer stating conformance to the Sustainable Agricultural Network's Sustainable Agricultural (SANSA) Standard in the form of a signed letter on company letterhead.
  - 3) For products containing recycled content: product cut sheet or a written affidavit on company letterhead (email is not acceptable) from the manufacturer indicating the percentages, by material weight, of post-consumer and pre-consumer recycled content.
  - 4) Regionally sourced products that have raw materials extracted, are manufactured, and purchased within 100 miles of the Project site: a cut sheet or a written affidavit from the manufacturer indicating:
    - a) The Point of Purchase (location of purchase transaction). If purchased online or not-in-person, Point of Purchase is considered the location of product distribution.
    - b) Product component materials which are extracted, manufactured and purchased within 100 miles of the project site and the material percentage by weight.
    - c) The distance, in miles from the Points of raw material extraction, product manufacturing, and purchasing to the Project site location, measured as the most direct route between all the points.
  - 5) Permanently installed non-recycled wood and wood based material, submit the following:
    - a) Forest Stewardship Council's Chain of Custody (CoC) Certification Number for each installed certified wood product, declaring conformance with FSC Guidelines for certified wood. COC numbers shall be obtained from the manufacturer and must be itemized on line-item basis. When applicable, a COC number is required by the source forest, transportation entity, supplier/manufacturer, and vendors of the material.
    - b) Vendor invoices, including all FSC-certified and non FSC-certified wood products purchased. Vendors are defined as those companies that sell products to the project contractor or subcontractors. Invoices must include:
      - i. Itemization of each wood product identified as such on a line item basis
      - ii. FSC products identified as such on a line-item basis and must be identified as "FSC Pure, FSC Mixed Credit", or "FSC Mixed [NN] %" (where NN is the percentage of FSC material)
      - iii. The dollar value of each line item
      - iv. The vendor's chain-of-custody (CoC) number must be shown on any invoice that includes FSC products.
      - v. If it is impractical for a vendor to invoice wood products on a line-item basis because the invoice would be excessive in length, the invoice should indicate the aggregate value of wood products sold by the vendor.
4. EQ Credit Low-Emitting Materials: submit the following documentation, as applicable and as described in the LEED v4 BD+C Reference Guide.
- a. Composite wood and agrifiber products, including core materials, but excluding softwoods: Submit a cut sheet or written affidavit from the manufacturer stating

- that they meet Phase 2 CARB formaldehyde emission limit and CARB ATCM requirements for ultra-low-emitting formaldehyde (ULEF) or no added formaldehyde (NAF) resins.
- b. Flooring products, including but not limited to carpet, resilient flooring, engineered wood, and mineral-based tile: Submit documentation of compliance with LEED v4 General Emissions Evaluation (VOC emissions testing or approved third-party certification) for each installed product or system.
  - c. Wet-applied, field installed interior products listed below: submit the following included with the product submittal to demonstrate compliance with both VOC content limits and LEED v4 General Emissions Evaluation (VOC emissions testing or approved third-party certification).
    - 1) Adhesives: Submit Material Data Safety Sheet (MSDS) or product data sheets highlighting VOC content measured in grams per liter (g/L) less water and exempt solvents, and General Emissions Evaluation documentation.
    - 2) Sealants: Submit Material Data Safety Sheet (MSDS) or product data sheets highlighting VOC content measured in grams per liter (g/L) less water and exempt solvents, and General Emissions Evaluation documentation.
    - 3) Paints
      - a) Material Data Safety Sheet (MSDS) or product data sheets highlighting VOC content measured in grams per liter (g/L) less water and exempt solvents, and General Emissions Evaluation documentation.
      - b) Cut Sheet highlighting compliance with Green Seal requirements.
    - 4) Architectural Coatings: Material Data Safety Sheet (MSDS) or product data sheets highlighting VOC content measured in grams per liter (g/L) less water and exempt solvents, and General Emissions Evaluation documentation.
  - d. Ceiling assemblies, wall assemblies, and insulation (thermal or acoustic): Submit documentation of compliance with LEED v4 General Emissions Evaluation (VOC emissions testing or approved third-party certification).
  - e. Furniture and furnishings: Submit documentation of compliance with LEED v4 Furniture Evaluation, including the testing model scenario per ANSI/BIFMA Standard Method M7.1-2011 used to demonstrate compliance with ANSI/BIFMA e3-2011 Furniture Sustainability Standard, Sections 7.6.1 and 7.6.2.
  - f. Wet-applied, field installed exterior products listed below: submit the following included with the product submittal to demonstrate compliance with VOC content limits or formaldehyde restrictions:
    - 1) Exterior Applied Adhesives, Sealants, Coatings, Roofing, and Waterproofing: Material Data Safety Sheet (MSDS) or product data sheets highlighting VOC content measured in grams per liter (g/L) less water and exempt solvents.
    - 2) Batt insulation: Material Data Safety Sheet (MSDS), product data sheets, or a written affidavit from the manufacturer stating that the product does not contain added formaldehyde, including urea formaldehyde, phenol formaldehyde, and urea-extended phenol formaldehyde.
5. SS Credit Rainwater Management: For stormwater filtration devices, submit cut sheets or a written affidavit from the manufacturer indicating the percentage of Total Suspended Solids (TSS) filtered and the percentage of Total Phosphorus filtered by the devices.
  6. WE Prerequisite and Credit Indoor Water Use Reduction: For plumbing fixtures, submit cut sheets with water consumption flow rates highlighted.

7. WE Prerequisite and Credit Outdoor Water Use Reduction: Submit cut sheets for components of the landscape irrigation system (if applicable) indicating water saving efficiency.
  8. EQ Credit Construction Indoor Air Quality Management Plan: For submittal requirements, refer to Section 018120 - Construction Indoor Air Quality Requirements.
  9. MR Credit Construction and Demolition Waste Management: For submittal requirements, refer to Section 017419 - Construction and Demolition Waste Management.
  10. SS Prerequisite Construction Activity Pollution Prevention: The Contractor shall implement and document the Project Erosion and Sedimentation Control (ESC) Plan for construction activities associated with the project.
    - a. The documentation shall consist of one (1) or more of the following measures, as determined by the Owner and Architect.
      - 1) The Contractor shall declare the occurrence of periodic inspections throughout the construction process and provide documentation and reporting that the Erosion and Sedimentation Control Plan was executed appropriately. The documentation must include the following:
        - a) Documentation of sample dates.
        - b) Inspection frequency, which shall occur a minimum of once per month.
        - c) Minimum of three (3) inspections equally spaced over the duration of site work.
        - d) Detailed descriptions of corrective actions taken.
      - 2) The Contractor shall provide date-stamped photos which shall document the implemented measures prescribed by the Erosion and Sedimentation Control Plan and document corrective actions taken during construction.
      - 3) The Contractor shall provide a narrative describing the measures taken to implement the Erosion and Sedimentation Control Plan.
- E. LEED Submission Documentation:
1. At or before substantial completion, the Contractor shall prepare supporting documentation for each LEED construction prerequisite and credit to be attempted, which have been assigned to the Contractor by the Owner or Architect.
    - a. Sustainability/LEED Consultant shall prepare and distribute Documentation Matrix to the Contractor. The Documentation Matrix illustrates the deliverables required to adequately record that the project has met the intent of each credit.
    - b. Contractor shall register and log-in to LEED Online (<http://www.leedonline.com>).
    - c. Contractor shall complete LEED Online credit forms and upload associated required backup documentation for all the credits assigned in Documentation Matrix. The LEED Online credit forms shall contain:
      - 1) All proper data fields completed declaring that the project has met the intent of the credit, including narrative(s) when applicable.
      - 2) Electronic signature of Contractor and date signed.
    - d. The contractor shall notify sustainability/LEED Consultant of completion of LEED Online documentation and availability for review.

## 1.8 QUALITY ASSURANCE

- A. This article includes LEED v4 for Prerequisites required for LEED Gold Certification, and high-value credits that significantly affect the level of LEED certification achievable. Refer to LEED v4 BD+C Reference Guide for specific requirements.
  - 1. EA Prerequisite Minimum Energy Performance:
    - a. Exceed the minimum energy efficiency and performance standards by five percent (5%) as established by ASHRAE 90.1-2010.
  - 2. EA Credit Optimize Energy Performance: Demonstrate energy cost savings as documented by Whole Building Energy Simulation
  - 3. EA Prerequisite Fundamental Commissioning and Verification: Verify and ensure that fundamental building system elements are designed, installed, tested and calibrated to operate as intended.
  - 4. EA Prerequisite Fundamental Refrigerant Management: Ensure that no CFCs or HCFCs are used in building HVAC&R equipment.
  - 5. WE Prerequisite Outdoor Water Use Reduction: Demonstrate strategies that in aggregate use thirty percent (30%) less potable water for irrigation than the baseline determined by the site's peak watering month.
- B. WE Prerequisite Indoor Water Use Reduction: Demonstrate strategies that in aggregate use a minimum of twenty percent (20%) less potable and process water than the water use baseline calculated for the building (not including irrigation) by complying with EAct 1992 standard, Fixture Flow Requirements.
- C. EA Prerequisite Building-Level Energy Metering: Provide building systems metering sufficient to allow for the ongoing accountability and optimization of water consumption and building and/or energy system performance over time.
- D. EQ Prerequisite Minimum Indoor Air Quality Performance: Provide HVAC equipment that will comply with the minimum requirements of ASHRAE 62.1-2010, Sections 4-7: Ventilation for Acceptable Indoor Air Quality (with errata).
- E. EA Prerequisite Environmental Tobacco Smoke Control: Prohibit smoking inside the building and outside the building within 25 feet of entries, outdoor air intakes, and operable windows. Place signage within 10ft of building entrances indicating no-smoking policy.
- F. EQ Credit Thermal Comfort: Provide HVAC equipment and building envelope to comply with ASHRAE Standard 55-2010 for thermal comfort standards including humidity control within established ranges.
- G. MR Prerequisite Storage and Collection of Recyclables: Provide easily-accessible dedicated area or areas for the collection and storage of materials for recycling. Materials must include at a minimum paper, corrugated cardboard, glass, plastics, and metals. Provide appropriate measures for safe collection, storage, and disposal of all mercury containing products and either batteries or electronic waste.
- H. MR Credit Building Life-Cycle Impact Reduction: Reduce embodied carbon of materials in structure, envelope, and interior products. Additional requirements for FSC wood, concrete mixes, and carbon limits for products are specified in the associated sections.

- I. MR Credits for Building Product Disclosure and Optimization (BPDO): Install products that meet LEED v4 criteria for manufacturer disclosure and/or optimization criteria, as described in this Section.
- J. EQ Credit Low-Emitting Materials: Reduce the quantity of air contaminants by ensuring that adhesives, sealants, coatings, flooring, composite wood, ceiling, walls, insulation (thermal and acoustic), furniture, and roofing used or installed on the building comply with applicable requirements for VOC content, VOC emissions testing, low-emissions evaluation, and formaldehyde content as described in this Section.

## PART 2 - PRODUCTS

### 2.1 UNAUTHORIZED PRODUCTS

- A. Materials and products required for Work of this Section shall not contain asbestos, polychlorinated biphenyls (PCBs) or other hazardous materials identified by the Owner.
- B. Lamps required for Work of this Section shall not include preheat T-9, T-10 or T-12 fluorescents, mercury vapor high-intensity discharge (HID) lamps, or probe-start metal halide HID lamps for interior spaces. Exit signs may not contain mercury.

### 2.2 MATERIALS GENERAL

- A. Provide products and procedures necessary to obtain LEED credits required in this Section. Although other Sections may specify some requirements that contribute to these LEED credits, the Contractor shall provide additional materials and procedures necessary to obtain LEED credits indicated.
- B. The Building Life-Cycle Impact Reduction credit requires compliance with reductions in embodied carbon and other categories through selection of materials such as wood, concrete, steel, and envelope materials. Criteria has been incorporated in these sections that detail out supplemental cementitious material, steel global warming potential thresholds, and alternatives for insulation products where appropriate to meet the credit requirements.
- C. LEED Performance Criteria: Products and Materials shall meet the following project-wide criteria as well as applicable product-specific criteria in Part 2 of this Section.
  - 1. MR Credit Building Life-Cycle Assessment
    - a. Option 4 (Whole Building Life-Cycle Assessment): Requires a reduction of the impact of the project's structure and enclosure by 10% reduction in at least 3 of the following impact categories:
      - 1) global warming potential (greenhouse gases), in CO<sub>2</sub>e;
      - 2) depletion of the stratospheric ozone layer, in kg CFC-11;
      - 3) acidification of land and water sources, in moles H<sup>+</sup> or kg SO<sub>2</sub>
      - 4) eutrophication, in kg nitrogen or kg phosphate;
      - 5) formation of tropospheric ozone, in kg NO<sub>x</sub> or kg ethene; and
      - 6) depletion of nonrenewable energy resources, in MJ
  - 2. MR Credit Building Product Optimization and Disclosure - EPD

- a. Option 1 (EPD): At least 20 different products from at least five different manufacturers shall have Environmental Product Declarations that comply with LEED requirements. Industry-wide (generic) Environmental Product Declarations shall be valued as one-half of a product.
- b. Option 2 (Multi-Attribute Optimization): Install products that demonstrate impact reductions relative to industry standards per impact categories as described in the LEED v4 BD+C Reference Guide for at least fifty percent (50%), by cost, of the total value of permanently installed building products in the Project.
3. MR Credit BPDO – Sourcing of Raw Materials
  - a. Option 2 (Leadership Extraction Practices): Install products that meet at least one (1) of the LEED v4 responsible extraction criteria described in the LEED v4 Reference Guide, and in aggregate comprise at least 25 percent (25%), by cost, of the total value of permanently installed building products in the Project.
    - 1) Recycled Content-Containing Products: Products containing recycled content in the Divisions indicated in Part 1 of this section shall meet minimum suggested recycled content targets listed in the Appendix of this section.
      - a) Cost of postconsumer recycled content plus one-half of preconsumer recycled content of an item shall be determined by dividing weight of postconsumer recycled content plus one-half of preconsumer recycled content in the item by total weight of the item and multiplying by cost of the item.
      - b) Do not include plumbing, mechanical and electrical components, and specialty items, such as elevators and equipment, in the calculation.
4. Low-Emitting Materials: Install interior products that meet overall Project compliance levels, as listed below and described in the LEED v4 Reference Guide.
  - a. Field-applied interior adhesives, sealants, paints, and architectural coatings:
    - 1) 100 percent compliance for VOC content criteria
    - 2) Minimum 90 percent compliance (by volume) for VOC emissions criteria
  - b. Flooring products: 100 percent compliance
  - c. Composite wood products: 100 percent compliance
  - d. Composite wood products: 100 percent compliance
  - e. Ceiling assemblies, wall assemblies, and insulation (acoustic or thermal insulation): 100 percent compliance.
  - f. Furniture included in Project scope of work: minimum 90 percent compliance, by cost.
5. Certified Wood: Wood-based materials shall be produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001.

### 2.3 LOW-EMITTING MATERIALS

- A. Paints and Coatings: For field applications **that are inside the weatherproofing system**, paints and coatings shall comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:
  1. Flat Paints and Coatings: 50 g/L.
  2. Nonflat Paints and Coatings: 50 g/L.
  3. Dry-Fog Coatings: 150 g/L.
  4. Primers, Sealers, and Undercoaters: 100 g/L.

5. Bond Breakers: 350 g/L
  6. Rust-Preventive Coatings: 100 g/L.
  7. Zinc-Rich Industrial Maintenance Primers: 100 g/L.
  8. Japan/faux finishing coatings: 350 g/L
  9. Magnesite cement coatings: 450 g/L
  10. Mastic coatings: 300 g/L
  11. Metallic pigmented coatings: 500 g/L
  12. Multi-color coatings: 250 g/L
  13. Pigmented lacquer: 550 g/L
  14. Recycled coatings: 250 g/L
  15. Pretreatment Wash Primers: 420 g/L.
  16. Clear Wood Finishes, Varnishes: 275 g/L.
  17. Clear Wood Finishes, Lacquers: 275 g/L.
  18. Clear Wood Finishes, Sanding Sealers: 275 g/L
  19. Clear Wood Finishes, Clear Brushing Lacquer: 275 g/L
  20. Concrete-curing compounds (non-roadway): 100 g/L
  21. Fire-proofing exterior coatings: 350g/L
  22. Graphic arts (signs) coatings: 500 g/L
  23. Industrial Maintenance (IM) coat: 100/g/L
  24. High temperature IM coatings: 420 g/L
  25. Floor Coatings: 100 g/L.
  26. Shellacs, Clear: 730 g/L.
  27. Shellacs, Pigmented: 550 g/L.
  28. Specialty primers: 100 g/L
  29. Stains: 100 g/L.
  30. Swimming pool coatings: 340 g/L
  31. Waterproofing sealers: 100 g/L
  32. Waterproofing concrete/masonry sealers: 100 g/L
  33. Wood preservatives: 350 g/L
  34. Other: 420 g/L
- B. Paints and Coatings: For field applications that are inside the weatherproofing system, 90 percent of paints and coatings shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- C. Adhesives and Sealants: For field applications **that are inside the weatherproofing system**, adhesives and sealants shall comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:
1. Wood Glues: 30 g/L.
  2. Metal-to-Metal Adhesives: 30 g/L.
  3. Adhesives for Porous Materials (Except Wood): 50 g/L.
  4. Subfloor Adhesives: 50 g/L.
  5. Plastic Foam Adhesives: 50 g/L.
  6. Indoor Carpet Adhesives: 50 g/L.
  7. Outdoor Carpet Adhesives: 150 g/L.
  8. Dry Wall and Panel Adhesives: 50 g/L.
  9. Carpet Pad Adhesives: 50 g/L.
  10. VCT and Asphalt Tile Adhesives: 50 g/L.
  11. Cove Base installation: 50 g/L.

12. Gypsum Board and Panel Adhesives: 50 g/L.
  13. Rubber Floor Adhesives: 60 g/L.
  14. Ceramic Tile installation: 65 g/L.
  15. Multipurpose Construction Adhesives: 70 g/L.
  16. Fiberglass Adhesives: 80 g/L.
  17. Contact Adhesives: 80 g/L.
  18. Special Purpose Contact Adhesives: 250 g/L.
  19. Structural Glazing Adhesives: 100 g/L.
  20. Wood Flooring Adhesives: 100 g/L.
  21. Structural Wood Member Adhesives: 140 g/L.
  22. Single-Ply Roof Membrane Adhesives: 250 g/L.
  23. Special-Purpose Contact Adhesives (That Are Used to Bond Melamine-Covered Board, Metal, Unsupported Vinyl, Rubber, or Wood Veneer 1/16 Inch or Less in Thickness to Any Surface): 250 g/L.
  24. Top and Trim Adhesives: 250 g/L.
  25. Plastic Cement Welding Compounds: 250 g/L.
  26. ABS Welding Compounds: 325 g/L.
  27. CPVC Welding Compounds: 490 g/L.
  28. PVC Welding Compounds: 510 g/L.
  29. Adhesive Primer for Plastic: 550 g/L.
  30. Sheet-Applied Rubber Lining Adhesives: 850 g/L.
  31. Aerosol Adhesive, General-Purpose Mist Spray: 65 percent by weight.
  32. Aerosol Adhesive, General-Purpose Web Spray: 55 percent by weight.
  33. Special-Purpose Aerosol Adhesives (All Types): 70 percent by weight.
  34. Other Adhesives: 250 g/L.
  35. Architectural Sealants: 250 g/L.
  36. Non-membrane Roof Sealants: 300 g/L.
  37. Single-Ply Roof Membrane Sealants: 450 g/L.
  38. Other Sealants: 420 g/L.
  39. Sealant Primers for Nonporous Substrates: 250 g/L.
  40. Sealant Primers for Porous Substrates: 775 g/L.
  41. Modified Bituminous Sealant Primers: 500 g/L.
  42. Other Sealant Primers: 750 g/L.
- D. Adhesives and Sealants: For field applications that are inside the weatherproofing system, 90 percent of adhesives and sealants shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- E. Flooring: Flooring shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- F. Composite Wood: Composite wood, agrifiber products, and adhesives shall be made using ultra-low-emitting formaldehyde resins as defined in the California Air Resources Board's "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products" or shall be made with no added formaldehyde.
- G. Ceilings, Walls, and Thermal Insulation: Ceilings, walls, and thermal insulation shall comply with the requirements of the California Department of Public Health's "Standard Method for the

Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

### PART 3 - EXECUTION

#### 3.1 NONSMOKING BUILDING

- A. Smoking is not permitted within the building or within 25 feet of entrances, operable windows, or outdoor-air intakes.

#### 3.2 CONSTRUCTION WASTE MANAGEMENT

- A. Comply with Section 017419 "Construction Waste Management."

#### 3.3 CONSTRUCTION IAQ MANAGEMENT

- A. Comply with SMACNA's "SMACNA IAQ Guideline for Occupied Buildings under Construction."
  - 1. If Owner authorizes use of permanent heating, cooling, and ventilating systems during construction period as specified in Section 015000 "Temporary Facilities and Controls," install MERV 8 filter media at each return-air inlet for the air-handling system used during construction.
  - 2. Replace air filters immediately prior to occupancy.

#### 3.4 IAQ ASSESSMENT

- A. Flush-Out:
  - 1. After construction ends, prior to occupancy and with all interior finishes installed, perform a building flush-out by supplying a total volume of 14,000 cu. ft. of outdoor air per sq. ft. of floor area while maintaining an internal temperature of at least 60 deg F and a relative humidity no higher than 60 percent.
  - 2. If occupancy is desired prior to flush-out completion, the space may be occupied following delivery of a minimum of 3500 cu. ft. of outdoor air per sq. ft. of floor area to the space. Once a space is occupied, it shall be ventilated at a minimum rate of 0.30 cfm per sq. ft. of outside air or the design minimum outside-air rate, whichever is greater. During each day of the flush-out period, ventilation shall begin a minimum of three hours prior to occupancy and continue during occupancy. These conditions shall be maintained until a total of 14,000 cu. ft./sq. ft. of outside air has been delivered to the space.

END OF SECTION 018113.14

APPENDICES

APPENDIX A-018113 – SAMPLE MATERIALS REPORTING FORM (MRF)

APPENDIX B – SAMPLE VOLATILE ORGANIC COMPOUNDS (VOC) REPORTING FORM

APPENDIX C – SAMPLE BUILDING PRODUCT DISCLOSURE AND OPTIMIZATION  
CALCULATOR

APPENDIX D – SAMPLE LOW-EMITTING MATERIALS CALCULATOR

APPENDIX E – LEED SCORECARD (TO BE INCLUDED AT 100% CDs)

## SECTION 018119 – CONSTRUCTION INDOOR AIR QUALITY REQUIREMENTS

### 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.
- B. Sustainable Design Requirements – Section 018113.14
- C. All technical Sections of the Specifications related to interior construction and finish materials, MEPFP systems, and items affecting indoor air quality.

#### 1.2 DESCRIPTION OF WORK

- A. This Section includes requirements for the development of a Construction Indoor Air Quality Management Plan (herein referred to as the Plan). The Plan shall be developed by the Contractor and approved by the Owner and Architect. The plan shall be implemented throughout the duration of the Project construction under the direction of the Contractor's IAQ Representative and shall be documented per the Submittal Requirements in Part 1 of this Section. The Plan is part of the Project LEED Requirement.

#### 1.3 CONSTRUCTION IAQ MANAGEMENT GOALS FOR THE PROJECT

- A. The Owner has established that this Project shall minimize the detrimental impacts on Indoor Air Quality (IAQ) resulting from construction activities. Factors that contaminate indoor air, such as dust entering HVAC systems and ductwork, improper storage of materials on-site, and poor housekeeping, shall be minimized.

#### 1.4 SUSTAINABLE DESIGN REQUIREMENTS

- A. The Owner requires the Contractor to implement practices and procedures to meet the project's environmental performance goals, which include ~~achieving~~ **aiming for** LEEDv4 Gold Certification. Specific project goals that may impact this area of work include: use of recycled-content materials; use of locally-manufactured materials; use of low-emitting materials; construction waste recycling; and the implementation of construction indoor air quality management plan. The Contractor shall ensure that the requirements related to these goals, as defined in the Articles below, are implemented to the fullest extent. Substitutions, or other changes to the work proposed by the Contractor or their Subcontractors, shall not be allowed if such changes comprise the aforementioned environmental goals and LEED certification.

## 1.5 DEFINITIONS

- A. Volatile Organic Compounds (VOC's): Carbon compounds that participate in atmosphere photochemical reactions (excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides and carbonates, and ammonium carbonate). The compounds vaporize (become a gas) at normal room temperatures. These compounds are common in and emitted by many building products, including solvents in paints, coatings, adhesives and sealants, wood preservatives; composite wood binder and foam insulations. Not all VOC's are harmful, but many of those contained within building products contribute to the formation of smog and may irritate the building occupants or construction workers by their smell and/or health impact.
1. Materials that act as "sinks" for VOC contamination: adsorptive materials, typically dry and soft (such as textiles, carpeting, acoustical ceiling tiles and gypsum board) that readily absorb VOC's emitted by "source" materials and release them over a prolonged period of time.
  2. Materials that act as "sources" for VOC contamination: products with high VOC contents that emit VOC's either rapidly during application and curing ( typically "wet" products, such as paints, sealants, adhesives, caulks and sealers) or over a prolonged period (typically "dry" products such flooring coverings with plasticizers and engineering wood with formaldehyde).
- B. Minimum Efficiency Reporting Value (MERV): Filter rating established by ASHRAE and determined according to ASHRAE Standard 52.2-2007. MERV categories range from 1 (very low efficiency) to 16 (very high efficiency),

## 1.6 REFERENCE STANDARDS

- A. ANSI/SMACNA 008-2008, "IAQ Guidelines for Occupied Buildings Under Construction", Second Edition 2007, Chapter 3, The Sheet Metal and Air Conditioner National Contractors Association (SMACNA), [www.smacna.org](http://www.smacna.org).
- B. ANSI/ASHRAE 52.2-2007, "Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size", [www.ashrae.org](http://www.ashrae.org).
- C. EPA PB90200288 – Compendium of Methods for the Determination of Air Pollutants in Indoor Air, U.S. Environmental Protection Agency (EPA), 1990, available from National Technical Information Service, [www.ntis.gov](http://www.ntis.gov)

## 1.7 CONSTRUCTION IAQ MANAGEMENT PLAN (DURING CONSTRUCTION) – OVERVIEW

- A. The Contractor shall implement indoor air quality management during construction per the requirements of IEQ LEED Credits 'Construction IAQ Management Plan' and 'IAQ Assessment – **Option 1**'.

- B. The Contractor shall prepare and submit a Construction IAQ Management Plan for the construction and pre-occupancy phases of the Project to the Owner and Architect. The Construction IAQ Management Plan shall meet the following criteria:
1. Construction activities shall be planned to meet or exceed the minimum requirements included in the SMACNA “IAQ Guidelines for Occupied Buildings Under Construction”, as listed in Part 1 of this Section.
  2. Absorptive or porous materials shall be protected from moisture damage when stored onsite and after installation. Contractor shall not install water damaged materials in the building.
  3. Filtration media shall be installed to protect ductwork and/or HVAC equipment used during the construction process, per the requirements of Part 2 of this Section.
  4. The use of tobacco products shall be prohibited inside the building and within 25 feet of the building entrance during construction.
  5. Only low-emitting and low- or no-VOC products shall be installed in the field on the interior of the Project, per the requirements of Division 01 Section 018113 - Sustainable Design Requirements. Examples of such products include, but are not limited to, adhesives, sealants, paints, coatings, and carpet.
  6. A Sequence of Finish Installation Plan shall be developed, highlighting measures to reduce the absorption of VOCs by materials that act as “sinks”.
  7. Upon approval of the Plan by the Owner and Architect, it shall be implemented by the Contractor and Subcontractors throughout the duration of the construction process and documented in accordance with the LEED Submittal Requirements of this Section.
  8. All occupiable and habitable spaces within the Project shall be subject to ~~either~~ an air flush-out ~~or air testing~~ after construction and immediately prior to occupancy, as directed by the Owner and described in Part 1 of this Section.

1.8 CONSTRUCTION IAQ MANAGEMENT PLAN (DURING CONSTRUCTION) – DETAILED REQUIREMENTS

- A. The SMACNA “IAQ Guidelines for Occupied Buildings Under Construction” (Chapter 3) outline IAQ measures in five categories as listed below. The Construction IAQ Management Plan shall be organized in accordance with the SMACNA format and shall address measures to be implemented by the Contractor and/or Subcontractors in each of the five SMACNA categories (including subsections). All subsections shall be listed in the Plan; items that are not applicable for this project should be listed as such.
1. HVAC Protection:
    - a. Return Side
    - b. Central Filtration
    - c. Supply Side
    - d. Duct Cleaning
  2. Source Control
    - a. Product Substitution
    - b. Modifying Equipment Operation
    - c. Changing Work Practices
    - d. Local Exhaust
    - e. Air Cleaning
    - f. Cover or Seal
  3. Pathway Interruption
    - a. Depressurize Work Area

- b. Pressurize Occupied Space
- c. Erect Barriers to Contain Construction Areas
- d. Relocate Pollutant Sources
- e. Temporarily Seal the Building
- 4. Housekeeping
  - a. Suppressing dust
  - b. Cleaning and excess applications of products containing solvents
  - c. Addressing spills, water conditions, and accumulated water
  - d. Vacuuming
  - e. Protecting porous materials and other building systems from exposure to moisture and contamination
- 5. Scheduling
  - a. Sequencing installation of materials
    - 1) Installation during unoccupied periods
- 6. Avoid building occupancy while construction-related pollutants are still present
- B. Protection of Materials from Moisture Damage: Under the Housekeeping section of the Plan, describe measures to prevent installed materials or material stored on-site from moisture. This section should also describe measures to be taken if moisture damage does occur to absorptive materials during the course of construction.
  - 1. Store materials on elevated platforms or pallets under cover and in a dry location.
  - 2. If materials are not stored in an enclosed location, cover tops and sides of materials with waterproof sheeting, securely tied.
  - 3. Phase construction such that absorptive materials are installed only in areas that are weather-tight.
- C. Protection of Ductwork: Under the HVAC Protection section of the Plan, describe measures to protect air handling and distribution equipment and air supply and return ducting during construction.
  - 1. All ductwork arriving on site shall have the ends and openings sealed with plastic sheeting and stored on pallets or dunnage until installed. Plastic seals shall remain in place during ductwork installation and shall be repaired or replaced as necessary to maintain continuous protection throughout the duration of construction.
  - 2. The Contractor shall cover and protect all exposed air inlets and outlets, openings, grilles, ducts, plenums, etc. to prevent water, moisture, dust and other contaminant intrusion.
  - 3. All ductwork shall be stored on site above the ground or floor slabs.
  - 4. Ducting runs shall be protected at the end of each day's work.
  - 5. The Contractor shall apply protection immediately after ducting.
  - 6. The Contractor's designated IAQ Representative shall inspect work and monitor subcontractor(s) to ensure compliance.
- D. Temporary Filtration: The Contractor shall inspect temporary filtration weekly and replace as required to maintain the proper ventilation rates in the building.
  - 1. Filtration Media shall meet the requirements as listed in Part 2 of this Section.
- E. Replacement of Filtration Media: Under the HVAC Protection section of the Plan, provide a description of the filtration media in all ventilation equipment used during construction. The description shall include replacement criteria for filtration media during construction and confirmation of filtration media replacement for all equipment immediately prior to occupancy.
  - 1.

Filtration media shall meet the requirements of Part 2 of this Section. As part of required LEED Submittals outlined in Part 1 of this Section, at the end of construction the Contractor shall provide a confirmation that all filtration media were replaced prior to occupancy.

F. Sequence of Finish Installation for Materials

1. Absorptive materials should be installed after the installation of materials or finishes which have high short-term emissions of VOC's, formaldehyde, particulates, or other air-borne compounds.
  - a. Absorptive materials ("sinks") include, but are not limited to: carpets; acoustical ceiling panels; fabric wall coverings; insulations (exposed to the air stream); upholstered furnishings; and other woven, fibrous or porous materials.
  - b. Materials with high short-term emissions ("sources") include, but are not limited to: adhesives, sealants and glazing compounds (specifically those with petrochemical vehicles or carriers); paints, wood preservatives and finishes; control and/or expansion joint fillers; hard finishes requiring adhesive installation; finish processes and products associated with gypsum board installation; and composite or engineered wood products with formaldehyde binders.
2. The Contractor shall develop a Sequence of Finish Installation Plan and schedule that identifies how the sequencing of finish material installation will occur for the project. The schedule shall be submitted to the Owner and Architect in accordance with the Submittal Requirements of this Section.

- G. Ventilation during installation of materials and finishes: **[100%]** outside air shall be provided during the installation of materials and finishes, beginning after the building is substantially enclosed. If permanent building HVAC systems are used to supply the ventilation air, filtration media shall be installed per the requirements of Part 2 of this Section.

1.9 CONSTRUCTION IAQ MANAGEMENT PLAN (BEFORE OCCUPANCY)

- A. As directed by the Owner, the Contractor shall implement the following prior to occupancy per the requirements of IEQ LEED Credit 'IAQ Assessment – **Option 1**'. After construction ends and prior to occupancy the Contractor shall assist in coordinating and implementing ~~one of the following two alternative compliance options.~~
1. OPTION 1 - Flush-Out: Prior to occupancy and with all interior finishes and new filtration media installed, perform a building flush-out by supplying a total air volume of 14,000 cu. ft. of outdoor air per sq. ft. of floor area while maintaining an internal temperature of at least 60 degrees F and relative humidity no higher than 60 percent. Alternatively, if occupancy is desired prior to completion of the flush-out, the space may be occupied following delivery of a minimum of 3,500 cu. ft. of outdoor air per sq. ft. of floor area to the space. Once a space is occupied, it shall continue to be ventilated at a minimum rate of 0.30 cfm/sq. ft. of outside air or the design minimum outside air rate determined in the MEP design, whichever is greater. During each day of an occupied flush-out period, ventilation shall begin a minimum of three hours prior to occupancy and continue during occupancy. These conditions shall be maintained until a total 14,000 cu. ft./sq. ft. of outside air has been delivered to the space.

- ~~2. OPTION 2 – Air Quality Testing: Conduct base line IAQ testing, after construction ends and prior to occupancy, using testing protocols consistent with the U.S. Environmental Protection Agency (EPA) "Compendium of Methods for the Determination of Air Pollutants in Indoor Air" and as additionally detailed in the Green Interior Design and Construction Rating System or Green Building Design and Construction Rating System Reference Guide. Concentrations of contaminants shall be tested and shall not exceed maximum levels specified in the Reference Guide. The following minimum guidelines shall be followed:~~
- ~~a. Areas where ventilation is most limited shall be tested by an independent IAQ testing agency as outlined in this Section.~~
  - ~~b. Testing agent shall take a minimum of one (1) sample per 25,000 square feet of area in each portion of the building served by separate ventilation systems.~~
  - ~~c. Samples shall be collected from the breathing zone (3' 0" to 6' 0") above the finished floor.~~
  - ~~d. Samples shall be collected during normal occupied hours with the HVAC system operating at normal daily start times and at the minimum outside airflow rate.~~
  - ~~e. Follow up samples shall be collected and tested where required by the Owner or to demonstrate compliance with standards or rating system.~~

#### 1.10 LEED SUBMITTAL REQUIREMENTS

- A. The Contractor shall submit the following required records and documents:
1. Prior to start of construction, submit the following:
    - a. A construction schedule outlining the start-up date and expected duration of all Construction IAQ Management Plan control measures.
    - b. A copy of the Construction IAQ Management Plan and the Sequence Installation Plan for approval by the Owner and Architect, as defined in Part 1 of this Section.
  2. Product cut-sheets for all filtration media used during construction and installed immediately prior to occupancy, with MERV values highlighted and meeting the criteria for filtration media in Part 2 of this Section. Cut sheets shall be submitted with the Contractor's 'approved' stamp as confirmation that the products submitted are the same products installed on the project.
  3. Construction IAQ Management Summary Reports.
  4. At end of construction, submit the following:
    - a. Photographs that document the implementation of the Construction IAQ Management Plan throughout the course of the project construction. Submit a minimum of (18) photographs, (6) photographs taken on at least (3) different occasions during construction, each labeled with the SMACNA control measure illustrated. Examples include photographs of ductwork sealing and protection, temporary ventilation measures, and conditions of on-site materials storage to prevent moisture damage. Photographs shall include integral date stamping and shall be submitted with brief descriptions or be referenced to project meeting minutes or similar project documents.
    - b. Required documentation for IEQ LEED credits 'Construction IAQ Management Plan' and 'IAQ Assessment – **Option 1**', including completed credit forms and supporting documentation.

## 1.11 QUALITY ASSURANCE

- A. Contractor IAQ Representative: IAQ Engineer with five (5) years experience performing IAQ supervision on projects of comparable size and scope.
- ~~B. IAQ Testing Agency: Independent testing and inspecting agency, subject to approval by the Owner and with minimum of five (5) years experience in performing the types of testing specified herein and to meet requirements of LEED IEQ credit 3.2, Option 2, on projects of comparable size and scope.~~

## PART 2 – PRODUCTS

### 2.1 FILTRATION MEDIA

- A. Construction filters: If permanently installed air handlers are used during construction, filtration media must be installed at each return grill and air handling unit, having a Minimum Efficiency Reporting Value (MERV) of at least 8 as determined by ASHRAE Standard 52.2-2007. All construction filtration media shall be replaced immediately prior to occupancy.
- B. Flush-out filters: If the Flush-out option will be pursued for IEQ LEED ‘IAQ Assessment’, as described in Part 1 of this Section, new filtration media shall be installed at air handling units having a Minimum Efficiency Reporting Value (MERV) of 13 as determined by ASHRAE Standard 52.22007.
- C. Final filters: Replace all filtration media immediately prior to occupancy. For all ventilation systems that supply outside air, install filters having a Minimum Efficiency Reporting Value (MERV) of 13 or better as determined by ASHRAE Standard 52.2-2007.

### 2.2 BUILDING MATERIALS

- A. Low-emitting products specified in technical Sections of the Project Manual. VOC content shall comply with requirements specified in Division 01 Section 018113 - Sustainable Design Requirements.
- B. Dust Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches, commencing with installation of finishes inside the Project.

### 2.3 CLEANING SUPPLIES

- A. Use low toxicity cleaning supplies for surfaces, equipment and workers personal use, during periodic and final cleaning. Comply with requirements for closeout and final cleaning specified in Division 01.

### PART 3 - EXECUTION

#### 3.1 IMPLEMENTATION AND COORDINATION

- A. The Contractor shall be responsible for implementation of the Construction IAQ Management Plan and for the coordination of the Plan with all affected trades per the requirements of Part 1 of this Section.
  - 1. The Contractor shall designate one individual as the Construction IAQ Representative, who will be responsible for communicating the progress of the Plan with the Owner and Architect on a regular basis and for assembling the required LEED documentation.
  - 2. The Contractor shall include provisions in the Construction IAQ Management Plan for addressing conditions in the field that do not adhere to the Plan, including provisions to implement a stop work order or to rectify non-compliant conditions.
- B. The Contractor shall include procedures related to IAQ Management on the agenda during pre-construction meetings and during regularly scheduled meetings on the jobsite. Minutes shall be recorded at all such meetings.
- C. Trade subcontractors shall be responsible for the implementation of specific control measures, as specified in the Construction IAQ Management Plan. Subcontractors shall coordinate their responsibilities through the Contractor and their designated Construction IAQ Representative.

END OF SECTION 018119

SECTION 018900  
SITE CONSTRUCTION PERFORMANCE REQUIREMENTS

## PART 1 – GENERAL

## 1.01 DESCRIPTION

- A. This Section specifies the general requirements for the site work included in the Contract.
- B. These requirements supplement those contained in the Standard General Conditions of the Construction Contract and their Supplemental Conditions.
- C. References are included in this Section to Articles of the General Conditions to call the Contractor's attention to frequently needed requirements.

## 1.02 PERMITS

- A. Unless otherwise provided in the Supplementary Conditions, the Contractor shall obtain and pay for all construction permits and licenses. The Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. The Contractor shall pay all charges and inspection fees necessary for the prosecution of the Work and shall pay all charges of utility owners for connections to the Work.

## 1.03 LAWS AND REGULATIONS

- A. Contractor shall give all notices and comply with all laws and regulations applicable to furnishing and performance of the Work.
- B. If the Contractor performs any work that is contrary to laws or regulations, the Contractor shall bear all claims, costs, losses and damages caused by, arising out of or resulting therefrom.

## 1.04 UTILITIES

- A. Shown or Indicated: The information and data shown or indicated in the Contract Documents with respect to existing underground facilities (utilities) at or contiguous to the site is based on information and data furnished to Owner or Engineer by the owners of such underground facilities (utilities) or by others.
  - 1. The Owner and Engineer shall not be responsible for the accuracy or completeness of any such information or data; and
  - 2. The cost of all of the following will be included in the Contract and Contractor shall have full responsibility for: (i) reviewing and checking all such information and data; (ii) locating all underground facilities (utilities) shown or indicated in the Contract Documents; (iii) coordination of the Work with the owners of such underground facilities (utilities) during construction; and (iv) the safety and protection of all such underground facilities (utilities) and repairing any damage thereto resulting from the Work.
- B. Not Shown or Indicated: If an underground facility (utility) is uncovered or revealed at or contiguous to the site which was not shown or indicated in the Contract Documents, the Contractor shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency), identify the owner of such underground facility (utility) and give written notice to that facility (utility) owner and to Owner and Engineer. Engineer will promptly review the underground

facility (utility) and determine the extent, if any, to which a change is required in the Contract Documents to reflect and document the consequences of the existence of the underground facility (utility). If the Engineer concludes that a change in the Contract Documents is required, revised plans and specifications will be issued to reflect and document such consequences. During such time, the Contractor shall be responsible for the safety and protection of such underground facility (utility).

- C. Contractor shall notify all municipal agencies and public and private utility companies owning or operating utilities, of proposed work affecting the utilities, or agencies.
- D. Contractor shall give written notification within the time period required by the agency or company for advance notification. A copy of the notification shall be furnished to the Engineer.
- E. Contractor shall notify "DIG SAFE" before commencing any work in the vicinity of existing subsurface utilities.
- F. Contractor shall secure in-place existing utilities whose support is affected by the work and cooperate and assist the agency or company operating the utility in maintaining the utility services. Contractor shall correct any damage to the utilities caused by construction operations by repair or replacement, as required by the utility owner. When the repair or replacement is made by the utility owner, Contractor shall pay all costs assessed by the utility owner for the work.
- G. If the existing utilities are found to conflict with the proposed work, the Contractor shall protect and maintain the utilities and take measurements to determine the location, type and dimensions of the utility. The information shall be furnished to the Engineer who will determine the changes required in the proposed work or existing utilities to resolve the conflict as soon thereafter as is reasonable.
- H. Contractor shall verify the location, size, invert elevation and type of existing facilities at all points of connection prior to ordering new utility materials.

#### 1.05 SOILS INFORMATION

- A. A geotechnical report on site soil conditions has been prepared for the Owner. Refer to Section 310000 – EARTHWORK for information about and use of the geotechnical report.
- B. The geotechnical report and the soils data are furnished to Contractor for informational purposes only and are specifically not a part of these Contract Documents. The Owner does not guarantee that the information is representative of all soils, rock, and other materials that may be encountered on the site.
- C. Contractor may make additional subsurface explorations upon written request to, and upon approval by, the Owner at no additional cost to the Owner.

#### 1.06 SOIL SUPPORT

- A. Contractor shall furnish and install excavation soil support devices or use soil strengthening techniques required to perform excavations in accordance with the current requirements of the U.S. Department of Labor, Occupational Health & Safety Administration and all federal, state, and municipal laws and regulations.

## 1.07 REFERENCE STANDARDS

- A. References are made to technical societies, organizations and groups using the following abbreviations. All work so referred shall conform to the current edition of the referenced standard.

306R	Cold Weather Concreting
AASHTO	American Association of State Highway Transportation Officials
ACI	American Concrete Institute
ACOE	United States Army Corps of Engineers
AGC	Associated General Contractors of America
ANSI	American National Standards Institute
AOAC	Association of Official Agricultural Chemists
ASTM	American Society for Testing and Materials
AWPA	American Wood Preservers Association
AWWA	American Water Works Association
NEMA	National Electrical Manufacturers Association
NEWWA	New England Water Works Association
OSHA	Occupational Safety and Health Administration
UL	Underwriters Laboratory

## 1.08 TRAFFIC MAINTENANCE

- A. Contractor shall maintain access to the site and through the work zones for personnel and vehicles of emergency services, utility agencies, inspection services, and others authorized to enter, move about and work on the site.
- B. When work is required on public roadways, Contractor shall furnish, install, maintain, and remove all signs, drums, barricades, steel plates, and other devices required by the federal or state government or municipality to maintain and protect pedestrians and vehicular traffic.
- C. Protective measures shall be installed at site access points to prevent mud and other debris from being deposited on the public roadways by construction traffic. The public roadways shall be swept as required to remove any deposits.

## 1.09 STATE AND LOCAL REFERENCE STANDARDS

- |    |               |   |
|----|---------------|---|
| A. | Building Code | New York State Building Code                            |
|    | Fire Code     | New York State Fire Code                                |
|    | NYSDEC        | New York State Department of Environmental Conservation |
|    | NYSDOT        | NYSDOT Design Standards                                 |

END OF SECTION 018900

## SECTION 024113

## SELECTIVE SITE DEMOLITION AND REMOVALS

## 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. Provide all equipment and do all work necessary to demolish and/or remove the structures indicated and 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 010000, GENERAL REQUIREMENTS; Temporary Tree and Plant Protection.
2. Section ~~311200, SITE CLEARING~~; Clearing and grubbing, stripping and stockpiling topsoil and tree removal.
3. Section ~~312000, EARTHWORK~~; Excavation and backfill.
4. Section ~~329600, TRANSPLANTING~~.

## 1.03 SUBMITTALS

- A. The following shall be submitted:

1. Permits and notices authorizing building demolition.
2. Certificates of severance of utility services.
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.
5. Location plan of staging areas and schedule for moving staging equipment into those areas shall be submitted for Architect's approval prior to mobilization and related site preparation operations.
6. A list of all site operations and programs to be accommodated during construction period.

- B. Predemolition photographs: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by building demolition operations. Submit before the Work begins.

## 1.04 QUALITY ASSURANCE

- A. Predemolition Conference: Conduct conference at Project site to comply with requirements in Section 010000, GENERAL REQUIREMENTS. Review methods and procedures related to selective demolition including, but not limited to, the following:

311100, CLEARING  
AND GRUBBING

310000

329643, TREE  
TRANSPLANTING

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

#### 1.05 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.

#### 1.06 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. Before Construction Documents are issued to the Contractor for construction, the Owner will certify to the Architect and Contractor that the site is free of asbestos. 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.

#### 1.07 MAINTAINING TRAFFIC

- A. Do not close or obstruct roadways without permits.
- B. Conduct operations with minimum interference to public or private roadways.

#### 1.08 MATERIALS OWNERSHIP

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

- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other 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.

#### 1.09 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective 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 a location on site to be determined by the Owner.
- B. Mechanical and electrical items to be salvaged shall be protected from the weather.
- C. Storage requirements during construction.- storage site/location to be determined and reviewed by Architect and Owner.

### PART 3 EXECUTION

#### 3.01 DEMOLITION

- A. Structures indicated to be removed shall be completely removed including foundations, except when approved by the Architect, to a minimum of 4 ft. below finished grade for graded areas.
- 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 in Section ~~312000~~, EARTHWORK. 310000
- E. Rough grade areas affected by demolition and leave areas level, maintaining grades and contours of site.
- 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. Contractor shall arrange with appropriate utility company for disconnecting and sealing indicated utilities that serve existing structures before site clearing, when requested by Contractor.
  1. Verify that utilities have been disconnected and capped before proceeding with site clearing.
- B. 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.
- C. Other utility pipes shall be cut and capped outside the excavation and abandoned piping removed from the site.
- D. Frames, grates, covers, traps, and other castings shall be salvaged.

### 3.03 REMOVALS

- A. Materials indicated on the Drawings or designated by the Architect in the field to be removed shall be dismantled, removed, and legally disposed of off-site or stockpiled as indicated on the Drawings.
- B. Areas formerly occupied by structures shall be regraded to conform with surrounding topography following demolition.

### 3.04 SALVAGEABLE MATERIALS

- A. Materials indicated on the Drawings or designated by the Architect in the field to be salvaged shall be carefully removed, protected from damage, and put in temporary storage as follows:
  1. Salvaged material shall be stockpiled on-site in an area designated by the Owner.

### 3.05 DEMOLITION

- A. Existing structures indicated on the Drawings to be removed, shall be completely dismantled and removed from the site.
  1. Structures not indicated on the Drawings for removal but conflict with proposed site improvements shall be reviewed with Architect prior to start of any removal operations.

- B. Areas formerly occupied by structures shall be regraded to conform with surrounding topography following demolition.
- C. 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.
- D. Remove from site, contaminated, vermin infested, or dangerous materials encountered and disposed of by safe means.
- E. Backfill areas excavated as a result of demolition. Use backfill material specified in Section ~~312000~~, ~~EARTHWORK~~. 310000
- F. Rough grade areas affected by demolition and leave areas level, maintaining grades and contours of site.
- G. 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.

### 3.06 PROTECTION OF EXISTING STRUCTURES AND UTILITIES

- A. Existing memorials, fences, stone walls, catch basins, structures and utilities shall be suitably protected from damage.

### 3.07 PAVEMENT AND CURB 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.
  - 1. Pavement and/or curb removal shall include removal of subbase as required to accommodate proposed construction materials.

### 3.08 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. 310000

### 3.09 PROTECTION OF PROPERTY TO REMAIN

- A. The Contractor's attention is directed to Section ~~312000~~, EARTHWORK for protection of

utilities to remain, and for the protection of existing trees, fences, etc.

3.10 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.
- B. Debris, rubbish, and other material shall be disposed of promptly and shall not be left until final cleanup of site.

END OF SECTION

SECTION 024116

BUILDING DEMOLITION

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

- A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

- A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the building demolition as shown on the drawings and/or specified herein including, but not limited to, the following:
  - 1. Selective demolition of structures, and components designated to be removed.
  - 2. Protection of portions of building adjacent to or affected by selective demolition.
  - 3. Removal of abandoned utilities and wiring systems.
  - 4. Notification to Owner of schedule of shut-off of utilities which serve occupied spaces.
  - 5. Pollution control during selective demolition, including noise control.
  - 6. Removal and legal disposal of materials.

1.3 RELATED SECTIONS

- A. Clearing and Grubbing - Section 311100.
- B. Site Excavating, Backfilling and Compacting - Section 312300.

1.4 QUALITY ASSURANCE

- A. The Contractor shall comply with the requirements of all applicable Federal, State, and local safety and health regulations regarding the demolition of structures, including ANSI/NFPD 241 - Building Construction and Demolition Operations.
- B. The Contractor shall be responsible for any damage to any adjacent buildings to remain.

1.5 SUBMITTALS

- A. Prior to beginning work, prepare a careful study of the building to be demolished and map out a definite plan of procedure before demolition is begun, for review of the Architect.

1.6 SPECIAL PRECAUTION

- A. Lead Paint and Asbestos Dangers in Demolition: Take adequate precautions (including bagging of asbestos for disposal and protective equipment, such as properly functioning respirators) against injury of Contractor's personnel or public from the following:
  - 1. Any material which is likely to contain crocidolite (blue asbestos).

2. Inhaling large amounts of lead fumes by welding operations (burning through) at the steel beams coated with accumulation of lead-containing paint.

#### 1.7 JOB CONDITIONS

- A. Buildings and other structures to be demolished will be vacated and discontinued in use prior to the start of the work.
- B. Condition of Structures
  1. The Owner assumes no responsibility for the actual condition of structures to be demolished.
  2. Conditions existing at the time of inspection for bidding purposes will be maintained by the Owner insofar as practicable.
- C. Partial Removal
  1. Items of salvageable value to the Contractor may be removed from the structure as the work progresses. Salvaged items must be transported from the site as they are removed.
  2. Storage or sale of removed items on the site will not be permitted.
- D. Explosives: The use of explosives will not be permitted.
- E. Traffic
  1. Conduct demolition operations and the removal of debris to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities.
  2. Do not close or obstruct streets, walks or other occupied or used facilities without permission from authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.
- F. Protection
  1. Ensure the safe passage of persons around the area of demolition.
  2. Erect temporary covered passageways as required by authorities having jurisdiction.
  3. Provide interior and exterior shoring, bracing, or supporting to prevent movement or settlement or collapse of structures to be demolished and adjacent facilities to remain. The Contractor shall engage a Professional Engineer licensed to advise on bracing, shoring, underpinning, or other structural requirements. The Contractor shall bear all responsibility for prevention of movement or other structural fault.
  4. Promptly repair damages caused to adjacent facilities by demolition operations at no cost to the Owner.
- G. Utilities
  1. Maintain any existing utilities required to remain; keep in service and protect against damage during demolition operations.
  2. Do not interrupt existing utilities serving occupied or used facilities, except when authorized in writing by authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to the governing authorities.

3. The Contractor shall arrange to shut off utilities serving the structure. Disconnect and seal the abandoned utilities before starting demolition operations. Coordinate all work with local utility companies having jurisdiction.
- H. Rodent Control: Employ a certified exterminator and treat the entire building in accordance with governing health regulations.

## PART 2 PRODUCTS

(Not Applicable)

## PART 3 EXECUTION

### 3.1 DEMOLITION

#### A. Pollution Controls

1. Use water sprinkling, temporary enclosures, and other suitable methods to limit the amount of dust and dirt rising and scattering in the air to the lowest practical level. Comply with governing regulations pertaining to environmental protection.
  - a. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.
2. Clean adjacent structures and improvements of dust, dirt, and debris caused by demolition operations. Return adjacent areas to condition existing prior to the start of the work.
3. Provide drainage for temporary water use.

#### B. Building Demolition

1. Demolish building completely and remove from the site. Use such methods as required to complete the work within the limitation of governing regulations.
2. Proceed with demolition in a systematic manner, from the top of the structure to the ground. Complete demolition work above each floor or tier before disturbing supporting members on lower levels.
3. Demolish concrete and masonry in small sections.
4. Remove structural framing members and lower to ground by means of hoists, derricks, or other suitable methods.
5. Break up and remove concrete slabs on grade at street level.
6. Locate demolition equipment throughout the structure and remove materials so as to not impose excessive loads to supporting walls, floors, or framing.

#### C. Rubble Backfill

1. Buildings shall be demolished down to underside of existing street level grade slabs, which shall be broken up and removed. Cellar slabs on below grade earth shall be broken up and displaced so as not to create a reservoir.
2. The Contractor shall remove debris and equipment of every kind except masonry and concrete from the cellars or basements of the buildings. Concrete cellar floors on earth or fill shall be broken up to permit drainage, but need not be removed.

3. The Contractor shall fill areaways basements, and cellars to a level no lower than six (6) inches below sidewalk grade with clean acceptable masonry and concrete rubble.
  4. Only masonry or concrete materials will be permitted to remain on the site for fill.
  5. When quantity of acceptable rubble is insufficient to fill such openings, the Contractor shall install additional acceptable material for this purpose.
- D. Relics and antiques (i.e. cornerstones, plaques, tablets, etc.) and similar objects remain the property of the Owner. Notify Architect prior to removal and obtain acceptance regarding removal method.
- E. Pump out buried tanks located outside building proper. Remove tanks and service piping where tanks interfere with new construction. Fill tanks with sand or fine gravel and cover with fill where tanks may be left in place.

### 3.2 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Remove from the site debris, rubbish, and other materials resulting from demolition operations that are not acceptable as fill material. Burning of removed materials from demolished structures will not be permitted on the site.
- B. Removal: Transport materials removed from demolished structures and legally dispose of off site. Leave the site in an orderly condition to the approval of the Architect.

END OF SECTION

SECTION 034501

ARCHITECTURAL PRECAST CONCRETE - SITEWORK

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

- A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

- A. The Work of this Section includes all labor, materials, equipment and services necessary to complete the architectural precast concrete for sitework as shown on the drawings and/or specified herein, including but not necessarily limited to the following:

1. Architectural precast concrete curbs, ~~steps, seat walls, veneer~~ and wall caps, with surfaces that are smooth with appearance and surface texture of limestone, ~~including cast-in metal skate stop at top of seat wall.~~
2. Structural design, fabrication, and erection of architectural precast units.
3. Connection and anchorage devices.

General note: turn off all track changes

1.3 RELATED SECTIONS

- ~~A. Ornamental Metals - Section 057000, for decorative railings.~~

- B.A.** Joint Sealers - Section 072000.

1.4 QUALITY ASSURANCE

- A. Provide precast concrete work conforming to ACI 318, Chapter 16, and PCI MNL-122. Plant quality control program shall comply with PCI MNL-117.
- B. Inspection: Permit the Architect or his authorized representative to conduct unlimited inspections at the precast plant and the site. The Architect or his authorized representative reserves the right to inspect precast units at the plant before shipping, upon delivery to the site, and during and after erection. Precast units may be rejected at any time, even if previously inspected and approved.
- C. Engineering and Design: Provide the services of a Professional Engineer, registered in the State of New York, to design, engineer, and certify that the work of this section meets or exceeds the requirements specified in this section. The engineer shall assume professional responsibility for precast and connection design and safety. Design decisions and modifications which affect visual characteristics shall be subject to the approval of the Architect.

1.5 SUBMITTALS

- A. Product Data: Submit manufacturer's product data, installation instructions, use limitations and recommendations for each material used. Provide certifications stating that materials comply with requirements.
- B. Shop Drawings: Provide large scale shop drawings for fabrication and erection of all parts of the work. Provide plans, elevations, and details of anchorages, connections, lifting

devices, and accessory items. Provide installation templates for work installed by others and embedded in other construction. Provide information on erection sequence with plans coded to numbered precast units.

- C. Calculations: Provide professionally prepared calculations and certification of the performance of this work. Show how design load requirements and other performance criteria have been satisfied.
- D. Initial Selection Samples: Submit individual cube samples showing complete range of colors, textures, and finishes available for each precast color and texture required for the Project.
- E. Verification Samples: After approval of cube samples, submit minimum 12 in. x 12 in. samples of each finish that is to be exposed in the finished work, showing full range of color and finish variations expected.
- F. Certified copies of test reports including all test data and all test results. Tests for compressive strength of concrete shall be performed by an approved independent commercial testing laboratory, except that compressive strength tests for initial prestress may be performed in the manufacturer's plant laboratory.
- G. The Contractor shall submit the mix design formula giving the maximum nominal coarse aggregate size, the proportions of all ingredients and the type and amount of any admixtures that will be used in the manufacture of each strength and type of concrete, prior to commencing operations. The statement shall be accompanied by test results from an approved testing laboratory, certifying that the proportions selected will produce concrete of the properties required. No substitutions shall be made without additional tests to verify that the concrete properties are satisfactory.

#### 1.6 REGULATIONS AND REFERENCE STANDARDS

- A. All work shall be done according to the following codes and reference standards unless specifically shown or specified otherwise in Contract Documents:
  1. Local Building Code.
  2. ACI 318: "Building Code Requirements for Reinforced Concrete."
  3. ACI 315: "Manual of Standard Practice for Detailed Reinforced Concrete Structures."
  4. ACI 306: "Cold Weather Concreting."
  5. ACI 305: "Hot Weather Concreting."
  6. ACI 211.1: "Recommended Practice for Selecting Proportions for Normal and Heavyweight Concrete."
  7. ACI 304-73: Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete."
  8. ACI 347: "Recommended Practice for Concrete Formwork."
  9. PCI MNL-117: "Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products."
  10. PCI Design Handbook, Precast and Pre-Stressed Concrete.
  11. AISC Manual of Steel Construction, Latest Edition.

12. AWS D1.1 - Rev. 2: "Structural Welding Code."
  13. AWS D12.1: "Reinforcing Steel Welding Code."
  14. Applicable ASTM Specification.
  15. Industrial Fasteners Institute, Handbook for Fastener Standards.
- B. The Contractor shall have available at all times for reference the above regulations, standards, etc., editions noted (or the latest edition, if edition is not noted).
  - C. Where reference is made to Specifications of American Society for Testing Materials (ASTM) or other specific standards, furnish material and/or work in strict accordance with referenced standard, subject to any qualifications herein.
  - D. In the event of discrepancies between various regulations and standards referred to above, most stringent requirements govern.

#### 1.7 MOCK-UPS

- A. Prior to commencing primary work of this Section, provide a full-size mock-up of wall unit, as selected by Architect, showing the exterior finish (matrix color, surface color, surface texture), finish, edge treatment, joint treatment, reinforcement, anchorage insert, lifting inserts, and other accessories. Mockup shall also include typical joints, including exterior corner joints and joints between units. Obtain Architect's acceptance of visual qualities. Protect and maintain approved mock-up throughout the work of this Section.
  1. Provide additional mock-ups as directed by Architect.
- B. Prior to commencing primary work of this Section, provide a mock-up of seat wall unit (size to be determined by Architect), with cast in skate stop, showing the exterior finish (matrix color, surface color, surface texture), finish, edge treatment, joint treatment, reinforcement, anchorage insert, lifting inserts, and other accessories. Mockup shall also include typical joints, including exterior corner joints and joints between units. Obtain Architect's acceptance of visual qualities. Protect and maintain approved mock-up throughout the work of this Section.
- C. Mock-up Unit: If unit is approved by Architect, it shall remain on-site and be used as a standard of quality for all architectural precast concrete work. Fabrication of the precast work shall not commence until on-site mock-up unit has been approved by Architect. Approved mock-ups may be incorporated into the finish work

#### 1.8 TESTS AND INSPECTIONS

- A. Testing by Independent Agency: Materials and workmanship furnished under this Section are subject to inspection and testing in plant and field by Architect and an independent testing agency, approved by Architect, selected and paid for by Owner, as specified in Division 1, General Requirements. Such inspection and testing shall not relieve the Precaster of responsibility to furnish materials and workmanship in accordance with requirements of Contract Documents.
- B. The Architect retains the right to inspect placing of concrete; to make slump tests of concrete; and to test concrete cylinder samples for compressive strength. Architect will review materials proposed for use by Precaster, and he may, to extent deemed advisable, inspect batching operations at plant from time to time.

## 1.9 PERFORMANCE REQUIREMENTS

- A. Design: Engineer and design architectural precast concrete units to withstand stresses induced by live loads, dead loads, temperature, shrinkage, fabrication, handling and erection in accordance with applicable codes. Furnish engineer's certificate stating that precast design meets or exceeds requirements of Contract Documents.

## 1.10 DELIVERY, STORAGE, HANDLING AND PROTECTION

- A. Precast units temporarily stored at the manufacturer's plant shall be protected from damage in accordance with PCI MNL-116 and PCI MNL-117 and PCI MNL-122. Immediately prior to shipment to the job site, all precast concrete units shall be inspected for quality to insure that all precast units conform to the requirements specified. Inspection for quality shall include, but shall not necessarily be limited to, the following elements: color, texture, dimensional tolerances, chipping, cracking, staining, warping and honeycombing. All defective precast concrete units shall be replaced or repaired as approved.
- B. Precast units shall be delivered to the site in accordance with delivery schedule to avoid excessive build-up of units in storage at the site. Upon delivery to the jobsite all precast units shall be inspected for quality as specified above. If the precast units cannot be unloaded and placed directly into the work, they shall be stored onsite, off the ground and protected from weather, marring, or overload. Precast units shall be handled in accordance with manufacturer's instructions.
- C. Sequence deliveries to avoid delays, but minimize on-site storage.
- D. Finished surfaces adjacent to the precast concrete work shall be adequately protected from soiling, staining, and other damage.

## PART 2 PRODUCTS

## 2.1 MATERIALS AND PRODUCTS

- A. Formwork, General: Comply with applicable requirements of ACI 347, and with PCA Ref. Forms shall be steel of adequate thickness, braced, stiffened, anchored and aligned to produce precast architectural concrete units within required dimensional tolerances. Forms shall be sufficiently rigid to provide dimensional stability during handling and concrete placement and consolidation. Fiberglass-reinforced plastic, plastic coated wood, elastomeric or other nonabsorptive material shall be used for making tight joints and rustication pieces.
- B. Form Coating: Provide non-staining form release agent that will not interfere with adhesion of sealants, glazing compound, insulation adhesives or applied finishes. Do not use castor oil or form release agents containing castor oil or retardants.
- C. Galvanized Reinforcing Bars: ASTM A 767, Class II, hot-dip galvanized after fabrication and bending. Test galvanized reinforcing for uniformity of coating by a ten (10) cycle Preece test conforming to ASTM A 239.
- D. Steel Wire: ASTM A 82, plain, cold-drawn steel.
- E. Welded Wire Fabric: ASTM A 185.
- F. Reinforcing Supports: Provide reinforcing supports, including bolsters, chairs, spacers, and other devices for fastening, spacing, and supporting reinforcing.
- G. Concrete, General: Similar to Wausau Tile; color TBD, precast concrete containing 20% recycled porcelain aggregate, with acid wash finish, manufactured by Wausau Tile, Inc. PO

~~November 6, 2020~~ April 16, 2021

50%~~90%~~ Construction Documents

50%~~90%~~ Construction Documents

~~November 6, 2020~~ April 16, 2021

034501-4

Architectural Precast Concrete -  
Sitework

Box 1520 Wausau, WI 54402-1520 Phone: (715) 359-3121; Toll Free: (800) 388-8728; Fax: (715) 355-4627; General E-Mail: wtile@wausautile.com; Website: www.wausautile.com.

- H. Concrete Materials: Provide normal weight, 28-day 5,000 psi minimum compressive strength concrete with 4% to 6% total air content. Provide concrete materials as follows:
1. Portland Cement: ASTM C 150, Type I or Type III. Use only one brand, type, color, and source of cement throughout the Project.
  2. Cement Color: Provide white Portland Cement for facing concrete mix if required to match Architect's sample.
  3. Water: Clean, clear, potable and free from deleterious chemicals and substances.
  4. Coarse Aggregate: ASTM C 33, specially selected for color, supplied from a single source for entire Project. Provide aggregate washed, clean, hard and durable, inert, material, free of staining or deleterious material. Provide aggregate color as required to match Architect's sample.
  5. Air-Entraining Admixtures: ASTM C 260, manufacturer and product as approved by the Architect.
  6. Water Reducing Admixture: ASTM C 494, Type A, manufacturer and product as Approved by Architect.
- I. Connection and Erection Materials: Provide ASTM A 36 and ASTM A 283 steel shapes and plate. Provide ASTM A 569 and A 307 bolts as indicated on approved shop drawings.
1. Hot-dip galvanize all connection and erection materials after fabrication in compliance with ASTM A 123 and A 153. Provide minimum 1.5 oz./ft<sup>2</sup> zinc coating.
- J. Stainless Steel Dowels and Shapes: AISI Type 302/304.
- K. Slotted Inserts: Heavy malleable iron inserts with a depth of not less than 2-1/2 in. and a length of 4-1/2 in., with 3/4 in. steel nuts, hot-dip galvanized in accordance with ASTM A 123.
- L. Threaded Inserts: Malleable iron, with 3/4 in. sound standard threaded steel bolts, unless otherwise shown on Drawings, hot-dip galvanized in accordance with ASTM A 123.
- M. Lifting Devices: Design and place lifting devices so as not to weaken unit during manufacture and handling.
- N. Anchors: Design and place anchors to permit proper installation without forcing. Do not induce or superimpose any undue loads or stresses onto other work. Design anchors to allow for leveling, plumbing and positioning of precast units to accepted tolerances in structural steel as defined by AISC Code.
- O. Plastic Washers and Shims: Multipolymer plastic material with a minimum compressive strength of 8,000 psi, equal to Korolath, manufactured by the Koro Corporation, or approved equal.
- P. Neoprene Bearing Pads: 70 durometer hardness.

## 2.2 CONCRETE MIX

- A. Submit proposed concrete mix proportions to Architect for approval prior to fabrication. Show batch weights, gradations, specific gravity, absorption of aggregates, slump, fresh unit

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50%~~90%~~ Construction Documents

50%~~90%~~ Construction Documents

~~November 6, 2020~~ April 16, 2021

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Architectural Precast Concrete -  
Sitework

weight and air content. Verify mix design and provide four compression tests, two at 7-days, and two at 28 days, on 6 in. diameter x 12 in. high cylinders filled with proposed mix materials in proposed proportions.

- B. Proportion mixes by either laboratory trial batch or field experience methods, using materials to be employed on the project for each type of concrete required, complying with ACI 318.
- C. Adjustment to Concrete Mixes: Mix design adjustments may be requested when characteristics of materials, job conditions, weather, test result, or other circumstances warrant.
- D. Admixtures: Use admixtures in strict compliance with manufacturer's instructions. Adjust admixture quantities as required to maintain quality control.

### 2.3 FABRICATION

- A. General: Design and fabricate precast concrete units to comply with manufacturing and testing procedures, quality control recommendations, and dimensional tolerances of PCI MNL-117, unless otherwise indicated.
- B. Fabricate units straight, smooth, and true to size and shape, with exposed edges and corners precise and square unless otherwise indicated.
- C. Built-In Items: Provide reglets, slots, holes, embeds, anchors, and other accessories in units to receive windows, cramps, dowels, reglets, waterstops, flashings, light fixtures and other similar work as indicated. Provide all necessary cast in embeds and anchors.
- D. Anchorages: Provide loose steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other miscellaneous steel shapes not provided by other trades, necessary for securing precast units to supporting and adjacent members.
  - 1. Design and provide items to be embedded in and attached to other work. Design and engineer support systems to support precast units.
- E. Repairs: Surface defects may be repaired when acceptable to the Architect and when indistinguishable in finish, color, texture and quality from acceptable unrepaired surfaces. Demonstrate repair techniques, including curing; obtain Architect's approval of repair results before continuing work. Replace units that cannot be repaired as directed.
  - 1. Determine repair mix formulas by trial to obtain finish, color, and texture match when both repaired and acceptable unrepaired concrete are cured and dry.
  - 2. Fill holes, if any, using the same source of cement, sand, and pigment used in the parent concrete.
  - 3. Moist cure repaired units for 7 days. Keep units continually damp by covering with damp flannel and polyethylene. Do not wash out repair mortar.
- F. Predelivery Cleaning: Clean objectionable stains or spots off units as directed by the Architect using brushes, soap and clean, running water before delivery to site. Acid cleaning is not acceptable unless approved by Architect.
- G. Identification: Mark each unit on a surface concealed from view in final installation with a non-staining, non-migrating paint. Coordinate marking with approved erection drawings.

## 2.4 MORTAR MATERIALS

- A. Portland Cement: ASTM C 150, Type I or Type II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of Portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 207.
  - 1. For pigmented mortar, use a colored Portland cement-lime mix of formulation required to produce color indicated or, if not indicated, as selected from manufacturer's standard formulations. Pigments shall not exceed 10 percent of Portland cement by weight.
- D. Aggregate: ASTM C 144; except for joints narrower than 1/4 inch and pointing mortar, use aggregate graded with 100 percent passing No. 16 sieve.
- E. White Aggregates: Natural white sand or ground white stone.
- F. Colored Aggregates: Natural-colored sand or ground marble, granite, or other durable stone; of color necessary to produce required mortar color.
- G. Mortar Pigments: Natural and synthetic iron oxides, compounded for use in mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortar and containing no carbon black.
- H. Water: Potable.
- I. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Colored Portland Cement-Lime Mix:
    - a. Color Mortar Blend; Glen-Gery Corporation.
    - b. Rainbow Mortamix Custom Color Cement/Lime; Holcim, Inc.
    - c. Centurion Colorbond PL; Lafarge Corporation.
    - d. Lehigh Custom Color Portland/Lime; Lehigh Portland Cement Co.
    - e. Riverton Portland Cement Lime Custom Color; Essroc.
  - 2. Mortar Pigments:
    - a. Bayferrox Iron Oxide Pigments; LanXess
    - b. True Tone Mortar Colors; Davis Colors.
    - c. Centurion Pigments; Lafarge Corporation.
    - d. SGS Mortar Colors; Solomon Grind-Chem Services, Inc.

## 2.5 FINISH

- A. Acid-Etched Finish: Use acid and hot-water solution, equipment, application techniques, and cleaning procedures to expose aggregate and surrounding matrix surfaces. Protect hardware, connections, and insulation from acid attack.
- B. Finish exposed-face surfaces of precast concrete curb units to match approved design reference sample and as follows:

1. Smooth-Surface Finish: Free of pockets, sand streaks, and honeycombs, with uniform color and texture. Curb units shall have a uniform, smooth texture finish, free from cracks and other defects. Color of units shall be uniform.

## 2.6 MORTAR MIXES

- A. General: Comply with referenced standards and with manufacturers' written instructions for mix proportions, mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures needed to produce mortar of uniform quality and with optimum performance characteristics.
  1. Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated. Do not use calcium chloride.
  2. Combine and thoroughly mix cementitious materials, water, and aggregates in a mechanical batch mixer, unless otherwise indicated. Discard mortar when it has reached initial set.
- B. Portland Cement-Lime Setting Mortar: Comply with ASTM C 270, Proportion Specification, for types of mortar indicated below:
- C. Set with Type N mortar.
- D. Pointing Mortar: Comply with ASTM C 270, Proportion Specification, Type N unless indicated otherwise. Provide pointing mortar mixed to match Architect's sample and complying with the following:
  1. Pigmented Pointing Mortar: Select and proportion pigments with other ingredients to produce color required. Do not exceed pigment-to-cement ratio of 1:10, by weight.

## PART 3 EXECUTION

### 3.1 INSPECTION

- A. Examine the areas and conditions where architectural precast concrete elements are to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected by the responsible trade to permit proper installation of the work.

### 3.2 INSTALLATION

- A. Do not install precast units until concrete has attained its design strength.
- B. Precast units shall be erected in accordance with the detail drawings and without damage to other units or to adjacent members. Units shall be set true to alignment and level, with joints properly spaced and aligned both vertically and horizontally. Erection tolerances shall be in accordance with the requirements of PCI MNL-117 and PCI MNL-122. As units are being erected, shims and wedges shall be placed as required to maintain correct alignment. After final attachment, precast units shall be grouted as shown. After erection, welds and abraded surfaces of steel shall be cleaned and touched-up with a zinc-rich paint. Welds shall be made by a certified welder in accordance with the manufacturer's erection drawings. Pickup points, boxouts, inserts, and similar items shall be finished to match adjacent areas after erection. Erection of precast units shall be supervised and performed by workmen skilled in this type of work. Welding and the qualifications of welders shall be in accordance with AWS D1.1/D1.1M.

- C. Accessories: Install pins, dowels and other accessories required for erection of precast units to supporting members and back-up materials.
- D. Anchor units in final position as indicated on the Drawings. Remove temporary shims, wedges, and spacers as soon as possible after anchoring is completed.
  - 1. At bolted connections use lock washers or other acceptable means to prevent loosening of nuts.
  - 2. At welded connections apply rust inhibitive coating on damaged areas, same as shop applied material. Use galvanizing repair coating on galvanized surfaces.
  - 3. All connections shall be concealed within building finishes.

### 3.3 GENERAL ACCEPTANCE CRITERIA

- A. Units shall meet specifications. No structural deficiencies, cracks, loose inserts or anchors, exposed steel, steel with less than 1 in. minimum cover, or other defects shall be permitted.
- B. Appearance Acceptance Criteria: When viewed at a distance of 10 ft. in natural daylight, exposed surfaces shall be uniform in color, texture, and finish shall be within the range of approved mock-up samples when compared side by side. Panel edges and details of decoration shall be clear, well-defined and true-to-line within specified alignment tolerances. Following is a list of finish defects which are unacceptable and cause for rejection of panels:
  - 1. Ragged or irregular edges.
  - 2. Excessive air voids, commonly called bug holes, evident on exposed surface.
  - 3. Adjacent flat, round and return surfaces with a greater difference in exposure than the approved samples.
  - 4. Casting lines evident from different placements.
  - 5. Visible form joints or irregular surfaces.
  - 6. Rust stains on panel surfaces.
  - 7. Blocks not matching approved sample or non-uniformity of color within a panel or in adjacent panels due to areas of variable aggregate concentration and variations in depth of exposure.
  - 8. Blocking stains or acid stains evident on panel surface.
  - 9. Non-uniformity of textures or color.
  - 10. Areas of backup concrete bleeding through the facing concrete.
  - 11. Foreign material embedded in the face.
  - 12. Visible repairs.
  - 13. Reinforcement shadow lines.
  - 14. Visible cracks.
  - 15. Telegraphing of form lines such as plywood grain.
  - 16. Burns or other damage resulting from welding work.

~~November 6, 2020~~ April 16, 2021

50%~~90%~~ Construction Documents

50%~~90%~~ Construction Documents

~~November 6, 2020~~ April 16, 2021

034501-9

Architectural Precast Concrete -  
Sitework

**3.4 CLEANING**

- A. Not sooner than 72 hours after joints are sealed, faces and other exposed surfaces of precast concrete discolored during erection shall be cleaned to remove dirt and stains by dry scrubbing with a stiff fiber brush, wetting the surface and vigorous scrubbing of the finish with a stiff fiber brush followed by additional washing, or by chemical cleaning compounds such as detergents or other commercial cleaners. Commercial cleaners shall be used in accordance with the manufacturer's recommendations. Cleaning procedure shall be performed on a designated test area and shall be approved prior to proceeding with cleaning work. Discolorations which cannot be removed by these procedures, will be considered defective work. Cleaning work shall be done when temperature and humidity permit surfaces to dry rapidly. Adjacent surfaces shall not be damaged during cleaning operations.

**3.5 PROTECTION**

- A. Precast concrete work shall be properly and adequately protected under the responsibility of the Contractor until final acceptance of the Project by Owner.
- B. After the architectural precast concrete 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 precast concrete shall be used. Nails shall be high-quality galvanized or non-rusting.

**3.6 DEFECTIVE WORK**

- A. Precast concrete units damaged during erection shall be repaired as soon after occurrence as possible or replaced, as directed, using approved procedures. All repairs to precast concrete units shall match the adjacent surfaces in color and texture and shall be as approved. Unless otherwise approved, repair procedures shall conform to PCI MNL-116 and PCI MNL-117.

**END OF SECTION**

SECTION 044302  
GRANITE - SITEWORK

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

- A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

- A. Provide all equipment and materials, and do all work necessary to furnish and install the solid granite steps, as indicated on the Drawings and as specified.

1.3 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 033000, CAST-IN-PLACE CONCRETE; Concrete footing.
- 2. Section 055213, EXTERIOR METAL HANDRAIL.
- 3. Section ~~312300, SITE EXCAVATING, BACKFILLING, AND COMPACTING.~~

←  
310000, EARTHWORK

1.4 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 615 Granite Dimension Stone
  - A 167 Stainless and Heat Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

1.5 SUBMITTALS

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

<u>Item</u>	<u>Quantity and Size</u>
Granite Step	One section required, full t long, specified color and finish.

Granite Wheel Stop:  
One piece required,  
size per drawings  
specified color and  
finish.

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

- B. Shop Drawings: Cutting and setting drawings of stone 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 a monolithic stone block bench.
    - 2. Shop drawings shall indicate the setting number of each piece and each piece shall bear the corresponding number in a non-staining paint.
  - C. Contractor's Review: Before commencing work, submit signed statement that Contract Documents have been reviewed with a qualified representative of Stone supplier, and that selected materials and construction are proper, compatible, and adequate for application shown.
  - D. 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)
- 1.6 MOCK UP
- A. Provide mock up step installation as directed by Architect, conforming to typical Project construction. Sample shall show the proposed Stone type, color, and finish, setting system, relationship to paving, jointing and other pertinent details of installation.
  - B. 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 Stone work to conform to approved sample installation.
- 1.7 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.

## 1.8 DELIVERY, HANDLING, AND STORAGE

- A. Stone shall be carefully packed and banded by the supplier for shipment. Following shipping stone 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 Stone materials and to prevent breakage, cracking, and damage to stone pieces. Stone materials shall be stored in such a manner as to allow air to circulate around the stone material. Stone shall not be permitted to be in direct contact with the ground any time during storage.
- B. Stone shall be carefully handled to prevent chipping, breakage, soiling, or other damage. Pinch or wrecking bars shall not be used without protecting edges of stone with wood or other rigid materials. Stone 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 stone finish shall not be used.
- C. Stone damaged in any manner will be rejected and shall be replaced with new materials at no additional cost to the Owner.

## 1.9 PROTECTION OF FINISHED SURFACES

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

## 1.10 QUALITY ASSURANCE

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

## 1.11 SOURCE QUALITY CONTROL

- A. Stone shall be supplied by a source approved by the Architect.

## 1.12 JOB CONDITIONS

- A. Cold Weather Protection:
  - 1. Do not use frozen materials or materials mixed or coated with ice or frost.
  - 2. Do not build on frozen work; remove and replace Stone work damaged by frost or freezing.
  - 3. During all seasons, protect partially completed Stone work against weather when work is not in progress.

## PART 2 PRODUCTS

### 2.1 GENERAL STANDARDS

#### A. Quarrying Supervision

1. Quarrying shall be supervised and coordinated by the stone fabricator to ensure that the as-quarried block orientations will yield finished material with characteristics as described herein.
2. All stone 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 Stone 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 Stone

1. Visual: All examinations, selections, and approvals shall be for the purpose of achieving a final appearance of stone with greatest possible uniformity, and will be based upon the following criteria:
2. Stone 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, with the exception of irregular marble blocks selected by the Architect.
3. Inherent variations characteristic of the stone and the quarry from which the stone 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. Stone 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. Stone materials rejected for non-compliance with these standards shall be replaced at no additional cost to the Owner.

## 2.2 STONE FABRICATION

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

## 2.3 GRANITE

- A. Granite shall conform to ASTM C 615 and be of the sizes and dimensions indicated on the Drawings.
- B. Granite: "Chester Gray" granite, supplied by Williams Stone Company 1158 Lee-Westfield Road, East Otis, MA 01029; Telephone (800) 832-2052; (413) 269-4544; Facsimile (413) 269-6148; E-Mail; info@williamsstone.com
  - 1. Sizes: As indicated on the Drawings.
  - 2. Finish: Thermal top; sawn edges.
- C. Use only one source for each type of granite throughout the entire Project. Other sources will be reviewed according to substitution requirements specified in the Conditions of the Contract.
- D. 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.
- E. Back of granite which will be concealed in the finished work shall be sawn to approximately true planes. Maximum variation in thickness shall be 1/8 in. Sawn backs shall be cleaned of rust stains and iron particles.
- F. All faces shall be at right angles to the plane of the top.
- G. Granite shall be cut accurately to required shapes and dimensions.
- H. 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.
- I. Arrises shall be cut sharp and true to square, and continuous with adjoining arrises. Where exposed, arrises shall be eased.

## 2.4 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.

## 2.5 THIN SET BED AND/OR BOND COAT

- A. High strength bond coat between concrete base slab and setting bed mortar, and between setting bed mortar and granite 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.

## 2.6 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.

## PART 3 EXECUTION

### 3.1 ACCEPTABILITY OF CONCRETE BASE

- A. Contractor shall examine the concrete foundation to determine its adequacy to receive stone unit and 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.

### 3.2 PREPARATION

- A. Advise installers of other work about specific requirements for placement of inserts, flashing reglets, and similar items to be used by dimension stone Installer for anchoring, supporting, and flashing of stone system. Furnish installers of other work with Drawings or templates showing locations of these items.
- B. Protect stone during erection as follows:
  - 1. Cover tops of stone installation with nonstaining, waterproof sheeting at end of each day's work. Cover partially completed structures when work is not in progress. Extend cover a minimum of 24 inches (600 mm) down both sides and hold securely in place.
  - 2. Prevent staining of stone from mortar, grout, sealants, and other sources. Immediately remove such materials without damaging stone.
  - 3. Protect from rain-splashed mud and mortar splatter by coverings spread on ground and over wall surface.
  - 4. Protect from mortar and sealant droppings.

- C. Clean stone surfaces that are dirty or stained by removing soil, stains, and foreign materials before setting. Clean stone by thoroughly scrubbing with fiber brushes and then drenching with clear water. Use only mild cleaning compounds that contain no caustic or harsh materials or abrasives.

### 3.3 SETTING

- A. All setting shall be done by competent granite setters under adequate supervision and in accordance with the approved shop drawings.
- 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. 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.
- E. Bond coat shall be applied to concrete base slab using flat trowel. Thickness of bond coat shall be approximately 1/16 in.
- F. Mortar bed shall be spread evenly over the troweled bond coat. Bond coat shall be applied to mortar bed using flat trowel to thickness of 1/16 in.
- G. 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.
- H. 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.
- I. Holes, slots, and other sinkages for anchors, and dowels, shall be completely filled with mortar during setting of granite.
- J. 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.

- K. Planter wall and curbs shall be set according to the details and locations indicated on the Drawings. Vertical face of wall and curb shall be plumb with tops paralleled to adjacent surface.
  - L. 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.
  - M. Extreme care shall be taken not to destroy alignment during backfilling operations. Sections disturbed during backfilling or otherwise shall be reset to line and grade, and properly backfilled.
- 3.4 SEALANT
- A. Sealant for pointing of joints indicated to be sealed shall be applied in accordance with ASTM C 962. Where recommended by the sealant manufacturer, joints shall be primed prior to sealant application.
- 3.5 CLEANING
- A. After setting, Stone work shall be carefully cleaned, removing all dirt, 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.
  - B. Upon completion of Stone work, surfaces shall be left in a clean, unsoiled condition, acceptable to the Architect.
- 3.6 PROTECTION
- A. Stone work shall be properly and adequately protected under the responsibility of the Contractor until final acceptance of the Project by Owner.
  - B. After the stone 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 stone shall be used. Nails shall be high-quality galvanized or non-rusting.

END OF SECTION

## SECTION 055213

## EXTERIOR METAL HANDRAILS

## PART 1 GENERAL

## 1.1 GENERAL REQUIREMENTS

- A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

## 1.2 SECTION INCLUDES

- A. The work of this Section consists of providing all exterior steel handrails with powdercoat finish, and related items, as indicated on the Drawings and as specified herein.

## 1.3 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 033000, CAST-IN-PLACE CONCRETE; Installation of inserts and sleeves.
  2. Section 044302, GRANITE - SITEWORK; Granite steps; Installation of inserts and anchor bolts.

## 1.4 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 Architectural Manufacturers Association  
(AAMA):2605 Powdercoating Standard
  2. 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
A 653	Steel Sheet, Zinc-Coated (Galvanized) Or Zinc-Iron Alloy-Coated (Galvannealed) By The Hot-Dip Process
A 924	General Requirements For Steel Sheet, Metallic-Coated By The Hot-Dip Process
B 117	Standard Practice For Operating Salt Spray (Fog) Apparatus
C 579	Compressive Strength Of Chemical- Resistant Mortars, Grouts, Monolithic Surfacing, And Polymer Concretes
C 827	Change In Height At Early Ages Of Cylindrical Specimens Of Cementitious Mixtures
D 822	Filtered Open-Flame Carbon-Arc Exposures Of Paint And Related Coatings
D 2794	Resistance Of Organic Coatings To The Effects Of Rapid Deformation (Impact)
D 3363	Film Hardness By Pencil Test
D 7803	Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Powder Coating

3. American Welding Society (AWS):

D1.1	Structural Welding Code - Steel
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1.5 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.
- 1.6 MOCKUP
- A. Handrails:
    - 1. Construct a mockup section before start of any handrail work. Sample section shall exhibit proposed connection of post to rail at end of rail. Rail and post shall be minimum 12 in. long.
    - 2. Sample section shall be inspected by the Architect. If the sample is not acceptable, construct additional panels, at no additional cost to the Owner, until an acceptable panel is constructed. Accepted panel; shall become the standard for the entire job and shall remain undisturbed until Substantial Completion.
- 1.7 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.
- 1.8 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.

## 1.9 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.

## 1.10 DISSIMILAR MATERIALS

- A. Where dissimilar metals are in contact, or where aluminum is 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.

## 1.11 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.

## 1.12 PERFORMANCE REQUIREMENTS

- A. Structural Performances: Provide installed handrail and railing assemblies complying with following structural performances, unless otherwise indicated:
  - 1. Live Loads shall not be less than the minimum required by applicable building codes.
  - 2. Design shall incorporate safety factors as required by the applicable building codes.
  - 3. Design and construction shall be as such to assure that under the required design live loads there shall be no failure of any member, deflection of not more than  $L/240$  of length of any member, and without permanent deformation of any member or fastener.
- B. Handrails: Handrails shall be designed to resist a lateral load of 50 pounds per linear foot (plf) applied in any direction at the top and to transfer this load through the supports to the structure.
  - 1. Concentrated Load: Handrails shall be able to resist a single concentrated load 200 pounds, applied in any direction at any point along the top, and to transfer this load through the supports to the structure. This load need not be assumed to act concurrently with the uniform load specified above.
  - 2. Components: Intermediate rails (all those except the handrail), balusters and panel fillers shall be designed to withstand a horizontally applied normal load of 50 pounds on an area equal to 1 square foot, including openings and space between rails. Reactions due to this loading are not required to be superimposed with those of the previous sections.

## PART 2 PRODUCTS

### 2.1 STEEL HANDRAILS

- 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.

### 2.2 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 033000, CAST-IN-PLACE. Furnish anchors, bolts, and other items required to be built-into masonry under Section 044302, GRANITE - 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.

### 2.3 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 ASTM C827 modified 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.

### 2.4 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.

## 2.5 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 metal in accordance with ASTM D7803.
  - 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: Black.

## 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.

### 3.2 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.

### 3.3 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.

#### 3.4 STEEL HANDRAILS

- A. Fabricate and install exterior steel handrails at stairs, as called for on the Drawings.
- B. Handrails, 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. Exterior handrails shall be hot-dip galvanized after fabrication as specified hereinbefore.
- F. 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 055901

## MANUFACTURED METAL EDGING

## 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. Provide metal edging work required for paving and landscape edges as indicated on Drawings and as specified herein. Include, but do not limit to:

1. Flat vertical steel edging.
2. Angled steel edging.
3. "L" shaped angle aluminum edging.

## 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 321216, BITUMINOUS PAVING
2. Section 321223, RUSTIC SURFACE (CHIP SEAL) PAVING
3. Section 321440, STONE PAVING
4. Section 321540, GRANULAR STONE PAVING
5. Section 321543, STABILIZED STONE DUST PAVING
6. Section 329200, LAWNS AND GRASSES
7. Section 329300, PLANTING

## 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 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 386	Zinc Coating (Hot-Dip) on Assembled Steel Products
B 308	Aluminum-Alloy 6061-T6 Standard Structural Shapes, Rolled or Extruded

## 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. Show all interfaces and relationships to work of other trades.
- C. Samples: Submit representative samples of each shop finished 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.

## 1.05 ANCHORAGE

- A. Anchorage shall be provided where necessary for fastening metal edging securely in place. Anchorage not otherwise specified or indicated shall include slotted inserts made to engage with the anchors and power-driven fasteners when approved for concrete.

## 1.06 PRODUCT HANDLING AND STORAGE

- A. Store work off ground and under cover. Protect from damage. Repair and clean work before erection.

## PART 2 PRODUCTS

## 2.01 FLAT STEEL EDGE RESTRAINT

- A. Steel edging shall be Border Concepts Edging, "Border King", manufactured by Border Concepts, Inc., P.O. Box 471185, Charlotte, NC 28247 or approved equal. Steel edging shall be shop fabricated, 1/4 in. thick x 6 in. deep, primed and painted Black. Edging shall be furnished in 16 ft. lengths.
  - 1. Steel edging shall have slotted holes for staking steel edging every 30 in. o.c.
  - 2. Steel stakes shall be 15 in. long, tapered.
  - 3. Provide manufacturer's end stake and splicer unit.
  - 4. Provide manufacturer's optional preformed tree rings and tree squares as indicated on the Drawings.
  - 5. Provide manufacturer's standard touch-up paint for in field touch-up of scratched or marred areas.

## 2.02 ANGLED STEEL EDGE RESTRAINT

- A. Angled steel edging shall be manufactured by Ryerson Steel, Chicago, IL, tel. (855) 793-7766. Steel edging shall be shop fabricated, 3/8" thick x 3" x 3", grade A36. Edging shall be furnished in 20 ft. lengths.
  - 1. Finish: Galvanized
  - 2. Anchors: Threaded rod and leveling nuts as specified

## 2.03 2-1/2" ALUMINUM EDGE RESTRAINT

- A. Provide "Permaloc Asphalt Edge" with 0.210" thick exposed top lip x 2.5" high x 8 feet) long, extruded aluminum, alloy 6005, T-5 hardness as manufactured by Permaloc Corporation, Holland MI 49424, telephone (800) 356-9660 or (616) 399-9600. Horizontal base to have upward facing

angle profile designed to integrate restraint and asphalt surfaces for straight-line and curvilinear applications. Section shall have holes in base spaced 4" apart along its length to receive anchors.

1. Connection Method: Section ends shall splice together with horizontal 0.060" thick x 1" wide, or 0.53" wide for 1" high edging x 4" long aluminum sliding connector.
2. Anchors: 3/8" x 10" bright spiral steel spike, 3/16" x 1-1/2" or longer Ardox concrete nail, or drive pin fastener equal to Hilti DX 40 powder actuated pin or Ramset Trakfast Automatic Fastening System pin.
3. Finish: Mill Finish. Paint finish shall comply with AAMA 2603 for electrostatically baked-on paint.

#### 2.04 4" ALUMINUM EDGE RESTRAINT

- A. Provide "Permaloc Asphalt Edge" with 0.210" thick exposed top lip x 4" high x 8 feet) long, extruded aluminum, alloy 6005, T-5 hardness as manufactured by Permaloc Corporation, Holland MI 49424, telephone (800) 356-9660 or (616) 399-9600. Horizontal base to have upward facing angle profile designed to integrate restraint and asphalt surfaces for straight-line and curvilinear applications. Section shall have holes in base spaced 4" apart along its length to receive anchors.

1. Connection Method: Section ends shall splice together with horizontal 0.060" thick x 1" wide, or 0.53" wide for 1" high edging x 4" long aluminum sliding connector.
2. Anchors: 3/8" x 10" bright spiral steel spike, 3/16" x 1-1/2" or longer Ardox concrete nail, or drive pin fastener equal to Hilti DX 40 powder actuated pin or Ramset Trakfast Automatic Fastening System pin.
3. Finish: Mill Finish. Paint finish shall comply with AAMA 2603 for electrostatically baked-on paint.

#### 2.05 METAL

- A. General: Provide products and materials of new stock, free from defects, and of best commercial quality for each intended purpose.
- B. Steel Plates, Shapes, and Bars: ASTM A 36.
- C. Aluminum shall be 6061-T6 alloy and temper as defined in ASTM E 34, conforming to B 308 as applicable.

#### 2.06 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Galvanizing: Hot-dip galvanize exterior metal fabrications indicated to be galvanized, in compliance with ASTM A 123, ASTM A 153, or ASTM A 386. Provide minimum 1.5 oz./ft.<sup>2</sup> zinc coating. Galvanize after fabrication.
- D. Natural Mill Aluminum or Black DuraFlex Painted, AAMA 2603, electrostatically baked on paint.

## PART 3 EXECUTION

## 3.01 EXAMINATION

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

## 3.02 INSTALLATION, GENERAL

- A. Provide anchorage devices and fasteners where needed to secure metal edging to in-place construction.
- B. Perform cutting, drilling, and fitting required to install metal edging. Set edging accurately in location, alignment, and elevation; measured from established lines and levels.
- C. Backfill material on each side of edge 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.

## 3.03 STEEL EDGING

- A. Steel edging shall be installed at locations indicated on the Drawings. Where required, edging shall be cut square and accurately to required length.
  - 1. Steel edging shall be securely staked in required position. Stakes shall be driven every 30 in. o.c. along length of edging.
  - 2. Adjacent lengths of edging shall be spliced together with manufacturer's standard splicer unit.
  - 3. Edging shall be set plumb and vertical at required line and grade. Straight sections shall not be wavy; curved sections shall be smooth and shall have no kinks or sharp bends.

## 3.04 ALUMINUM EDGING

- A. Aluminum edging shall be installed at locations indicated on the Drawings. Where required, edging shall be cut square and accurately to required length.
  - 1. Install edging leaving 3/8" (9.5 mm) between sections for expansion.
  - 2. Drive spikes through edging holes in base of asphalt restraint edging (or drive nails through aluminum base when using powder actuated fastening system) at spaces for following applications.
    - a. Anchor each section end with anchor.
    - b. Aggregate Base: Spiral steel spikes at 4 inches (102 mm) to 12 inches (305 mm) on center.
    - b. Softer or Thinner Asphalt Base: 3/8 inch x 10 inches (9.5 mm x 254 mm) spiral steel spikes at 4 inches (102 mm) to 12 inches (305 mm) on center spacing.
    - b. Older, Harder, or Thicker Asphalt Base: Hilti DX A41 Fully Automatic Powder Actuated Tool is desirable where sufficient hold can be obtained. Provide 1-1/2 inches (38 mm) to 2-1/2 inches (64 mm) nail at 4 inches (102 mm) to 12 inches (305 mm) on center spacing with applicable charge recommended.
    - b. 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.

3. 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 TOUCH-UP REPAIR

- A. After erection abraded areas of edging surfaces shall be touched-up and repaired with manufacturer's standard materials.

END OF SECTION

SECTION 129300  
SITE FURNISHINGS

## PART 1 GENERAL

## 1.1 GENERAL REQUIREMENTS

- A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

## 1.2 SECTION INCLUDES

- A. Provide all materials and equipment, and do all work necessary to furnish and install the site furnishings, including trash and recycling receptacles, and bike racks, as indicated on the Drawings and as specified.

## 1.3 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 033000, CAST-IN-PLACE CONCRETE; Poured in place concrete foundation.
  - ~~2. Section 062014, CUSTOM TIMBER SEATING.~~

## 1.4 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
F 1487	Standard Consumer Safety Performance Specifications for Playground Equipment for Public Use

## 1.5 SUBMITTALS

- A. Complete shop drawings of each item specified shall be submitted for Architect's approval.
- B. Submit assembly instruction drawings showing layout(s), connections, bolting and anchoring details as per manufacturer's standards.
- C. Submit color samples of bench finish for Owner and Architect approval.

## PART 2 - PRODUCTS

## 2.1 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.

## 2.2 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.
- B. Exposed metal surfaces shall be finished in accordance with the requirements of Section

## 2.3 TRASH/RECYCLE RECEPTACLES

- A. Trash/Recycle Receptacles: shall be 600 Series – 600 Trash Containers, supplied by Maglin Site Furniture, Denver, CO; Tel. 1-800-716-5506, or approved equal.
1. Metal finish: Fine Textured Gunmetal.

## 2.4 BIKE RACK

- A. Bike Racks: shall be 500 Series – 500 Bicycle Rack, supplied by Maglin Site Furniture, Denver, CO; Tel. 1-800-716-5506, or approved equal.
1. Metal finish: Fine Textured Gunmetal.

## 2.5 BENCHES

- A. Bench Type A: shall be Rough&Ready Crosswise Benches, supplied by STREETLIFE America LLC, Philadelphia, PA; Tel. 215-247-0148, or approved equal.
- A. Bench Type 1A: Shall be Santa & Cole Bancal, supplied by Landscape Forms, 7800 E. Michigan Ave., Kalamazoo, MI 49048; Tel. 800.430.6209.
1. Metal finish: Low Sheen Obsidian
  2. Wood: Domestically-sourced Thermally Modified Ash (DSTMA)
  3. Length: 248"
  4. Backrest: 248" backrest
  5. Arms: With end and intermediate arms
- B. Bench Type 1B: Shall be Santa & Cole Bancal, supplied by Landscape Forms, 7800 E. Michigan Ave., Kalamazoo, MI 49048; Tel. 800.430.6209.
1. Metal finish: Low Sheen Obsidian
  2. Wood: Domestically-sourced Thermally Modified Ash (DSTMA)
  3. Length: 168"
  4. Backrest: 168" backrest
  5. Arms: With end and center arms
  6. Accessories: Backrest

## PART 3 - EXECUTION

## 3.1 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.

### 3.2 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.

### 3.3 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.

### 3.4 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.

### 3.5 TRASH/RECYCLE RECEPTACLES

#### A. Examination

1. Examine areas to receive trash/recycle receptacles.
2. Notify Architect of conditions that would adversely affect installation or subsequent use.
- 3.

#### B. Inst

1. **3.5 CONCRETE**  
Concrete footings for furnishings shall be furnished and installed under Section 033000, CAST-IN-PLACE CONCRETE (SITE)
- 2.
- 3.

#### C. Adj

1. Finish Damage: Repair minor damages to finish 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 trash/recycle receptacles promptly after installation.
  - 2. Do not use harsh cleaning materials or methods that could damage finish.
- E. Protection
- 1. Protect installed trash/recycle receptacles to ensure that, except for normal weathering, trash receptacles will be without damage or deterioration at time of Substantial Completion.
- F.. Concrete footings for pedestals shall be furnished and installed under Section 033000, CAST-IN-PLACE CONCRETE.

3.6 ~~BIKE RACK~~ **BENCHES, BIKE RACKS AND TRASH/RECYCLING RECEPTACLES**

- A. Work shall be executed only by workmen experienced in the trade.
- B. Examine areas to receive bike racks. **benches, bike racks, and trash/recycling receptacles**
- C. Notify Architect of conditions that would adversely affect installation or subsequent use.
- D. Do not begin installation until unacceptable conditions are corrected.
- E. Coordinate ~~bicycle racks~~ installation with installation of the surrounding surface at grade beneath the bicycle racks
- F. Installation
  - 1. Install ~~bike racks~~ in accordance with manufacturer's instructions at locations indicated on the Drawings.
  - 2. Install ~~bike racks~~ level and plumb. **← unless otherwise noted**
- G. 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.
- H. Cleaning
  - 1. Clean ~~bike racks~~ promptly after installation in accordance with manufacturer's instructions.
  - 2. Do not use harsh cleaning materials or methods that could damage finish.
- I. Protection
  - 1. 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.
  - 2. Protect installed bike racks to ensure that, except for normal weathering, ~~bike racks~~ will be without damage or deterioration at time of Substantial Completion. **↑**

END OF SECTION

**benches, bike racks,  
and trash/recycling  
receptacles**

## SECTION 265000

## LUMINAIRES

## 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. Provide luminaires in accordance with the requirements of the Contract Documents and information referenced to herein.
- B. Section Includes:
  - 1. General Requirements
  - 2. Products:
    - a. Interior and exterior luminaires and associated components of the project in front of house locations.
    - b. Lamps and luminaire accessories
    - c. Drivers, ballasts, and transformers for lighting
    - d. Light fixture supports
- C. Related Documents and Sections: Examine Contract Documents for requirements that directly affect or are affected by Work of this Section. A list of those Documents and Sections include, but is not limited to the following:
  - 1. Drawings and general provisions of the Contract, including General and Supplementary Conditions, and Division 01 General Requirements Specification Sections, apply to this Section.
  - 2. Section 26 05 00 – Common Work Results for Electrical Requirements
  - 3. Section 26 08 00 – Commissioning of Lighting
  - 4. Section 26 09 23 – Lighting Control Devices
  - 5. Section 26 09 43 – Lighting Controls
  - 6. Section 26 24 16 – Panelboards
- D. All luminaires included in 26 50 00 are to be supplied by the contractor.
- E. The Contractor is responsible for fixture installation and all necessary accessories including but not limited to wiring to fixtures for power and control, mounting equipment and supports not supplied with fixtures, etc.

## 1.3 CONTRACT DOCUMENTS

- A. All work of this section shall comply with the requirements of the conditions of the contract (general, supplementary and special) with all sections of division 1 – general requirements, with the drawings and with all other contract documents.
- B. These documents outline design intent for the architectural electric lighting scope areas. Where design intent is unclear, the Contractor shall contact the Lighting Consultant(s) in writing prior to proceeding with specific item that requires clarification.
- C. Where specification refers to Lighting Consultant, this shall mean Ove Arup & Partners P.C., 77

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#### 1.4 DEFINITIONS

- A. The language, abbreviations, and acronyms listed below may be used herein to describe the project requirements and salient features of luminaires:
1. CCT: Correlated color temperature.
  2. CRI: Color Rendering Index.
  3. Fixture: See "Luminaire"
  4. IP: International Protection or Ingress Protection Rating.
  5. LED: Light-emitting diode.
  6. Lumen: Measured output of lamp and luminaire, or both.
  7. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

#### 1.5 REFERENCE STANDARDS

- A. General: Comply with the applicable provisions of the referenced standards except as modified by governing codes and the Contract Documents. Where a recommendation or suggestion occurs in the referenced standards, such recommendation or suggestion shall be considered mandatory. In the event of conflict between referenced standards, this specification or within themselves, the more stringent standard or requirement shall govern.
1. ANSI/ASHRAE/IES – Standard 90.1 with New York State and Town of Cornwall Amendments.
  2. ANSI C78.377 – Chromaticity
  3. CIE TC1-69 - Color Rendering
  4. IESNA LM-79 - Approved Method for Electrical & Photometric Measurement of SSL Products
  5. IESNA LM-80 - Approved Method for Lumen Maintenance of LED Light Source
  6. IESNA RP1605-Nomenclature and Definitions for Illuminating Engineering
  7. IESNA TM-30 – IES Method for Evaluating Light Source Color Rendition
  8. NEMA LE 4 – Ceiling Compatibility for Recessed Fixtures
  9. NFPA 70 - National Electrical Code (NEC)
  10. NFPA 101 - Life Safety Code
  11. UL 924 - Emergency Lighting and Power Equipment
  12. UL 1598 – Luminaires
  13. UL 8750 – LED Equipment for Use in Lighting Products
  14. ANSI C78.379 Classification of the Beam Patterns of Reflector Lamps
  15. ANSI/IEEE C62.41 Guide on Surge Voltages in AC Power Circuits Rated up to 600V
- B. All luminaires and components shall be manufactured in accordance with the National Electric Code (NEC) and bear the Underwriter's Laboratories (UL) or Factory Mutual label.
1. All luminaires installed shall be UL listed for installation in their specific locations and shall comply with article 410 of the National Electric Code.
  2. All luminaires shall comply with local, state or federal codes, regulations and building inspection standards. Contractor to verify and provide all required labels indicating compliance with above standards, affixed to each luminaire in a position concealing it from normal view.

#### 1.6 REGULATORY

- A. Conform to requirements of ANSI/NFPA 70.
- B. Conform to requirements of ANSI/NFPA 101.

- C. Furnish products listed and classified by Underwriters Laboratories, Inc., ETL, or testing firm acceptable to authority having jurisdiction (AHJ) as suitable for purpose specified and shown.
- D. Conform to the applicable version of ASHRAE/IESNA Standard 90.1.
- E. Conform to the requirements of New York State, and related building codes, NEC, and ADA.

#### 1.7 BIDDER EVALUATION & QUALIFICATION MATERIALS

- A. The Lighting Consultant shall retain the right to request additional bidder evaluation and qualification information including but not limited to bidder's company literature describing the firm's qualifications, project or Client references, personnel resumes, company experience and approach to providing the systems and services required for the Project.
- B. Submit a list of any anticipated work on the Project that bidder may subcontract. For all subcontracted work, bidder shall describe the work and identify the proposed subcontractor. Appropriate qualification information shall be submitted for each subcontracting firm.

#### 1.8 BID SUBMITTALS

##### A. General Information:

1. Bids received which omit any portion of these submittal requirements may be deemed non-responsive.
2. The cost for preparing the lighting system bid shall be borne solely by the bidder. No part of the cost of preparing the bid shall be incorporated into the bid itself.
3. Bids shall be submitted in accordance with the instructions outlined in this document.
4. Bidder warrants upon submission of bid that it has reviewed all construction drawings, specifications and related contract documents for the Project and that the bid submitted is inclusive of all labor, materials and supplies required to deliver the complete operational lighting system as specified.
5. All equipment proposed and supplied by the bidder shall be new and shall meet or exceed the technical and performance requirements outlined in this Specification.

##### B. Technical & Pricing Information:

1. Bidder shall submit itemized list of all equipment proposed to be supplied. Itemized equipment listings must include all equipment necessary to develop the complete functioning systems, whether or not the equipment is specifically identified in this Specification. Each piece of equipment shall be individually priced. Sub-totals shall be provided for each unique system and sub-system.
2. Technical data sheets or other documentation of each major piece of equipment shall be provided upon request to show how each item meets the requirements of the specification.
3. Bidder shall submit schematic diagram(s) illustrating conceptual system architecture where proposed equipment/system deviates from this Specification and accompanying documentation.
4. Itemized bid pricing of luminaires shall exclude installation costs, which is to be itemized separately by function.

##### C. Other Submittal Information:

1. Bidder shall submit a Warranty Statement clearly identifying any exclusions or conditions affecting warranty of the lighting system. Minimum warranty coverage (Basic Warranty) is defined in the Scope of Work. Bids submitted that do not include Basic Warranty coverage may be deemed non-responsive.
2. Bidder shall submit descriptions and pricing for any supplemental warranty and support

services available, including Enhanced Warranty and Maintenance Support as described in the Scope of Work. Costs for supplemental warranty and support coverage shall be itemized separately and identified in the bidder's submittal as indicated on the Bid Form. Client shall retain the right to accept or reject supplemental warranty and support services as proposed up until commencement of Basic Warranty.

3. Bidder shall identify in the bid submittal any long lead equipment items that may adversely affect the project schedule.
4. Manufacturers listed in the fixture schedule shall be assumed capable of supplying the listed fixtures unless exceptions are set forth in their quotations. Any such exceptions shall immediately be brought to the attention of the Architect and the Lighting Consultant.
5. Manufacturer shall have not less than 5 years of experience in design and manufacture of lighting fixtures of the type and quality shown, unless otherwise specified. Pre-qualification submissions must include a list of completed projects and dated catalog pages or drawings indicating length of experience.
6. Manufacturer shall submit a prototype sample of each fixture for review by the Architect and Lighting Consultant. Prototype samples shall be sufficiently detailed and operational to allow evaluation of compliance with the salient features of the specification. Preliminary design or shop drawing shall not be accepted in place of prototype samples.
7. The Lighting Consultant shall be the sole judge in determining whether the prototype sample complies with the specifications and shall reserve the right to disqualify any bidders.
8. Within 14 days of contract award, successful contractor shall submit a complete list of lighting products intended to be furnished with manufacturer and catalog designations, along with currently quoted lead times for delivery of same. Should the contractor anticipate that the delivery schedule of any specified product may adversely impact the construction schedule, it shall be brought to the attention of the Architect at this time.

- D. Within 14 days of bid award, contractor shall provide a complete list of all lamps, which will be furnished on the project. This list shall be organized alphabetically by the luminaire type indicated on the luminaire schedule, and include the manufacturer and exact model number of each lamp. Up to three samples of any listed lamp shall be supplied at no additional cost to the project, if so requested by the specifier.

## 1.9 SUBMITTALS

- A. The Contractor shall submit shop drawings, samples and prototypes as specifically instructed below. Shop drawings shall include but not be limited to:
1. Manufacturer's dimensioned scale drawings showing in complete detail the fabrication of all luminaires including overall fixtures, continuous fixture run lengths, and detail dimensions, finishes, metal thickness, glass thickness, type, fabrication methods, support method, ballasts, transformers, sockets, type of shielding, reflectors, trims, hinges, gaskets, provisions for re-lamping and all other information to show compliance with the contract documents.
  2. Installation instructions.
  3. Certified independent laboratory test data and reports including photometric data rendered by an independent testing laboratory developed according to methods of the Illuminating Engineering Society of North America.
  4. Maintenance and operating instructions, including tools required, types of cleaners to be used, replacement parts identification list, and final as-built shop drawings.
- B. All drawings shall clearly indicate the contract drawing number of luminaire details used as reference in the development of the shop drawings and the name of the project, Architect and Lighting Consultant.
- C. Submittals shall not be submitted piecemeal through the project. We expect to receive submittals as follows:

1. 1 submittal package inclusive of all luminaires (OUR PREFERENCE)  
OR
2. No more than 2 submittal packages indicating one for buildings and one for site

D. Light Fixture Submittal Review

1. An orderly process for reviewing the light fixture Submittal(s) and shop drawings is required. Contractor shall submit (1) package of light fixtures Front of House Scope separate from Back-of-House project scope. We expect this package to be received as one entire collection of light fixtures in a single package. We will not accept each light fixture as a separate Submittal.
  2. We expect the Contractor to provide the first name fixtures in the package, as specified in the first Submittal. Any proposed substitutions shall follow the procedures outlined in these specifications, inclusive of comparative uninstalled unit pricing, with corresponding labor rates for installation.
  3. Contractor to provide itemized list of base unit costs of fixtures as well as the cost including installation, indicated separately.
  4. After this process, an in-person review of operational Physical samples of exact luminaires shall be undertaken of all fixtures in one package. This review will include all stakeholders.
  5. After the physical sample review, a final set of documentation, taking on board any and all comments and direction from the previous dialog, for submission is issued and reviewed.
  6. Any fixture that is part of the fixture sample review may not be returned nor used in the final project installation.
- E. Submittal log showing all luminaire designations shall be submitted with each submittal showing the current review status of each fixture type.
- F. Allow a minimum of (15) business days for review by the Lighting Consultant. Process may require more time for additional party review.

1.10 SAMPLES

- A. Samples may be requested for any or all of the luminaires specified herein and are required for all luminaires designated as 'modified' or 'custom luminaires' as well as all contractor substitutions.
- B. Submit for review samples called for to the Lighting Consultant when and where directed, the components tagged with the name of the project and provided with a cord and plug and specified lamps. Samples will not be returned. Allow 2 weeks from the date of receipt for thorough examination and review by the Lighting Consultant.
- C. Luminaires under the contract shall be identical with the approved sample Luminaire. No luminaire used as a sample will be allowed to be installed on the project.
- D. In the event the submissions are disapproved, the luminaires will be returned to the Contractor to immediately make a new submission of luminaire or luminaires meeting the contract requirements.
- E. All charges for these shipments are to be prepaid by the Contractor.
- F. Prototypes: All custom luminaires require a submission of material finish samples, component review and a complete operating prototype luminaire to be reviewed at the fabricator's shop prior to shipment of any material to the project.
- G. The Contractor shall submit shop drawings for all luminaires no later than 60 days after award of contract. The Contractor shall be responsible for coordinating submittal reviews to allow timely delivery to the project site.
- H. Shop drawings and samples requested shall be submitted for review before fabrication. Any material produced prior to the review of shop drawings or samples and not in conformance with

the contract documents shall be disapproved with the Contractor bearing full responsibility and cost.

- I. When required and requested by the Lighting Consultant, samples submitted as per above shall be subjected to photometric, thermal, mechanical, electrical or water testing at an independent test laboratory, at no additional expense to Owner.
- J. Luminaire sample submittals shall include an operable 120-volt non-returnable sample, complete with lamp(s), 72 inch grounded cord and plug, and specified finish.
- K. No variation from the general arrangement and details indicated on the drawings shall be made on the shop drawings unless required to suit the actual conditions on the premises and then only with the written acceptance of the architect. All variations must be clearly marked as such on the drawings submitted for review.

#### 1.11 WORK INCLUDED

- A. The contractor shall install a luminaire of the type indicated by designation at each location shown on the drawings. All materials, accessories, and any other equipment necessary for the complete and proper installation of all luminaires included in the contract shall be furnished by the contractor.
- B. Luminaires shall be manufactured in strict conformance with the contract drawings and specifications. Specifications and scale drawings are intended to convey the salient features, function, and character of the luminaire only, and do not undertake to illustrate or set forth every item or detail necessary for the work. Minor details not usually indicated on the drawings nor specified, but that are necessary for the proper completion of luminaire installation, shall be included as if they were herein specified or indicated on the drawings.
- C. The Owner, Architect, and Lighting Consultant shall not be held responsible for omission or absence of any detail, construction feature, etc., that may be required in the production of the luminaires.
- D. The responsibility of accurately fabricating and installing the luminaires to the fulfillment of this specification rests with the contractor.

#### 1.12 QUALITY ASSURANCE

- A. Materials, equipment and appurtenances as well as workmanship provided under this section shall conform to the highest commercial standards and as specified and as indicated on drawings. Luminaire parts and components not specifically identified or indicated shall be made of materials most appropriate to their use or function and as such resistant to corrosion and thermal and mechanical stresses encountered in the normal application and function of the luminaires.
- B. All luminaires shall be manufactured to a consistent level of quality. Size, color and components parts shall be identical for all Luminaires.
- C. All new luminaires and related materials shall be new.
- D. The Contractor shall coordinate all luminaires, mounting hardware, and trim with ceiling system and other items, including work of other trades.

#### 1.13 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Section 260500 "Basic Electrical Requirements".
- B. Accurately record actual locations of each luminaire, which proper luminaire designation and control circuiting, for preparation of As-Built drawings and corresponding luminaire schedules to

be submitted upon completion of the project.

#### 1.14 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Division 1.
- B. Operations and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.
- C. Provide a list of all lamp types used on Project; use ANSI and manufacturer codes.
- D. Include list of all replacement part.

#### 1.15 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Lamps: 10 for every 100 of each type and rating installed, unless otherwise indicated. Furnish at least one of each type.
  - 2. Diffusers and Lenses: 1 for every 100 of each type and rating installed. Furnish at least one of each type.
  - 3. Drivers: 1 for every 100 of each type and rating installed. Furnish at least one of each type.
  - 4. Luminaires (Standard White Goods): 1 for every 100 of each type. Furnish at least one of each type.
  - 5. Battery and Charger: 1 for every 20 of each emergency lighting unit

#### 1.16 OPERATING PARAMETERS

- A. All interior components shall be designed to operate properly between 50°F and 115°F without increased failure rate; in addition to any stated conditions below such as cold weather starting ballasts or drivers.

All exterior fixtures shall be suitable for outdoor environmental conditions and be exterior rated.

#### 1.17 SUBSTITUTIONS

- A. Alternate products other than those listed by name in the specification will not be considered without prior written consent from the Lighting Consultant.
- B. Substitutions for the specified lighting products are not acceptable and will not be considered in the bid process. Failure to include one of the specified products as a part of the base bid may, at the discretion of the Architect, invalidate the entire lighting product bid and exclude the contractor from further consideration.
- C. Should the contractor wish to have considered products other than those specified, the items must be submitted 7 days in advance of the bid. Failure to submit within that deadline constitutes a guarantee that the specified products will be supplied. The Lighting Consultant will invoice the contractor, at appropriate hourly rates, to review any product not listed in the specification. Submittal of a bid for this project shall include a written acknowledgement of these terms for the contractor.
- D. Equal manufacturers identification by means of manufacturers' names and catalogue numbers is required to establish basic features and performance standards. Any substitutions must meet or exceed these standards. Qualifications: Within sixty days of placement of order, Contractor must furnish independent photometric tests and samples for all alternative luminaires. If these luminaires fail to comply with the specification requirements at that time, Contractor will furnish

acceptable luminaires at no additional cost to Owner and with no delay to the project.

- E. Any submittals for cost reduction alternates or value engineering shall include unit prices for the specified manufacturer, the specified equal manufacturer and the proposed alternate.
- F. The Lighting Consultant shall be the sole judge in determining whether proposed substitutions comply with the specifications and shall reserve the right to reject any proposed substitutions.
- G. Any substitutions need to be submitted during the bid/ project buyout phase.
- H. Substitutions need to be submitted via Luminaire Broker. Please refer to Project Number 271565-00 on luminairebroker.com.

#### 1.18 WARRANTY

- A. The Contractor shall warrant the fixture, its finishes and all or its component parts, except ballasts, to be free from defects for a period of one year from date of acceptance if operated within rated voltage range. Replacement of faulty materials and the cost of labor required to make the replacement shall be the responsibility of the Contractor.
- B. Warranty for LED Luminaires: Manufacturer's standard form in which manufacturer agrees to repair or replace luminaires that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period for LED Luminaires: Five years from date of Substantial Completion.

### PART 2 PRODUCTS

#### 2.1 MATERIALS

- A. Provide materials as specified with the following characteristics:
  - 1. Stainless steel:
    - a. AISI type 302 or UNS type S30200 18-8 grade: 18% chromium and 8% nickel austenitic grain structure with excellent corrosion resisters and high strength
    - b. AISI type 316 – most resistant to salt spray and industrial fumes for use in these applications
    - c. AISI type 430 – most economical ferritic chromium steel, very good corrosion resistance, for use only where specified
  - B. Galvanized steel: coated steel with zinc by a method of hot dipping or electroplating.
  - C. Aluminum: a pure metal, aluminum and aluminum alloys meeting the national standard ANSI H35.1-1982
  - D. Bronze: copper alloy, principal alloying elements are phosphor, aluminum, silicon and tin
  - E. Brass: copper alloy, principal alloying element is zinc. Wrought brass is of UNS designation C20000, C30000, C40000, C66400 to C69800. Cast brass includes leaded red brass (C83600), leaded semi red brass (C84400), and yellow and leaded yellow brass (C85200 to C85700).
  - F. Copper: a pure metal. Copper or high copper alloy containing less than 6% alloying elements. Wrought copper has UNS designation C10000. Cast copper has UNS designation C80100 to C82800.
  - G. Zinc: a pure metal. May be specified as an alloying element in copper and aluminum.
  - H. Glass: all glass shall be heat strengthened (tempered) clear float glass should conform to the

requirements of Federal Specification DD-G-1403B, transmittance not less than 88% or laminated safety glass. For exterior luminaires, use Borosilicate glass, tempered, Corning #7740. For luminaires directly exposed to the elements and aimed above horizontal with radiant energy of 4.16 watts per square inch or greater, use Vycor glass.

- I. Acrylic: 100% virgin acrylic polymer, colorless
- J. Neoprene: all neoprene rubber should be heat resistant to withstand heat generated by lamp operation.
- K. Silicone: plastic based on silicon which is not an organic compound. Suitable for use in a wide temperature range (-80 to +500° F). Used as an additive to plastic to improve adhesion, increase strength and improve water resistance.

## 2.2 FABRICATION

- A. Provide thickness of metal required or as specified so that all luminaires are rigid, stable and will resist deflection twisting, warping or bending under normal installation procedures, loading, relamping, etc. or no less than as follows:
  - 1. All steel luminaire housings minimum 20 gauge cold rolled steel
  - 2. All aluminum extrusion housings minimum 0.125" thick
  - 3. All spun, hydroformed, or sheet aluminum reflectors fabricated from #12 aluminum sheets, minimum 15 gauge, 0.57" or heavier
  - 4. All acrylic lenses minimum 0.1875" thick
  - 5. All glass lenses minimum of 0.375" thick
  - 6. All cast aluminum or bronze housings minimum of 0.375" thick
  - 7. All sheet bronze, steel, aluminum or other metal plate minimum of 22 gauge
- B. Provide neoprene or silicone gasketing, stops, and barriers where required to prevent light leak or water and water vapor (penetration).

## 2.3 FINISHES

- A. Luminaire finishes shall be applied in a manner that will assure a durable, wear resistant surface.
- B. Prior to finishing, all surfaces shall be free from foreign materials such as dirt, rust, oil, polishing compounds and mould release agents.
- C. Where necessary, surfaces shall be hot cleaned by accepted chemical means and shall receive corrosion inhibiting (phosphating) treatment assuring positive paint adhesion.
- D. Exposed metal surfaces used in interior areas, except chromium-plated parts, shall be given an even coat of high grade metacrylate lacquer, or transparent epoxy with a satin finish.
- E. All castings, extrusions and spinings shall be machined, sanded or similarly treated and given minimum one coat of baked-on clear metacrylate lacquer, unless a painted finish is specified, to provide a consistent texture, color and finish throughout all exposed surfaces.
- F. Exterior metal surfaces such as extruded parts or castings that do not otherwise receive a finishing coating, shall be machined, sanded or similarly treated. All such finished components shall be given a minimum of one coat of baked-on clear methacrylate lacquer, satin finish, unless an alternate finish is specified.
- G. Aluminum surfaces exposed to the weather shall receive a duronodic or polyester powder paint or clear metacrylate lacquer finish as specified for corrosion resistance. When in contact with concrete, aluminum shall be coated with bituminous paint, zinc chromate primer, or separated by

a layer of plastic or other gasketing material. Creosote and tar coatings should not be used because of their acid contents.

- H. Sheet steel luminaire housings, iron and steel parts, which have not received phosphate treatment ('Bonderizing' or similar process) or are to be used in exterior applications shall be made corrosion resistant by zinc or cadmium plating, or hot-dip zinc galvanizing after completion of all forming, welding or drilling operations. Where aluminum parts come in contact with steel (or other metals) the steel shall be zinc plated or cadmium plated. Minimum thickness of above protective coatings shall be:
  - 1. Hot galvanized zinc coating: 0.00050
  - 2. Cadmium plating: 0.00015
- I. Parts operated under temperatures injurious to hot-dipped galvanizing shall be electroplated.
- J. Where aluminum parts come in contact with bronze parts, apply to both surfaces a coating of Corogard No. 1706 as manufactured by Minnesota Mining & Manufacturing Company.
- K. Completely form painted reflectors before application of primer and enamel color coats. Reflectors and reflector bodies for fluorescent lamp luminaires having baked-on white enamel finish, shall be made of steel of the thickness specified and given a suitable primer and white color coats properly applied to meet the following requirements and tests:
  - 1. Initial reflection factor not less than 86%
  - 2. After 100 hours of exposure to a fade-o-meter, reflection factor not less than 85% and finish shows no visible color change
  - 3. Exposure for 48 hours to either hydrogen sulphide or sulphur dioxide causes no more than slight yellowing and no blistering
  - 4. A spot test with 5% potassium hydroxide at room temperature for four hours shows no effect other than a loss of not over 15% gloss
  - 5. Contact with 5% soda ash solution at room temperature for 24 hours shows no effect
  - 6. Exposure to 100% humidity at 110° F for 100 hours (Cook Box Test) shows no blistering or other effects
  - 7. Salt spray (20% sodium chloride) for 150 hours causes no breakdown of film
  - 8. Tabor Abrasion Test shows no more than 15mgm per 500 cycles, using CS-10 wheel
  - 9. Erickson Bump Test shows a minimum of 0.12" of penetration before cracking
  - 10. Sward Hardness Test minimum of 30
  - 11. Specular gloss, in accordance with ASTM method D-523-T, procedure A, minimum of 80
- L. When requested by the Lighting Consultant, the Contractor shall submit a sufficient quantity of flat metal panels having the identical primer and color coats applied in the same manner as proposed for the contract items, for subjection to any one or all of the tests listed herein by a recognized independent testing laboratory. Provide panels of suitable size and drilled as necessary for a particular test procedure. The Contractor shall bear the cost of all required tests.

## 2.4 WIRING

- A. All wiring shall comply with the following:
  - 1. All wiring devices within Luminaires or from the Luminaire to the splice with project branch circuit wiring shall be as specified below.
  - 2. Wiring between lampholders and associated operating and starting equipment shall be of similar or heavier gauge than the leads furnished with the approved types of drivers, transformers or ballasts with equal or better insulating and heat resisting characteristics.
  - 3. Wire leads to the receptacle or connector of any side-prong incandescent lamp or any 'cool-beam' lamp using a dichroic reflector shall be SF-2 (silicone rubber insulated) stranded wire.

- Wire within housing entirely covered with flexible woven fiberglass sleeve.
4. Wiring shall be protected with tape or tubing at all points where abrasion may occur.
  5. Wiring shall be concealed within the luminaire construction except where design or mounting dictates otherwise.
  6. Connections of wires to terminals of lampholders and other accessories shall be made in a neat and workmanlike manner and electrically and mechanically secure with no protruding or loose strands. The number of wires extending to or from the terminals of a lampholder or other accessory shall not exceed the number which the accessory is designed to accommodate.
  7. Joints in wiring within luminaires and connections of the luminaire wiring to the wiring of the building shall be as specified Section 260519 'Low Voltage Conductors and Cables'.
  8. Wiring channels and wireways shall be free from projections and rough or sharp edges throughout and all points or edges over which conductors must pass and may be subject to injury or wear, shall be rounded and bushed.
  9. Insulated bushings shall be installed at points of entrance and exit of flexible wiring.
  10. Junction boxes attached to luminaires shall be manufactured in accordance with the National Electrical Code and listed for the number of conductors indicated on the drawings. Supplementary junction boxes shall be installed where required to comply with Code.
  11. All exposed wire shall be jacketed with a flexible woven fiberglass sleeve or similar flexible metallic or armored cable (BS) or EMT type conduit.
  12. When exposed, all junction boxes and conduit to be painted as per the architects' direction.

## 2.5 MARKING OF LUMINAIRES

- A. Markings shall be clear and located to be readily visible to service personnel, but invisible from normal viewing angles when lamps are in place.
- B. Luminaires designed for voltages other than 110-125 volts shall be marked with operating voltage.
- C. Luminaires equipped for operation of a specific lamp type shall be clearly marked 'USE \_\_\_\_\_ LAMPS ONLY'.
- D. Luminaires designed for operation of lamps below the rated enclosure maximum shall be clearly marked 'Lamp Watts Not to Exceed \_\_\_\_\_' to maintain the design energy load.

## 2.6 SOUND TRANSMISSION

- A. Sound transmission through the light luminaire units, when spaced as indicated on drawings, shall be sufficiently attenuated to maintain speech privacy between adjoining spaces. Contractor to provide insulating battens around the luminaires where sound transmission levels are unacceptable.
- B. Luminaires shall not produce audible noise when installed.

## 2.7 THERMAL PROTECTORS

- A. Provide thermal protectors as required by the NEC, or as required by local code, to prevent operation of luminaires in enclosed spaces or adjacent to combustible materials at rated temperatures at or above 90°C (194°F).
- B. Luminaires listed for operation in fire-resistant material at temperatures up to 150°C (302°F) shall be plainly marked.

## 2.8 LAMPS

- A. Lamps as specified for the individual luminaires or lighting equipment shall be delivered and installed in luminaires and lighting equipment leaving these completely lamped and in normal

operating condition.

- B. Luminaires shall not be installed to track until aiming and adjustment takes place, just prior to the project's completion.
- C. Architectural lighting shall not be operated for work light at any time during construction, nor shall it be illuminated for any other reason. Failure to comply with this requirement will make necessary the replacement of fixtures by the contractor at no additional cost to Owner just prior to turnover of area to Owner.
- D. Unless indicated otherwise on luminaire data sheets, all lamps shall have a CRI greater than 90, and shall be 3500K color temperature.

## 2.9 LED (LIGHT EMITTING DIODE) MODULES

### A. Color Quality

- 1. Correlated Color Temperature (CCT)
  - a. CCT shall be 3500K unless otherwise indicated.
- 2. Color Consistency
  - a. CCT Tolerance: CCT tolerance shall be +/- 50K.
  - b. Chromaticity: All LED sources at the same CCT shall fall within a maximum of 2 MacAdam ellipses on the CIE 1931 xy chromaticity diagram
  - c. Duv Tolerance: Color shift from the black body curve between different LED modules at the same color temperature shall be less than or equal to +/- .002.
  - d. Color Consistency Over Time: After 50,000 hours of illumination, individual fixtures or LED modules shall not have more color shift than is listed above for CCT tolerance, Chromaticity, and Duv tolerance.
- 3. Color Rendering Index (CRI)
  - a. Aggregate Value: The aggregate CRI value of the source shall be greater than 90. Aggregate value shall be calculated based on IESNA TM-30-15.
  - b. R9 Value: The CRI value at CRI reference color R9 shall be greater than 90.

### B. Spectral Data

- 1. Spectral Power Distribution shall be available and provided for each source at maximum 10 nm increments from 380 nm to 780 nm.

### C. Ultraviolet Light Output (UV)

- 1. Light output power at 400nm and below shall be 0.

### D. Lamp Life

- 1. Rated Lumen Maintenance Life (per LM-80-08) shall be minimum 50,000 hours at L<sub>70</sub>.

### E. Maintenance

- 1. Both LED module and driver shall be able to be replaced without soldering or sending the luminaire back to the manufacturer. Quick-connect devices are preferred.

### F. Warranty

- 1. Warranty on complete luminaire assembly (driver, LED module, fixture housing) shall be a minimum of 5 years. Warranty shall be by luminaire manufacturer as the sole source of service.

## G. Testing, Reports and Listings

1. The following reports and listings shall be completed by the manufacturer through an independent testing lamp and available during the design process for review, and required for construction submittals:
  - a. LM-79-08 – Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products.
  - b. LM-80-08 – Approved Method: Measuring Lumen Maintenance of LED Light Sources
  - c. TM-30-15 – Method of Evaluating Light Source Color Rendition
  - d. Light source spectral power distribution data at 10 nm increments from 380 to 780 nm.
  - e. UL listed as a complete luminaire.

## 2.10 LED DRIVERS

## A. General Requirements:

1. Operate for at least 50,000 hours at maximum case temperature and 90 percent non-condensing relative humidity.
2. Provide thermal fold-back protection by automatically reducing power output (dimming) to protect LED driver and LED light engine/fixture from damage due to over-temperature conditions that approach or exceed the LED driver's maximum operating temperature at calibration point.
3. Provide integral recording of operating hours and maximum operating temperature to aid in troubleshooting and warranty claims.
4. Designed and tested to withstand electrostatic discharges without impairment when tested according to IEC 61000-4-2.
5. Manufactured in a facility that employs ESD reduction practices in compliance with ANSI/ESD S20.20.
6. UL 8750 recognized or listed as applicable.
7. UL Type TL rated where possible to allow for easier fixture evaluation and listing of different driver series.
8. UL 1598C listed for field replacement as applicable.
9. Designed and tested to withstand Category A surges of 4,000 V according to IEEE C62.41.2 without impairment of performance.
10. Class A sound rating; Inaudible in a 27 dBA ambient.
11. Demonstrate no visible change in light output with a variation of plus or minus 10 percent change in line-voltage input.
12. LED drivers of the same family/series to track evenly across multiple fixtures at all light levels.
13. Offer programmable output currents in 10 mA increments within designed driver operating ranges for custom fixture length and lumen output configurations, while meeting a low-end dimming range of 100 to 1 percent or 100 to 5 percent as applicable.
14. Meet NEMA 410 inrush requirements for mitigating inrush currents with solid state lighting sources.
15. Employ integral fault protection up to 277 V to prevent LED driver damage or failure in the event of incorrect application of line-voltage to communication link inputs.
16. LED driver may be remote located up to 100 feet (30 m) from LED light engine depending on power outputs required and wire gauge utilized by installer.

## B. Compatibility with lighting control protocol

1. Contractor shall verify and confirm all LED drivers are compatible with the lighting control protocol from the overall lighting control system, devices, control modules and associated control points.

## C. 3-Wire Control:

1. Provide integral fault protection to prevent driver failure in the event of a mis-wire.
2. Operate from input voltage of 120 V through 277 V at 50/60 Hz.

D. Digital Control:

1. Employ power failure memory; LED driver to automatically return to the previous state/light level upon restoration of utility power.
2. Operate from input voltage of 120 V through 277 V at 50/60 Hz.
3. Automatically go to 100 percent light output upon loss of control link voltage and lock out system commands until digital control link voltage is restored.
4. Each driver responds independently per system maximum.
5. Responds to digital load shed command. (Example: If light output is at 30 percent and a load shed command of 10 percent is received, the ballast automatically sets the maximum light output at 90 percent and lowers current light output by three percent to 27 percent).
6. Digital low-voltage control wiring capable of being wired as either Class 1 or Class 2.

E. Product(s):

1. Forward Phase (Neutral Wire Required), One Percent Dimming:
  - a. Dimming Range: 100 to one percent relative light output.
  - b. Complies with FCC requirements of CFR, Title 47, Part 15, for commercial and residential applications at 120 V.
  - c. Total Harmonic Distortion (THD): Less than 20 percent at full output; complies with ANSI C82.11.
  - d. Constant Current Drivers:
  - e. Support for light fixtures from 200 mA to 2.1 A to ensure a compatible driver exists.
  - f. Pulse Width Modulation (PWM) or Constant Current Reduction (CCR) dimming methods available.
  - g. UL listed.
  - h. Constant Voltage Drivers:
  - i. Support for light fixtures from 10 V to 60 V (in 0.5 V steps) to ensure a compatible driver exists.
  - j. Pulse Width Modulation (PWM) dimming method.
  - k. UL listed.

F. 3-Wire and Digital Control, One Percent Dimming:

1. Dimming Range: 100 to one percent relative light output.
2. Complies with FCC requirements of CFR, Title 47, Part 15, for commercial applications at 120 V or 277 V.
3. Total Harmonic Distortion (THD): Less than 20 percent at full output; complies with ANSI C82.11.
4. Constant Current Drivers:
  - a. Support light fixtures from 200 mA to 2.1 A to ensure a compatible driver exists.
  - b. Pulse Width Modulation (PWM) or Constant Current Reduction (CCR) dimming methods available.
  - c. UL listed.
5. Constant Voltage Drivers:
  - a. Support for light fixtures from 10 V to 60 V (in 0.5 V steps) to ensure a compatible driver exists.
  - b. Pulse Width Modulation (PWM) dimming method.
  - c. UL listed.

## 2.11 REFLECTORS

A. Reflectors and reflecting cones or baffles shall be as follows:

1. Absolutely free of any tooling marks, including spinning lines, indentations caused by riveting or other assembly techniques
  2. No rivets, springs or other hardware visible after installation
  3. First quality polished, buffed and anodized finish, 'Alzak' or equal
  4. Specular finish color as selected by the architect or as specified in paragraph 3.04 of this section
  5. All reflector and baffles of modified elliptical contour, with no apparent brightness from above 40° above the nadir, with no lamp image or any part of the lamp visible from above 40° above the nadir
  6. Cone flange formed as an integral part of the cone and with identical color and finish. Width of the flange covers all ceiling opening without light leaks or hardware visible.
- B. Other aluminum reflectors shall be as follows:
1. Formed and finished as noted on the drawings and elsewhere in the specification
  2. Reflectors free from blemishes, scratches or indentations which would distort their reflective function
  3. Finished by means of the 'Alzak' process or equal unless otherwise noted.
- C. Samples of colored aluminum finishes (black, brass, bronze etc.) shall be submitted for review before fabrication.
- D. All reflectors shall be finished according to the minimum requirements outlined below.
1. Class MI for normal interior service
    - a. Minimum Weight of Coating: 0.5 mg/sg in.
    - b. Minimum Reflectivity: 83% Specular; 75% Diffuse
  2. Class SI for medium service, interior industrial, exterior when operated within glass
    - a. Minimum Weight of Coating: 7.5 mg/sg in.
    - b. Minimum Reflectivity: 82% Specular; 73% Diffuse
  3. Class SE for exterior industrial or commercial service, exposed to atmosphere, and marine service enclosure
    - a. Minimum Weight of Coating: 10 mg/sg in.
    - b. Minimum Reflectivity: 78% Specular; 65% Diffuse
  4. Class M for marine service not protected by enclosure
    - a. Minimum Weight of Coating: 13 mg/sg in.
    - b. Minimum Reflectivity: 78% Specular; 65% Diffuse

## 2.12 LENSES

- A. All lenses secured by positive means with neoprene or silicone gasketing or washers as required to hold the lens tight within a frame or attach to a housing.
- B. All glass lenses shall be heat treated (tempered) or sealed with a clear acrylic laminate layer to provide a 'safety glass' rating. All lenses that require removal for relamping or normal maintenance shall be attached to the luminaire housing by a minimal length of safety chain to prohibit the lens from falling and striking surrounding surfaces. Glass edges exposed during the relamping process gasketed to prevent chipping or cracking.
- C. Glass lenses specified as translucent or 'opal' shall be treated as follows:
1. Sand blasted
  2. Acid etched
  3. White flashed
- D. Acrylic lenses shall be 100% virgin acrylic polymer, colorless, as manufactured by Rohm Hass, or

Dupont.

- E. The quality of the raw acrylic material must exceed IES, SPI and NEMA specifications by at least 100% which, as a minimum standard, shall not exceed yellowness factor of 3 after 2000 hours of exposure in the Fade-o-meter or as tested by an independent test laboratory. Acrylic plastic lenses and diffusers shall be properly cast, molded or extruded as specified and shall remain free of any dimensional instability, discoloration, embrittlement, or loss of light transmittance for at least 15 years.

#### 2.13 LOUVERS

- A. All louvers shall be fabricated of the specified material.
- B. Louver finishes shall be provided as specified.
- C. All plastic parabolic louvers shall be destaticized before and after fabrication to insure minimum maintenance.
- D. All metal louvers shall be coated with anti-rust material and electrostatically painted.
- E. All louvers shall be heat tested to withstand lamp-operating temperatures with no deformation of shape, paint blistering or discoloration.

#### 2.14 LUMINAIRE TRIMS

- A. Luminaires shall have finish trim designed for the ceiling types into which they are being installed.
  - 1. Recessed luminaires:
    - a. Plaster TL – trimless
    - b. Concrete IR – inside reveal
    - c. Wood OL – overlap trim
    - d. Gypsum TL – trimless
- B. Contractor shall confirm trim type for recessed luminaires is compatible with ceiling types.

#### 2.15 EMERGENCY LIGHTING

- A. Emergency lighting installation shall adhere to applicable code for project location.
- B. Designated emergency luminaires shall be provided with emergency power from a generator, separate service, central battery, or distributed battery packs.
- C. When battery packs are used to supply power for emergency lighting, an appropriate test apparatus shall be installed in accordance with the applicable code, in locations per Architect's direction.
- D. Emergency power for emergency lighting shall be capable of operating for a duration of 90 minutes without falling below 60% of initial light output.
- E. Infrastructure for temporary emergency lighting units shall be provided, along with a selection of units.

#### 2.16 EXIT SIGNS

- A. Exit signs shall be by the Architect and meet the following requirements:
  - 1. Use only light emitting diodes (LED) as light sources.

2. Local Code Compliant
  3. Must be warranted for at least 20 years.
  4. Be UL listed.
  5. Have left and right arrows available on all signs.
  6. Single-sided 8 inch signs shall use no more than 5 watts.
  7. Double-sided 8 inch signs shall use no more than 8 watts.
  8. THD shall not exceed 10%.
  9. Minimum power factor of 0.9.
  10. Shall have continuous stroke lettering.
- B. Exit signs shall have the following attributes unless otherwise indicated in the luminaire data sheets:
1. Manufacturers:
    - a. Cooper Lighting
- C. Housing: Die Cast aluminum. Mounting type to recessed unless otherwise indicated on drawings to be determined based on ceiling conditions – exit sign shall have options for wall, ceiling, and pendant mounting.
- D. Face: Polished extruded acrylic edge lit panel shall have precision etched letters 8" high. Color of letters shall be red with LED sensitive inks. Background color shall be clear.
- E. Direction Arrows: As indicated on drawings.
- F. Mounting: Recessed; unless indicated otherwise on drawings.
- G. Lamps: LED - Manufacturer's standard.
- H. Input Voltage: 120 volts.

## 2.17 LIGHTING FIXTURE SUPPORT COMPONENTS

- A. Comply with Division 26 Section "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.
- C. Twin-Stem Hangers: Two, 1/2-inch (13-mm) steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.
- D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm).
- E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage (2.68 mm).
- F. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.
- G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

## 2.18 DISCONNECTS

- A. All fixtures shall be provided with disconnecting means to allow the ballast or driver to be serviced in place. Acceptable means include a switch integral to the luminaire or quick connect latching modular plug between ballast and branch circuit, internal to the luminaire.

## 2.19 REQUIREMENTS FOR INDIVIDUAL LIGHTING FIXTURES

- A. Refer to Luminaire Data Sheets in Part 4 of this section with manufacturer information and requirements. Features noted within the product data sheets shall be considered part of the fixture requirements for any named manufacturers.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. The Contractor shall coordinate exact quantities and critical dimensions with field conditions.
- B. The Contractor shall verify and coordinate that appropriate framing, support structures, mounting brackets and other required structural connections are provided by the general contractor or other trades to ensure a timely, neat installation of all luminaires.
- C. The Contractor shall coordinate and provide any associated mounting hardware, conduit connections, or associated appurtenances to effectively install the luminaires. Provide each light luminaire with complete installation instructions. All luminaires to be installed in strict conformance with manufacturer's recommendations and instructions.
- D. Exact locations and orientations of all luminaires including mounting heights and plan dimensions shall be per the architectural drawings. Any ambiguities or conflicts in this dimensional information shall be identified to the Architect prior to installation.
- E. Do not install exposed luminaires, reflectors or trims until all plastering and painting that may mar luminaire finish is completed. Replace blemished, dented, damaged or unsatisfactory luminaires and mounting surfaces as directed.
- F. Set units plumb, square, and level with ceiling and walls, and secure according to manufacturer's written instructions and approved Shop Drawings. Set all trims for uniform alignment
- G. Support luminaires according to requirements.
  - 1. Sized and rated for luminaire weight.
  - 2. Able to maintain luminaire position after cleaning and relamping.
  - 3. Provide support for luminaire without causing deflection of ceiling or wall.
  - 4. Luminaire mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and vertical force of 400 percent of luminaire weight.
  - 5. Support all luminaires independent of ductwork or piping.
- H. Pole Mounted Luminaire:
  - 1. Fasten luminaire to indicated structural supports.
  - 2. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.  
Adjust aimable lighting fixtures under supervision of Lighting Consultant (Arup) as designated by Architect. Contractor shall coordinate meeting time for aiming at night with Lighting Consultant and a work crew as determined necessary by lighting Consultant. All required equipment shall be available for aiming, including ladders or other lift equipment, and lamps and accessories as specified.
- I. Structural Analysis Criteria For Pole Selection
  - 1. All load criteria for poles shall be verified with the Structural Engineer by the Contractor.

2. Dead Load: Weight of luminaire and its horizontal and vertical supports, lowering devices, and supporting structure, applied as stated in AASHTO LTS-4-M.
3. Ice Load: Load of 3 lbf/sq. ft. (145 Pa), applied as stated in AASHTO LTS-4-M Ice Load Map.
4. Wind Load: Pressure of wind on pole and luminaire and banners and banner arms, calculated and applied as stated in AASHTO LTS-4-M.

J. DELIVERY, STORAGE, AND HANDLING

1. Package aluminum poles for shipping according to ASTM B 660.
2. Store poles on decay-resistant-treated skids at least 12 inches (300 mm) above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.
3. Handle wood poles so they will not be damaged. Do not use pointed tools that can indent pole surface more than 1/4 inch (6 mm) deep. Do not apply tools to section of pole to be installed below ground line.
4. Retain factory-applied pole wrappings on fiberglass and laminated wood poles until right before pole installation. Handle poles with web fabric straps.
5. Retain factory-applied pole wrappings on metal poles until right before pole installation. For poles with nonmetallic finishes, handle with web fabric straps.

K. Pole Installation:

1. Alignment: Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on the pole.
2. Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features unless otherwise indicated on Drawings:
  - a. Fire Hydrants and Storm Drainage Piping: 60 inches (1520 mm).
  - b. Water, Gas, Electric, Communication, and Sewer Lines: 10 feet (3 m).
  - c. Trees: 15 feet (5 m) from tree trunk.

L. Field Conditions

1. Verify existing and proposed utility structures prior to the start of work associated with luminaire installation.
2. Mark locations of exterior luminaires for approval by Architect prior to the start of luminaire installation.

M. Flush-Mounted Luminaire Support:

1. Secured to outlet box.
2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
3. Trim ring flush with finished surface.

N. Wall-Mounted Luminaire Support

1. Attached to structural members in the wall or backing plate attached to wall structural members. Backing plates may exist on either side of the wall or both and must be fully concealed from view unless otherwise indicated.
2. Do not attach luminaires directly to gypsum board.

O. Ceiling-Mounted Luminaire Support:

1. Ceiling mount with two 5/32-inch diameter aircraft cable supports adjustable to 120 inches.
2. Ceiling mount with pendant mount two 5/32-inch diameter aircraft cable supports adjustable to 120 inches.

3. Ceiling mount with hook mount.
- P. Suspended Luminaire Support:
1. Pendants and Rods: Where longer than 48 inches brace to limit swinging.
  2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
  3. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and tubing or rod support for suspension for each unit length of luminaire chassis, including one at each end.
  4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.
- Q. Ceiling-Grid-Mounted Luminaire Support:
1. Units may be supported from suspended ceiling support system. Install ceiling support system rods or wires at a minimum of 4 rods or wires for each luminaire, located not more than 6 inches (150 mm) from luminaire corners.
  2. Install support clips for recessed luminaires, securely fastened to ceiling grid members, at or near each luminaire corner.
  3. Luminaires Smaller than Ceiling Grid: Install a minimum of 4 rods or wires for each luminaire and locate at corner of ceiling grid where luminaire is located. Do not support luminaires by ceiling acoustical panels.
  4. Luminaires of sizes less than ceiling grid: Center in acoustical panel unless indicated otherwise. Support luminaires independently with at least two 3/4-inch (20-mm) metal channels spanning and secured to ceiling tees.
- R. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.
- S. Lamping: Where specific lamp designations are not indicated, lamp units according to manufacturer's instructions.
- T. Luminaire attachment for exterior luminaires: Fasten to structural supports by means of wall brackets.
- U. Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with each other. Secure to prohibit movement.
- V. The Contractor shall verify and coordinate that appropriate framing, support structures, mounting brackets and other required structural connections are provided by the general Contractor or other trades to ensure a timely, neat installation of all luminaires.
- W. The Contractor to coordinate and provide any associated mounting hardware, conduit connections, or associated appurtenances to effectively install the luminaires.
- X. The Contractor shall rigidly align all continuous rows of luminaires for true in-line appearance.
- Y. Install recessed luminaires using accessories and fire stopping materials to meet regulatory requirements for fire rating.
- Z. Install wall mounted luminaires and exit signs at height as indicated on Drawings.
- AA. Install accessories furnished with each luminaire.
- BB. Install specified lamps in each luminaire.

- CC. Install recessed fixtures with trim tight to ceiling, not allowing light leaks onto the ceiling.

### 3.2 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

### 3.3 FIELD QUALITY CONTROL

- A. Inspect each installed luminaire for damage. Replace damaged luminaires and components.
- B. Give advance notice of dates and times for field tests.
- C. Provide instruments to make and record test results.
- D. Tests: Verify normal operation of each luminaire after luminaires have been installed and circuits have been energized with normal power source. Interrupt electrical energy to demonstrate proper operation of emergency lighting installation. Include the following information in tests of emergency lighting equipment:
  - 1. Duration of supply.
  - 2. Low battery voltage shutdown.
  - 3. Normal transfer to battery source and retransfer to normal.
  - 4. Low supply voltage transfer.
  - 5. Photometric Tests: Measure light intensities at night at locations where specific illumination performance is indicated. Use photometers with calibration referenced to National Institute of Standards and Technology (NIST) standards.
  - 6. Check for intensity of illumination.
  - 7. Check for uniformity of illumination.
  - 8. Check for excessively noisy ballasts or drivers.
  - 9. Prepare written report of tests indicating actual illumination results.
- E. Replace or repair malfunctioning luminaires and components, then retest. Repeat procedure until all units operate properly.
- F. Report results of tests.
- G. Replace luminaires that show evidence of corrosion during Project warranty period.
- H. Correct all comments from any punch list or site report.

### 3.4 FOCUS AND ADJUSTMENT

- A. All adjustable lighting units shall be aimed, focused, locked etc by the Contractor by direction or under the supervision of the Lighting Consultant.
- B. A pre-focus meeting shall be held with the Contractor and Lighting Consultant to review initial aiming strategy for all adjustable and orientation specific luminaires. The Lighting Consultant shall indicate the scope of the adjustments required during this coordination exercise with the various contractors, who then shall determine the number of crews (foreman and apprentice) required.
- C. All focusing and adjusting shall be carried out after the entire installation is complete and working including the lighting control system. All ladders, scaffolds, lifts, etc. required shall be furnished by the Contractor at the direction of the Lighting Consultant or as needed for access. As aiming and adjusting is completed, locking setscrews and bolts and nuts shall be tightened securely.
- D. Where possible, units shall be focused during the normal working day based on the pre-focus

meeting and further refinement of focusing shall occur after dark where daylight interferes with seeing the effect of the luminaire. This refinement shall be accomplished after dark or during the night, at a time mutually agreeable to Contractor, Lighting Consultant, Architect and Owner. Adjustments shall be made by the Contractor in accordance with the Lighting Consultant's stated intent, under his/her observation. This may require multiple focusing sessions.

- E. A focus and adjustment session under the base scope shall be held upon completion of the entire project for focus and aiming of all light fixtures across the project which may include but is not limited to the following:
  - 1. Interior architectural lighting
  - 2. Exterior lighting

### 3.5 CLEANUP

- A. At the time of final acceptance by the Architect, all luminaires shall have been thoroughly cleaned with materials and methods recommended by the manufacturers, any visible damage or broken parts shall have been replaced and all lamps shall be operative.

### 3.6 DEMONSTRATION

- A. Provide systems demonstration under provisions of Division 1.
- B. Provide for a minimum two-hour demonstration of luminaire operation and maintenance.

## PART 4 LUMINAIRE DATA SHEETS AND LIGHTING CONTROLS NARRATIVE

### 4.1 ATTACHMENTS

- A. Fixture Schedule with Luminaire Data Sheets and associated information are appended after this section.
- B. Lighting Controls Narrative.

(REFER TO "265000 LUMINAIRES PART 4A.PDF" AND "265000 LUMINAIRES PART 4B.PDF" ATTACHED)

END OF SECTION

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Landscape Lighting

Type:

**ARUP**  
Project Number: 271565  
Phone: 1 212 896 3000

**Manufacturer:** Ecosense : Trove  
**Description:** Wallwasher

**Fixture Wattage:** 6 W  
**Lumen Output:** 482 lumen  
**Lamp CRI:** 80+

**Lighting Controls:** 0-10V Dimming

**Voltage:** 120 V

**Fixture Finish:** Finish to be specified by landscape architect

**Lamp CCT:** 2700K

**Assembly Code:** L50-E-48-06-27-80-MULT-9x29

TRÖV®

OVERVIEW • SPECIFICATIONS • ORDERING

INTERIOR + EXTERIOR | L50 WASH

DATE	PROJECT	FIRM	TYPE
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THE L50 INCLUDES PATENTED OPTICAL DESIGN THAT DELIVERS THE WIDEST RANGE OF BEAM ANGLE OPTIONS FOR PRECISE COVE, WALL GRAZING, WALL WASHING OR LINE OF LIGHT APPLICATIONS. EXCLUSIVE FLIP TO FLAT™ HINGE DESIGN PROVIDES FLEXIBILITY WHEN MANAGING SMALL COVE DETAILS. TROV OFFERS SMOOTH, FLICKER FREE DIMMING DOWN TO 0%.

**FEATURES :**

- DIM TO 0%, ELV REVERSE PHASE
- 24 BEAM ANGLES
- MULTI-VOLT
- FLIP TO FLAT™
- 6 CCT OPTIONS
- 80+ AND 90+ CRI OPTIONS
- IP54 INTERIOR AND IP66 EXTERIOR OPTIONS



MODEL/ SIZE	INTERIOR/ EXTERIOR	LENGTH	POWER	CCT	CRI	VOLTAGE	OPTICS
L50	I E	12"	02	WHITE	80	MULT (120-277V)	GRAZING
		48"	04	CCT	90*		9 x 9
			06	MONO	Blank For Color		9 x 17
			08	COLOR			9 x 29
			10	GR****			9 x 59
			12	BL			15 x 15
				AM			15 x 23
				RD***			15 x 35
							15 x 65
							COVE
			120**				
			Asym				
			LINE OF LIGHT				
			LOL				

**EXAMPLE:** L50-I-48-10-27-90-MULT-15x65 \*90 CRI not available in 2200K or 5000K \*\*120 is only available with Exterior option. See L35 spec sheet for interior cove options. \*\*\*Red is not available in 12W or 10W. \*\*\*\*Green is not available in 12W.

PERFORMANCE	WATTS	OPTIC	LUMEN OUTPUT	EFFICACY
	2W	40°x 60°	110 lm/LF ( 361 lm/m )	55 lm/W
	4W	40°x 60°	302 lm/LF ( 1037 lm/m )	76 lm/W
	6W	40°x 60°	482 lm/LF ( 1614 lm/m )	80 lm/W
	8W	40°x 60°	675 lm/LF ( 2224 lm/m )	84 lm/W
	10W	40°x 60°	785 lm/LF ( 2644 lm/m )	79 lm/W
	12W	40°x 60°	923 lm/LF ( 3201 lm/m )	77 lm/W

ALL LUMEN DATA IS FROM 4000K 80CRI FIXTURES. PLEASE SEE PHOTOMETRY SPEC SHEET FOR ADDITIONAL LUMEN DATA.

<b>COLOR RENDERING INDEX</b>	80+, 90+			
<b>COLOR CONSISTENCY</b>	2-STEP MACADAM ELLIPSE			
<b>LUMEN DEPRECIATION / RATED LIFE</b>	WATTS	L70 @ 25C	L70 @ 50C	L90 @ 25C   L90 @ 50C
	2W-12W	>150,000	>70,000	>50,000   >25,000

\*CALCULATIONS FOR LED FIXTURES ARE BASED ON MEASUREMENTS THAT COMPLY WITH IES LM-80 TESTING PROCEDURES AND IES TM-21 CALCULATOR

\* CALCULATIONS FOR LED FIXTURES ARE BASED ON MEASUREMENTS THAT COMPLY WITH IES LM-80 TESTING PROCEDURES AND IES TM-21 CALCULATOR

ELECTRICAL	POWER CONSUMPTION	MAX FIXTURE RUN LENGTH												
		2W/LF		4W/LF		6W/LF		8W/LF		10W/LF		12W/LF		
		Volts	Max Run all 1'	Max Run all 4'	Max Run all 1'	Max Run all 4'	Max Run all 1'	Max Run all 4'	Max Run all 1'	Max Run all 4'	Max Run all 1'	Max Run all 4'	Max Run all 1'	Max Run all 4'
		120	214	214	186	186	152	152	114	114	91	91	76	76
		220	374	392	340	340	277	277	209	209	95	167	95	139
		277	374	494	374	428	349	349	263	263	95	190	95	175

4W, 6W, 8W, 10W, 12W >0.9, 2W<0.9  
MULTIVOLT: 110-277VAC, 50/60 Hz  
INTEGRAL TO FIXTURE; DE-RATED POWER AND SYNCHRONOUS START-UP AT FULL BRIGHTNESS  
-40° F TO 122° F (-40° C TO 50° C)  
-40° F TO 122° F (-40° C TO 50° C)  
-40° F TO 176° F (-40° C TO 80° C)

NOTE: Information on this Spec Sheet is subject to change, please visit [ecosenselighting.com/downloads/rise](http://ecosenselighting.com/downloads/rise) for the most updated information.

<b>ECOSENSE</b>	<b>ECOSENSE LIGHTING INC.</b> 837 NORTH SPRING STREET SUITE 103 LOS ANGELES, CA 90012	<b>P • 310.496.6255</b> <b>F • 310.496.6256</b> <b>T • 855.632.6736</b> 855.6.ECOSEN	SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE. VISIT <a href="http://ECOSENSELIGHTING.COM">ECOSENSELIGHTING.COM</a> FOR THE MOST CURRENT SPECIFICATIONS. © 2019 ECOSENSE LIGHTING INC. ALL RIGHTS RESERVED. ECOSENSE, THE ECOSENSE LOGO, RISE, TROV, SLIM COVE AND ECOSPEC ARE REGISTERED TRADEMARKS OF ECOSENSE LIGHTING INC. <b>FREEDOM TO CREATE™</b>	1/3
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Type:  
**ADS01**

Page 1 of 4

**Lighting Notes:**

1. Coordinate length with Landscape Drawings and confirm with Wayfinding Consultant.
2. Contractor to coordinate conduit routing to fixture with electrical and civil scope.

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Type:  
**ADS01**

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OVERVIEW • SPECIFICATIONS • ORDERING

INTERIOR + EXTERIOR | L50 WASH

DATE	PROJECT	FIRM	TYPE
<b>CONTROL</b>	<b>DIMMING</b>	110-277VAC, ELV TYPE 0.07%-100%, REVERSE PHASE, TRAILING EDGE ETC control systems require 0-10V control using EcoSense LDCM. TROV will not work with ETC phase dimmers.	
<b>PHYSICAL</b>	<b>DIMENSIONS</b> <b>HOUSING / LENS</b> <b>WEIGHT</b> <b>CONNECTORS</b> <b>ENVIRONMENT</b>  <b>BEAM ANGLE</b> <b>MOUNTING OPTIONS</b>	W 1.6" x H 2" x L 12"/48"; (41.6mm x 50.5mm x 304.7mm/1201mm) EXTRUDED ALUMINUM; UV STABILIZED POLYCARBONATE; STAINLESS STEEL FASTENERS; PLASTIC ENDCAPS RUBBER OVERMOLD FOR CABLE ASSEMBLY 1.52LBS / 0.69KG (1FT) ; 4.95LBS / 2.25KG (4FT) INTEGRAL MALE/ FEMALE CONNECTORS INDOOR • ETL CERTIFIED FOR DRY/DAMP LOCATIONS IP54 OUTDOOR • ETL CERTIFIED FOR WET LOCATIONS IP66 IMPACT RATED TO IK10 Not intended to be used in water features such as waterfalls, fountains, etc. GRAZING, WASHING, COVE, ASYMMETRIC, LINE OF LIGHT INTEGRAL MOUNTING AND ADJUSTABLE AIMING FROM 0°-180° IN 15° INCREMENTS	
<b>FIXTURE RATING &amp; CERTIFICATIONS</b>	<b>CE, ETL CERTIFIED</b> <b>RoHS COMPLIANT</b> <b>ENERGY STAR COMPLIANT</b> <b>RCM CERTIFIED</b>	    	Title 24 JA8-2016 *90 CRI models only
<b>LIMITED WARRANTY</b>	<b>5 YEARS</b>		

**WIRING OPTIONS (MVOLT): 110-277VAC**

Power Cable Assembly, TROV, Leader/Jumper, 10 foot.....	CBL-3P-L-UNV-10*
Power Cable Assembly, TROV, Leader/Jumper, 50 foot.....	CBL-3P-L-UNV-50*
Power Cable Assembly, TROV, Jumper, 5 foot.....	CBL-3P-L-UNV-05**
Power Cable Assembly, TROV, Jumper, 1 foot.....	CBL-3P-L-UNV-01**
Power Cable Assembly, TROV, Male and Female terminator caps.....	CBL-3P-L-UNV-CAPS

\*Two (2) terminators are included with the 10' and 50' power cable. One Leader need per circuit/fixture run. Cables are not plenum rated.  
\*\* If using the 5' or 1' power cable assembly as a leader to power a run one set of CBL-3P-L-UNV-CAPS will also be need per cable.

**0-10V CONTROL OPTIONS**

100-120VAC / 277VAC Linear Dimming Control Module 0-10V - Plenum Rated ..... LDCM-PL-120-277-010V-GR  
All products come standard with ELV dimming capabilities. 0-10V Control options required for operation at 0-10V.

**OPTIONAL ACCESSORIES**

**Mounting**

Mounting Track and Clips Set, 48 Inch Track, 8 Clips.....	MNT-L-TRKCLIP-48.....	48" track and clips set will work with one 48" fixture or four 12" fixtures. (FOR INTERIOR USE ONLY)
Mounting Track and Clips Set, 12 Inch Track, 2 Clips.....	MNT-L-TRKCLIP-12.....	12" track will not work with 48" fixtures. (FOR INTERIOR USE ONLY)
Mounting Track Clip, TROV, Set of 2.....	MNT-L-CLIP.....	Clips needed = 12" fixtures need 1 set of 2 and 48" fixture needs 2 sets of 2.
90 Degree L bracket, TROV, Set of 2.....	MNT-L-LBKT.....	L-Brackets needed = 12" fixtures need 1 set of 2 and 48" fixture need 1 set of 2.
Angle Locking Clip, TROV, Pack of 10.....	MNT-L-ANGLCK.....	Angle Locks needed = 12" fixtures need 1 and 48" fixtures need 2. (Must order separately)
Mounting, Fine Adjustment Bracket, TROV.....	MNT-L-FAB.....	Fine Adjustment Brackets needed = 12" fixtures need 1 and 48" fixtures need 2. *Fine Adjustment Bracket is highly recommended for Grazing Optics.
Mounting, Fine Adjustment L-Bracket, TROV.....	MNT-L-LFAB.....	Fine Adjustment L-Brackets needed = 12" fixtures need 1 and 48" fixtures need 2. *Fine Adjustment L-Bracket is recommended for Asymmetric Optics when aiming is needed.

**Snap-on Lenses**

Snap-on Lens, Frosted, 12 inch, L50.....	LENS-L50-FROST-12	Snap-on Lenses need = One 12" lens is needed per 12" fixture and one 48" lens is needed per 48" fixture. Snap on Lenses will not work with the asymmetric fixture. Clear lenses can be used to hold colored filters to customize the output color of any TROV fixture, except the ASYM. Color filters supplied by others.
Snap-on Lens, Frosted, 48 inch, L50.....	LENS-L50-FROST-48	
Snap-on Lens, Clear, 12 inch, L50.....	LENS-L50-CLEAR-12	
Snap-on Lens, Clear, 48 inch, L50.....	LENS-L50-CLEAR-48	

**Wall Mount Arm**

Wall Mount Arm, 6 inch, TROV.....	WMA-L-CA-06	Wall Mount Arms needed = For individual fixture installations two arms and one end set will be needed per fixture. For continuous run installation one endset will be needed per run. Each end set contains one left and one right end plate. One joining set will be needed per joint. One arm per fixture will be need plus one extra arm to complete the run. For example: A 10ft run made with two 4ft and two 1ft fixtures will contain; 1 x WMA-L-END, 3 x WMA-L-JNR, and 5 x WMA-L-CA-12. Leader cables are not included with wall mount arms, end sets, or joiners sets.
Wall Mount Arm, 12 inch, TROV.....	WMA-L-CA-12	
Wall Mount Arm, 18 inch, TROV.....	WMA-L-CA-18	
Wall Mount Arm, 24 inch, TROV.....	WMA-L-CA-24	
Wall Mount Arm End Plate Set, TROV, Includes Left and Right.....	WMA-L-END	
Wall Mount Arm Joiner Plate, TROV.....	WMA-L-JNR	

**Louvers**

Louver, Asymmetric, 12 inch, L50.....	LV-L50-ASYM-12	Louvers Needed = One 12" louver is needed per 12" fixture and one 48" louver is needed per 48" fixture. 48" louver is made up of four 12" louvers.
Louver, Asymmetric, 48 inch, L50.....	LV-L50-ASYM-48	Louvers cannot be used with the asymmetric fixture
Louver, Symmetric, 12 inch, L50.....	LV-L50-SYM-12	
Louver, Symmetric, 48 inch, L50.....	LV-L50-SYM-48	
Louver, Honeycomb, 12 inch, L50.....	LV-L50-HCOMB-12	
Louver, Honeycomb, 48 inch, L50.....	LV-L50-HCOMB-48	

**ECOSENSE**

**ECOSENSE LIGHTING INC.**  
837 NORTH SPRING STREET  
SUITE 103  
LOS ANGELES, CA 90012

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**ARUP**

Project Number: 271565  
Phone: 1 212 896 3000

TRÖV®

Type:  
**ADS01**

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OVERVIEW • SPECIFICATIONS • ORDERING

INTERIOR + EXTERIOR | L50 WASH

DATE	PROJECT	FIRM	TYPE
------	---------	------	------

**OPTIONAL ACCESSORIES**

**Masking Plates**

Masking Plate, 3 inch high, 12 inch, L50 & L35 ..... MP-L50-3H-12  
 Masking Plate, 3 inch high, 48 inch, L50 & L35 ..... MP-L50-3H-48  
 Masking Plates needed = One 12" plates is needed per 12" fixture and one 48" plates is needed per 48" fixture.

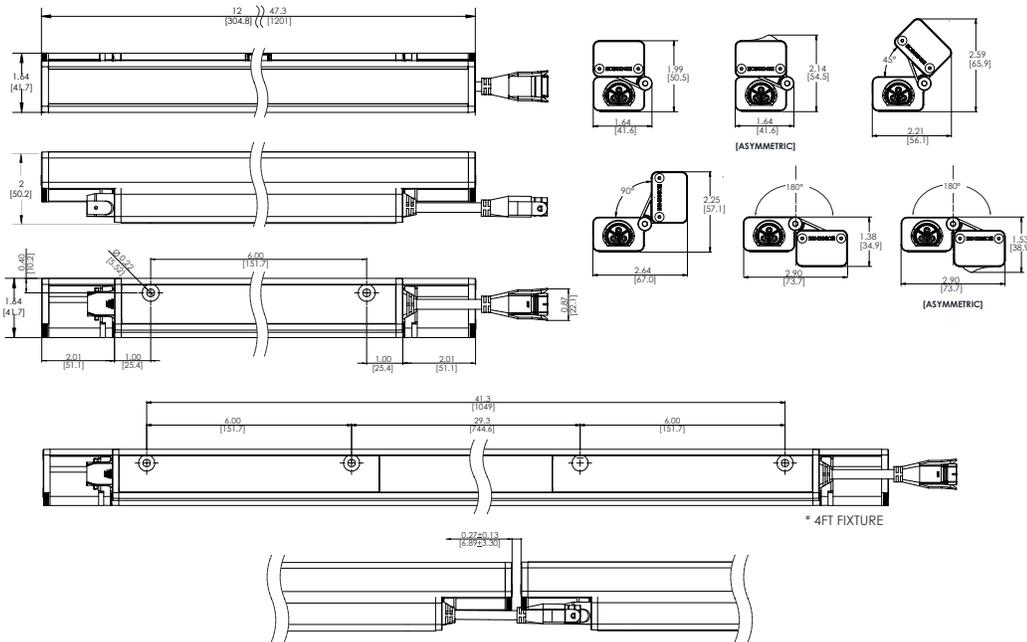
**Landscape Stake**

Landscape Stake, 6 inch, TROV, Set of 2 ..... LS-L-STK-06  
 Landscape Stake, 12 inch, TROV, Set of 2 ..... LS-L-STK-12  
 Landscape Stake, 18 inch, TROV, Set of 2 ..... LS-L-STK-18  
 Landscape Stakes needed = 12" and 48" fixtures both need one set of 2.

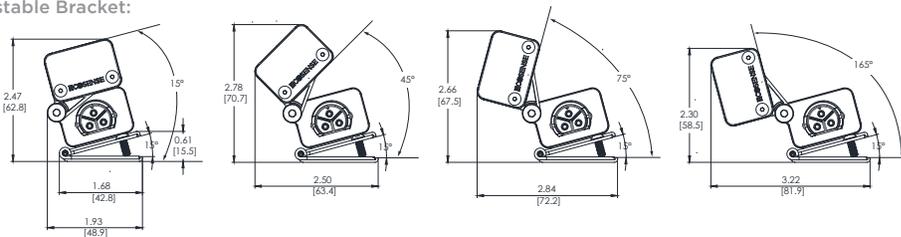
**Wire Box**

Conduit Connection, Wire Box, TROV, Interior Only, L50 ..... CC-L-WIREBOX  
 Wire box can be used instead of a leader cable to start a run. 1/2" conduit fitting can attach directly to the box on one end and the fixture to the other.

DIMENSIONS + MOUNTING



**Fine Adjustable Bracket:**



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Project Number: 271565  
Phone: 1 212 896 3000



TRÖV

Type:  
**ADS01**

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OVERVIEW • SPECIFICATIONS

ACCESSORIES | LANDSCAPE STAKE

DATE	PROJECT	FIRM	TYPE
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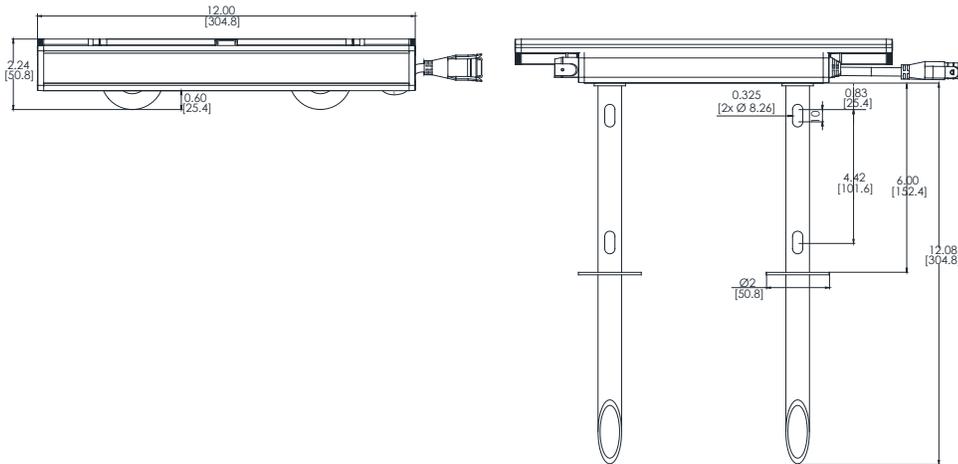
TRÖV LANDSCAPE STAKES ARE IDEA FOR MOUNTING THE FIXTURE IN THE GRASS OR DIRT. THEY ARE TYPICALLY USED TO LIGHT SIGNAGE IN LANDSCAPES

**FEATURES :**

- COMPATIBLE WITH L35 AND L50 SERIES FIXTURES
- MOUNT DIRECTLY INTO THE GROUND
- AVAILABLE IN 6", 12" AND 18" ABOVE GROUND HEIGHTS



**PHYSICAL**      **DIMENSIONS**      W 2" x H 6/12/18" x L 2" ; (50.8mm x 152.4/304.8/457.2mm x 50.8mm) APPROX  
**MATERIAL**      CLEAR ANODIZED ALUMINUM



**ORDERING**

TYPE	MODEL/SIZE	FINISH	LENGTH
LS - LANDSCAPE STAKE	L	STK	06 - 6" 12 - 12" 18 - 18"

**EXAMPLE** LS-L-STK-06

**ONE SET OF LANDSCAPE STAKES INCLUDE TWO PIECES**

**LIMITED WARRANTY** 5 YEARS

ECOSENSE LIGHTING INC.  
915 WILSHIRE BLVD  
SUITE 2175  
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**ARUP**  
Project Number: 271565  
Phone: 1 212 896 3000

**Manufacturer:** Selux : Lenova LED Pole Mount  
**Description:** 14ft Pole Light R3 Type Distribution

**Fixture Wattage:** 24 W  
**Lumen Output:** 2477 lumen  
**Lamp CRI:** 80+

**Lighting Controls:** 0-10V Dimming

**Voltage:** 120 V  
**Fixture Finish:** Dark Gray  
**Lamp CCT:** 2700K  
**Assembly Code:** LAL-R3-X-CL-5G250-XX-30-SP-120-DM-MOD

Date: \_\_\_\_\_ Customer: \_\_\_\_\_  
Project: \_\_\_\_\_  
Type: \_\_\_\_\_ Qty: \_\_\_\_\_

**selux**

**Type:**  
**ALP01**  
Page 1 of 6

**Lanova LED Pole Mount**



**Order Code:** LAL - - - - -

LAL	Pole Order Code:					
	Series	Series	Height	Finish	Options	
Series	LAL Lanova LED					
Optics	R1 Type I Distribution	R2 Type II Distribution	R3 Type III Distribution	R4 Type IV Distribution	R5S Type V Square	R5R Type V Round
Mounting	1 Single	2 Double	W Wall			DB Diffuse Bowl
Cylinder	CL Clear long	FL <sup>1</sup> 1/2 Frosted Long	CT Clear Tapered			<sup>1</sup> DB optics only
Light Engine	5G150 <sup>2</sup> 1556lm, 15W	5G250 <sup>2</sup> 2477lm, 24W	5G350 3468lm, 33W	5G450 4459lm, 42W		<sup>2</sup> Not Available with DM, HL30, or HL50 <sup>*</sup> Based on R2 distribution and 3000K CCT
Power Cord Length	8 8'	10 10'	12 12'	14 14'	16 16'	18 18'
CCT	30 3000K	40 4000K				XX <sup>3</sup> XX'
Finish	WH White	BK Black	BL Semi-Matte Black	BZ Bronze	SV Silver	SP Specify Premium Color
Voltage	120	208	240	277	347 <sup>4,5</sup>	480 <sup>4,5</sup>
Options	DM Dimming (0-10V)	HL30 <sup>6,7</sup> Hi-Lo Switching 30-100%	HL50 <sup>6,7</sup> Hi-Lo Switching 50-100%	HS* House Side Shield		

**Lighting Notes:**

1. Finish to be confirmed by architect.
2. Contractor to coordinate pole mounting with civil scope and other services according to manufacturer recommendations.
3. Modifications include (a) Straight Arms (b) power receptacles hidden in base (c) one circuit per pole.
4. Landscape Architect to Specify Base Cover.
5. Height of pole to be 14'.
6. Refer to Landscape Architect's drawing to determine single or double mount.

**Product Modifications**

Please list modification requirements for review by factory:

**Straight arm, power receptacle hidden in base - one circuit per pole**

**Approvals**

\_\_\_\_\_

Date: \_\_\_\_\_



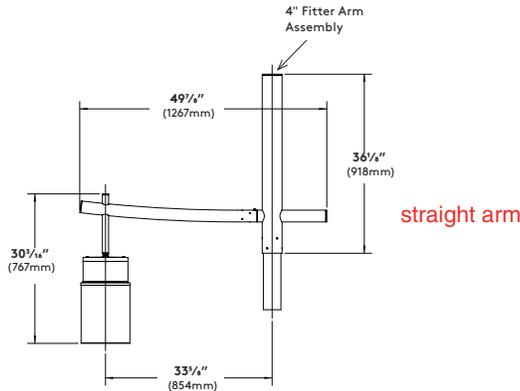
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**ARUP**  
Project Number: 271565  
Phone: 1 212 896 3000

Lanova LED

selux

Type:  
**ALP01**  
Page 2 of 6



Net Weight (19.5 lbs)  
EPA = 0.68 ft<sup>2</sup>

**Specifications**

**Luminaire Housing**

Die cast aluminum housing made from low copper marine grade aluminum.

**Gasketing**

(not shown) Continuous UV resistant silicone gasket provides weatherproofing, dust and insect control at all fixture connections.

**LED Array**

(not shown) High Flux LEDs mounted to metal core PCB and attached to aluminum heat sink for maximum LED performance and life. CCT tolerance within a 3 step bin and provided with a minimum CRI of 80. LED light engine has a reported lumen maintenance of 93% at 50,000 hours. L70 calculated greater than 100,000 hours.

**LED Optics**

Clear half frosted, or tapered UV stabilized acrylic outer cylinder creates the optical chamber. Technical Optics (R1, R2, R3, R4, R5S and R5R) use Selux signature light pattern acrylic lens holder to secure proprietary silicone optics. Diffuser Bowl (DB) option made of highly diffuse UV stabilized acrylic hides LED source and provides a pleasant/soft light quality.

**LED Driver**

LEDs are driven by RoHS compliant constant current programmable LED driver. Driver includes 0-10V dimming to 10%, meets the requirements of IP65 and includes a 5 Year warranty.

**Surge Protector**

(not shown) Independent surge protector device designed to protect luminaire from electrical surge up to 20kA.

**Power Cord**

(not shown) UV resistant black SJ power cord pre-installed at factory. Please specify power cord length available in 1' increments from 5' - 30'.

Standard exterior colors are White (WH), Black (BK), Semi-Matte Black (BL), 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 Lanova 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. For details, see "Selux Terms and Condition of Sale."

**Listings and Ratings:** Luminaire tested to IP65 and LM-79 standards. LEDs tested to LM-80 standards.

**Luminaire suitable for ambient temperatures from 40°C (104°F) maximum to -40°C (-40°F) minimum.**

**NRTL Listed (i.e. UL, CSA)**

**Visit selux.us for our LED End of Life recycling policy.**

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**ARUP**  
Project Number: 271565  
Phone: 1 212 896 3000

Lanova LED

**Mounting**

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Type:  
**ALP01**  
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**1 - Single Arm**

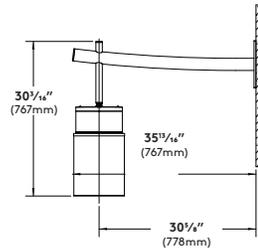
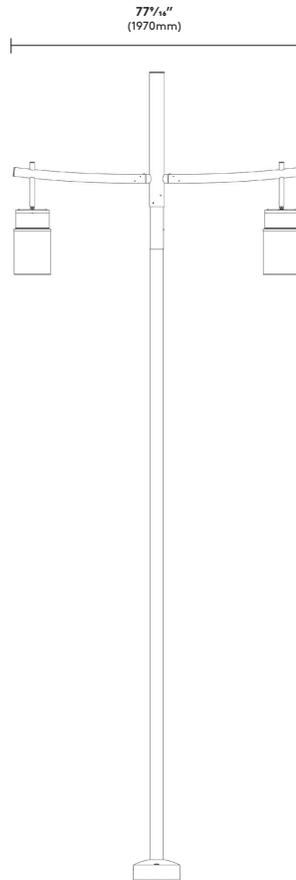
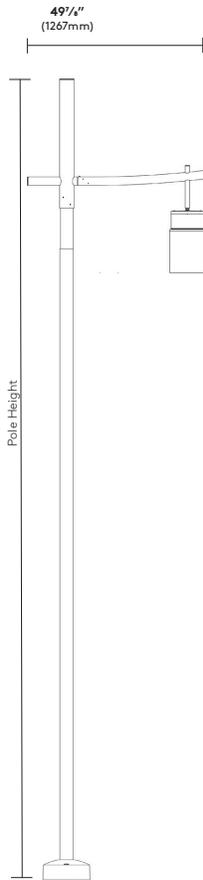
EPA = 1.57ft<sup>2</sup>  
Weight = 32lbs. (15kg)

**2 - Double Arm**

EPA = 1.3ft<sup>2</sup>  
Weight = 55lbs. (25kg)

**W - Wall Mount Arm**

EPA = N/A  
Weight = 24lbs. (11kg)



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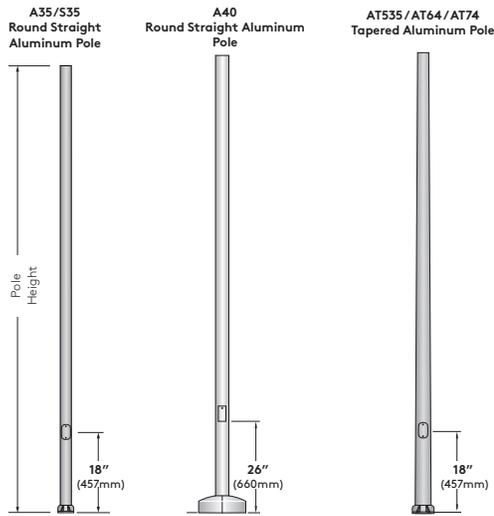
Type:  
**ALP01**

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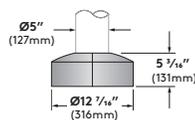
**Pole Information**

Refer to pole specification sheets for construction details, anchorage information and additional options.

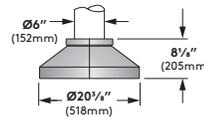
**Optional Base Covers for Poles**  
Die cast aluminum.



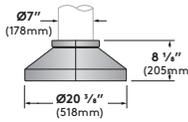
**BC3 Optional Base Cover (AT535)**  
Die cast aluminum, two-piece field installable base cover.



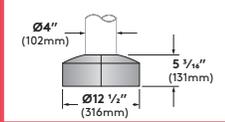
**BC9 Optional Base Cover (AT64)**  
Die cast aluminum, two-piece field installable base cover.



**BC10 Optional Base Cover (AT74)**  
Die cast aluminum, two-piece field installable base cover.



**BC13 Optional Base Cover (A40)**  
Die cast aluminum, two-piece field installable base cover.



Pole Data Chart Pole Series	Bolt Circle	Wind Speed (mph)										Height	Finish	Options
		90	100	110	120	130	140	150	160	170	180			
A35 3/2" Round Straight Aluminum Pole	7 1/2"	4.8	3.5	2.6	1.8	1.3	0.9	0.7	0.6	-	-	12 12ft	WH White	BC3 Decorative Cast Aluminium Base Cover (AT535)
A40 4" Round Straight Aluminum Pole	7 1/2"	9.3	7.2	5.6	4.5	3.7	3.1	2.7	2.3	2.0	1.7			
AT535 5" to 3 1/2" Round Tapered Aluminum Pole	8 1/2"	13.4	10.5	8.4	6.9	5.8	4.9	4.2	3.6	3.2	2.8			
AT64 6" to 4" Round Tapered Aluminum Pole	9 1/2"	20.3	16.1	13.1	10.9	9.2	7.9	6.8	5.9	5.2	4.5	14 14ft	BL Semi-Matte Black	BC10 Decorative Cast Aluminium Base Cover (AT74)
A35 3/2" Round Straight Aluminum Pole	7 1/2"	3.5	2.4	1.6	1.0	0.5	-	-	-	-	-			
<b>A40 4" Round straight Aluminum Pole</b>	<b>7 1/2"</b>	<b>10.3</b>	<b>7.9</b>	<b>6.1</b>	<b>4.9</b>	<b>4.0</b>	<b>3.4</b>	<b>2.9</b>	<b>2.5</b>	<b>2.1</b>	<b>1.8</b>	16 16ft	BZ Bronze	BC13 Decorative Cast Aluminium Base Cover (A40)
AT535 5" to 3 1/2" Round Tapered Aluminum Pole	8 1/2"	11.2	8.7	6.9	5.5	4.6	3.8	3.3	2.8	2.4	2.1			
AT64 6" to 4" Round tapered Aluminum Pole	9 1/2"	17.2	13.6	11.0	9.1	7.6	6.5	5.6	4.8	4.2	3.7			
A35 3/2" Round Straight Aluminum Pole	7 1/2"	2.1	1.2	0.6	-	-	-	-	-	-	-	18 18ft	SV Silver	T35 Supplied with 3/2" diameter tenon, 4/2" high (use for A40, AT64, AT74 only)
A40 4" Round straight Aluminum Pole	7 1/2"	8.3	6.2	4.7	3.6	3.0	2.5	2.1	1.7	1.5	1.2			
AT535 5" to 3 1/2" Round tapered Aluminum Pole	8 1/2"	9.1	6.9	5.4	4.3	3.4	2.9	2.4	2.0	1.7	1.5			
AT64 6" to 4" Round tapered Aluminum Pole	9 1/2"	14.3	11.2	9.0	7.4	6.2	5.2	4.4	3.8	3.3	2.9	18 18ft	SP Specify Premium Color	REC1 GFCI Receptacle with weather-proof cover
A40 4" Round straight Aluminum Pole	7 1/2"	6.6	4.8	3.5	2.6	2.1	1.7	1.4	1.1	0.9	0.7			
AT535 5" to 3 1/2" Round tapered Aluminum Pole	8 1/2"	9.2	7.0	5.4	4.2	3.4	2.8	2.5	2.0	1.7	1.4			
AT64 6" to 4" Round tapered Aluminum Pole	9 1/2"	11.9	9.2	7.3	6.0	4.9	4.2	3.5	3.0	2.6	2.2	18 18ft	REC2 GFCI Receptacle with weather-proof padlockable in-use cover	REC3 USB and Duplex Receptacle with weather-proof cover
AT74 7" to 4" Round tapered Aluminum Pole	10 1/2"	17.5	13.8	11.2	9.2	7.7	6.5	5.6	4.8	4.1	3.5			

Allowable EPA calculated according to AASHTO 1994 and include allowance for 1/3 gust factor. See Mounting Configuration pages for fixture arm weight and EPA values.

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Lanova LED

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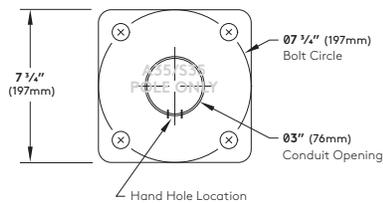
Type:  
**ALP01**  
Page 5 of 6

**Pole Information**

Refer to pole specification sheets for construction details, anchorage information and additional options.

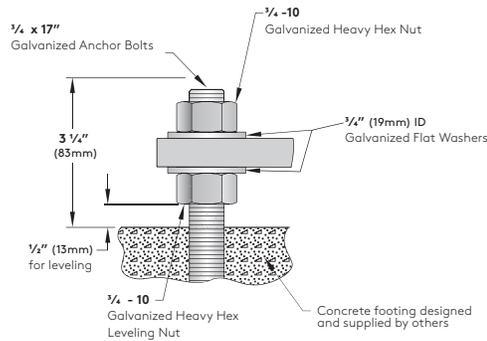
**Bolt Circle for A35 & S35**

Use caution when setting anchor bolts. Bolts must be vertically straight and centered on dimensions shown



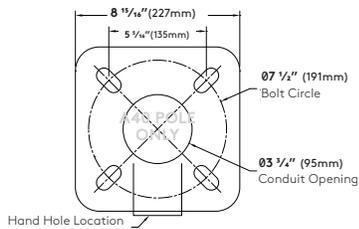
Note: Adequate drainage must be provided in concrete foundation.

**Anchor Bolt Detail for A35 & S35**



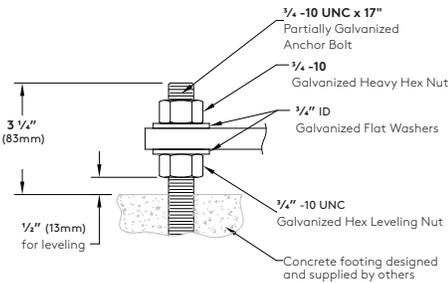
**Bolt Circle for A40**

Use caution when setting anchor bolts. Bolts must be vertically straight and centered on dimensions shown



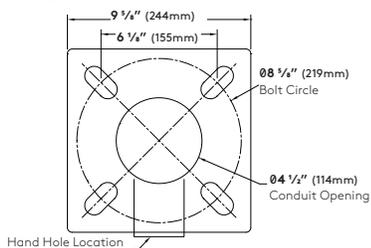
Note: Adequate drainage must be provided in concrete foundation.

**Anchor Bolt Detail for A40**

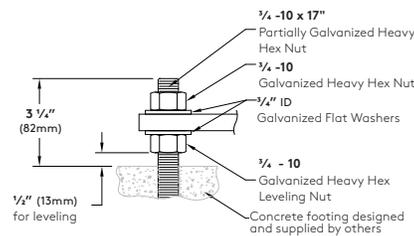


**Bolt Circle for AT535**

Use caution when setting anchor bolts. Bolts must be vertically straight and centered on dimensions shown



**Anchor Bolt Detail for AT535**



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**ARUP**  
Project Number: 271565  
Phone: 1 212 896 3000

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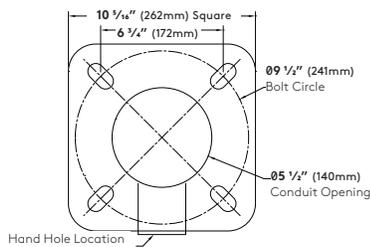
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**ALP01**  
Page 6 of 6

**Pole Information**

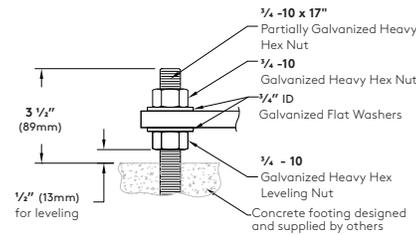
Refer to pole specification sheets for construction details, anchorage information and additional options.

**Bolt Circle for AT64**

Use caution when setting anchor bolts. Bolts must be vertically straight and centered on dimensions shown

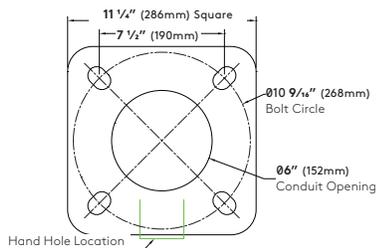


**Anchor Bolt Detail for AT64**

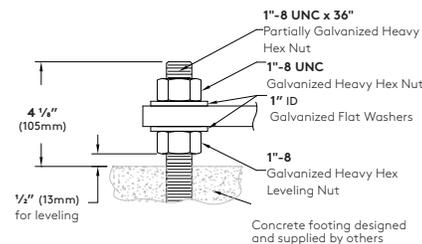


**Bolt Circle for AT74**

Use caution when setting anchor bolts. Bolts must be vertically straight and centered on dimensions shown



**Anchor Bolt Detail for AT74**



**Manufacturer:** Selux : Lenova LED Pole Mount  
**Description:** 14ft Pole Light R1 Type Distribution

**Fixture Wattage:** 24 W  
**Lumen Output:** 2477 lumen  
**Lamp CRI:** 80+

**Lighting Controls:** 0-10V Dimming

**Voltage:** 120 V  
**Fixture Finish:** Dark Grey  
**Lamp CCT:** 2700K  
**Assembly Code:** LAL-R1-X-CL-5G250-XX-30-SP-120-DM-MOD

Date: \_\_\_\_\_ Customer: \_\_\_\_\_  
Project: \_\_\_\_\_  
Type: \_\_\_\_\_ Qty: \_\_\_\_\_

**selux**

Type: **ALP02**  
Page 1 of 8

**Lanova LED Pole Mount**



Order Code: LAL - - - - -

		Pole Order Code: _____						
<u>LAL</u>	Series	LAL	Series	Height	Finish	Options		
	Optics	R1 Type I Distribution	R2 Type II Distribution	R3 Type III Distribution	R4 Type IV Distribution	R5S Type V Square	R5R Type V Round	DB Diffuse Bowl
	Mounting	1 Single	2 Double	W Wall				
	Cylinder	CL Clear long	FL <sup>1</sup> 1/2 Frosted Long	CT Clear Tapered				<sup>1</sup> DB optics only
	Light Engine	5G150 <sup>2</sup> 1556lm, 15W	5G250 <sup>2</sup> 2477lm, 24W	5G350 3468lm, 33W	5G450 4459lm, 42W			<sup>2</sup> Not Available with DM, HL30, or HL50 <sup>*</sup> Based on R2 distribution and 3000K CCT
	Power Cord Length	8 8'	10 10'	12 12'	14 14'	16 16'	18 18'	XX <sup>3</sup> XX'
	CCT	30 3000K	40 4000K					<sup>3</sup> Add length of arm + height of pole to determine power cord length for other CCT please consult factory
	Finish	WH White	BK Black	BL Semi-Matte Black	BZ Bronze	SV Silver	SP Specify Premium Color	
	Voltage	120	208	240	277	347 <sup>4,5</sup>	480 <sup>4,5</sup>	<sup>4</sup> Not available with HL30 or HL50 <sup>5</sup> Requires stepdown transformer, 60 Hz only
	Options	DM Dimming (0-10V)	HL30 <sup>6,7</sup> Hi-Lo Switching 30-100%	HL50 <sup>6,7</sup> Hi-Lo Switching 50-100%	HS* House Side Shield			<sup>6</sup> 120, 240, and 277V Only <sup>7</sup> Not available with DM option <sup>*</sup> Not available with R5S, R5R, or DB optics

**Lighting Notes:**

1. Finish to be confirmed by architect.
2. Contractor to coordinate pole mounting with civil scope and other services according to manufacturer recommendations.
3. Modifications include (a) Straight Arms (b) power receptacles hidden in base (c) one circuit per pole.
4. Landscape Architect to Specify Base Cover.
5. Height of pole to be 14'.
6. Refer to drawing to determine single or double mount.
7. Add alternate: Standard Finish

**Product Modifications**

Please list modification requirements for review by factory:

**Straight arm, power receptacle hidden in base - one circuit per pole**

**Approvals**

\_\_\_\_\_

Date: \_\_\_\_\_



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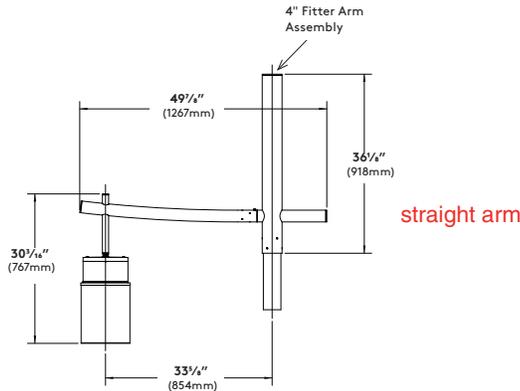
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**ARUP**  
Project Number: 271565  
Phone: 1 212 896 3000

Lanova LED

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Type:  
**ALP02**  
Page 2 of 8



Net Weight (19.5 lbs)  
EPA = 0.68 ft<sup>2</sup>

**Specifications**

**Luminaire Housing**

Die cast aluminum housing made from low copper marine grade aluminum.

**Gasketing**

(not shown) Continuous UV resistant silicone gasket provides weatherproofing, dust and insect control at all fixture connections.

**LED Array**

(not shown) High Flux LEDs mounted to metal core PCB and attached to aluminum heat sink for maximum LED performance and life. CCT tolerance within a 3 step bin and provided with a minimum CRI of 80. LED light engine has a reported lumen maintenance of 93% at 50,000 hours. L70 calculated greater than 100,000 hours.

**LED Optics**

Clear half frosted, or tapered UV stabilized acrylic outer cylinder creates the optical chamber. Technical Optics (R1, R2, R3, R4, R5S and R5R) use Selux signature light pattern acrylic lens holder to secure proprietary silicone optics. Diffuser Bowl (DB) option made of highly diffuse UV stabilized acrylic hides LED source and provides a pleasant/soft light quality.

**LED Driver**

LEDs are driven by RoHS compliant constant current programmable LED driver. Driver includes 0-10V dimming to 10%, meets the requirements of IP65 and includes a 5 Year warranty.

**Surge Protector**

(not shown) Independent surge protector device designed to protect luminaire from electrical surge up to 20kA.

**Power Cord**

(not shown) UV resistant black SJ power cord pre-installed at factory. Please specify power cord length available in 1' increments from 5' - 30'.

Standard exterior colors are White (WH), Black (BK), Semi-Matte Black (BL), 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 Lanova 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. For details, see "Selux Terms and Condition of Sale."

**Listings and Ratings:** Luminaire tested to IP65 and LM-79 standards. LEDs tested to LM-80 standards.

**Luminaire suitable for ambient temperatures from 40°C (104°F) maximum to -40°C (-40°F) minimum.**

**NRTL Listed (i.e. UL, CSA)**

**Visit selux.us for our LED End of Life recycling policy.**

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**ARUP**  
Project Number: 271565  
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Lanova LED

**Mounting**

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Type:  
**ALP02**

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**1 - Single Arm**

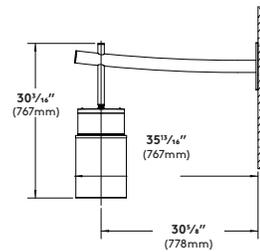
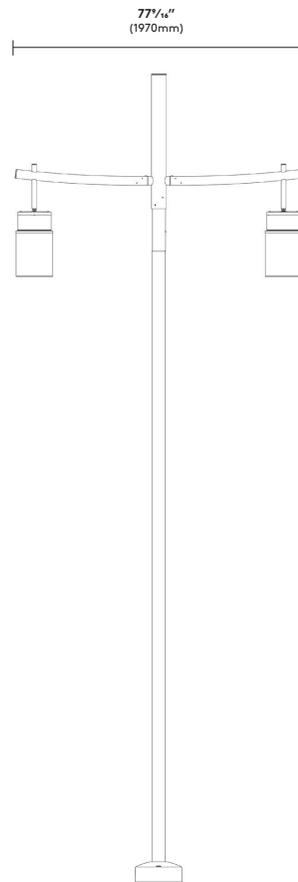
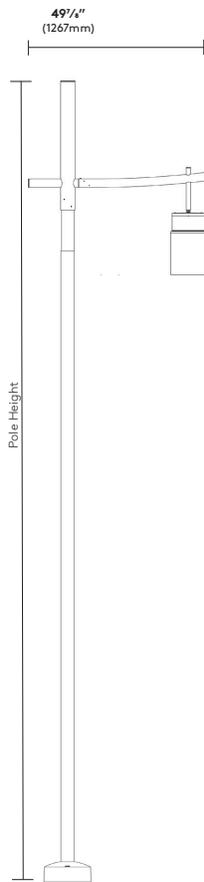
EPA = 1.57ft<sup>2</sup>  
Weight = 32lbs. (15kg)

**2 - Double Arm**

EPA = 1.3ft<sup>2</sup>  
Weight = 55lbs. (25kg)

**W - Wall Mount Arm**

EPA = N/A  
Weight = 24lbs. (11kg)



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Project Number: 271565  
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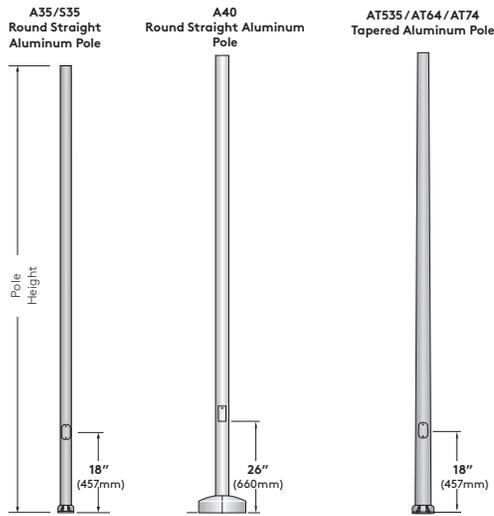
Type:  
**ALP02**

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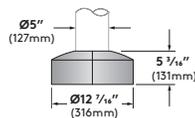
**Pole Information**

Refer to pole specification sheets for construction details, anchorage information and additional options.

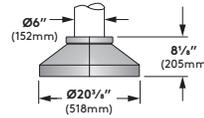
**Optional Base Covers for Poles**  
Die cast aluminum.



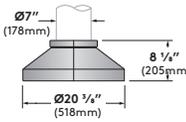
**BC3 Optional Base Cover (AT535)**  
Die cast aluminum, two-piece field installable base cover.



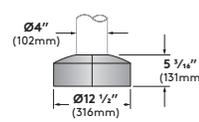
**BC9 Optional Base Cover (AT64)**  
Die cast aluminum, two-piece field installable base cover.



**BC10 Optional Base Cover (AT74)**  
Die cast aluminum, two-piece field installable base cover.



**BC13 Optional Base Cover (A40)**  
Die cast aluminum, two-piece field installable base cover.



Pole Data Chart Pole Series	Bolt Circle	Wind Speed (mph)										Height	Finish	Options
		90	100	110	120	130	140	150	160	170	180			
A35 3/2" Round Straight Aluminum Pole	7 1/2"	4.8	3.5	2.6	1.8	1.3	0.9	0.7	0.6	-	-	12 12ft	WH White	BC3 Decorative Cast Aluminium Base Cover (AT535)
A40 4" Round Straight Aluminum Pole	7 1/2"	9.3	7.2	5.6	4.5	3.7	3.1	2.7	2.3	2.0	1.7			BC9 Decorative Cast Aluminium Base Cover (AT64)
AT535 5" to 3 1/2" Round Tapered Aluminum Pole	8 1/2"	13.4	10.5	8.4	6.9	5.8	4.9	4.2	3.6	3.2	2.8			BC10 Decorative Cast Aluminium Base Cover (AT74)
AT64 6" to 4" Round Tapered Aluminum Pole	9 1/2"	20.3	16.1	13.1	10.9	9.2	7.9	6.8	5.9	5.2	4.5	14 14ft	BL Semi-Matte Black	BC13 Decorative Cast Aluminium Base Cover (A40)
A35 3/2" Round Straight Aluminum Pole	7 1/2"	3.5	2.4	1.6	1.0	0.5	-	-	-	-	-			T35 Supplied with 3/4" diameter tenon, 4/8" high (use for A40, AT64, AT74 only)
<b>A40 4" Round straight Aluminum Pole</b>	<b>7 1/2"</b>	<b>10.3</b>	<b>7.9</b>	<b>6.1</b>	<b>4.9</b>	<b>4.0</b>	<b>3.4</b>	<b>2.9</b>	<b>2.5</b>	<b>2.1</b>	<b>1.8</b>			REC1 GFCI Receptacle with weather-proof cover
AT535 5" to 3 1/2" Round Tapered Aluminum Pole	8 1/2"	11.2	8.7	6.9	5.5	4.6	3.8	3.3	2.8	2.4	2.1	16 16ft	BZ Bronze	REC2 GFCI Receptacle with weather-proof padlockable in-use cover
AT64 6" to 4" Round tapered Aluminum Pole	9 1/2"	17.2	13.6	11.0	9.1	7.6	6.5	5.6	4.8	4.2	3.7			REC3 USB and Duplex Receptacle with weather-proof cover
A35 3/2" Round Straight Aluminum Pole	7 1/2"	2.1	1.2	0.6	-	-	-	-	-	-	-			REC4 USB and Duplex Receptacle with weather-proof padlockable in-use cover
A40 4" Round straight Aluminum Pole	7 1/2"	8.3	6.2	4.7	3.6	3.0	2.5	2.1	1.7	1.5	1.2	18 18ft	SP Specify Premium Color	Motion Sensor w/ Optional Photocell
AT535 5" to 3 1/2" Round tapered Aluminum Pole	8 1/2"	9.1	6.9	5.4	4.3	3.4	2.9	2.4	2.0	1.7	1.5			
AT64 6" to 4" Round tapered Aluminum Pole	9 1/2"	14.3	11.2	9.0	7.4	6.2	5.2	4.4	3.8	3.3	2.9			
A40 4" Round straight Aluminum Pole	7 1/2"	6.6	4.8	3.5	2.6	2.1	1.7	1.4	1.1	0.9	0.7			
AT535 5" to 3 1/2" Round tapered Aluminum Pole	8 1/2"	9.2	7.0	5.4	4.2	3.4	2.8	2.5	2.0	1.7	1.4			
AT64 6" to 4" Round tapered Aluminum Pole	9 1/2"	11.9	9.2	7.3	6.0	4.9	4.2	3.5	3.0	2.6	2.2			
AT74 7" to 4" Round tapered Aluminum Pole	10 1/2"	17.5	13.8	11.2	9.2	7.7	6.5	5.6	4.8	4.1	3.5			

Allowable EPA calculated according to AASHTO 1994 and include allowance for 1/3 gust factor. See Mounting Configuration pages for fixture arm weight and EPA values.

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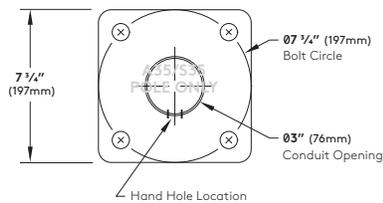
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**ALP02**  
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**Pole Information**

Refer to pole specification sheets for construction details, anchorage information and additional options.

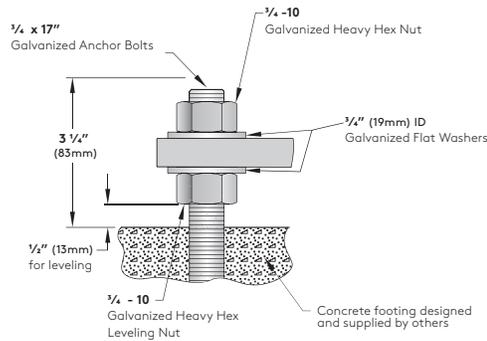
**Bolt Circle for A35 & S35**

Use caution when setting anchor bolts. Bolts must be vertically straight and centered on dimensions shown



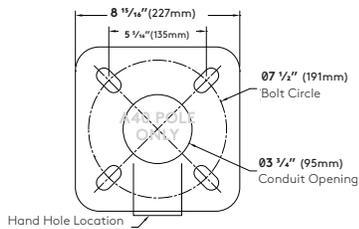
Note: Adequate drainage must be provided in concrete foundation.

**Anchor Bolt Detail for A35 & S35**



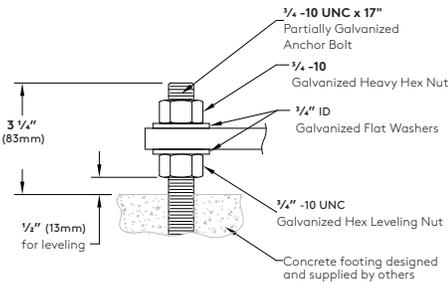
**Bolt Circle for A40**

Use caution when setting anchor bolts. Bolts must be vertically straight and centered on dimensions shown



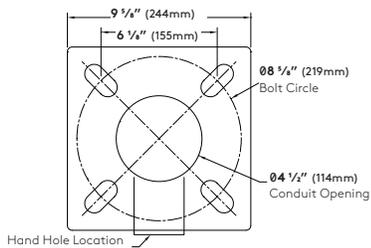
Note: Adequate drainage must be provided in concrete foundation.

**Anchor Bolt Detail for A40**

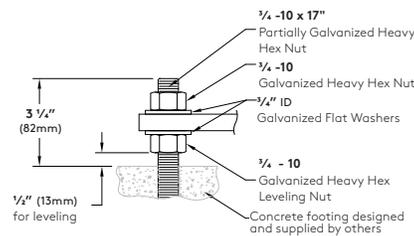


**Bolt Circle for AT535**

Use caution when setting anchor bolts. Bolts must be vertically straight and centered on dimensions shown



**Anchor Bolt Detail for AT535**



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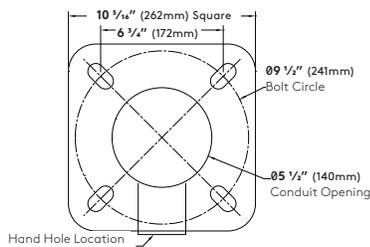
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**Pole Information**

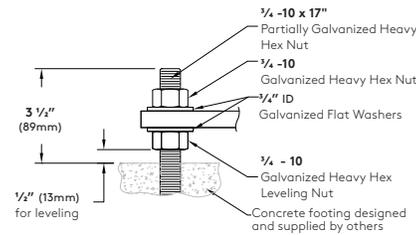
Refer to pole specification sheets for construction details, anchorage information and additional options.

**Bolt Circle for AT64**

Use caution when setting anchor bolts. Bolts must be vertically straight and centered on dimensions shown

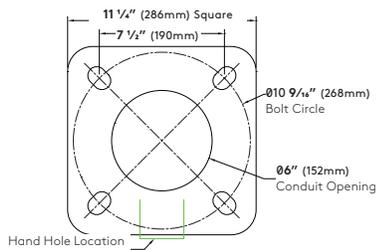


**Anchor Bolt Detail for AT64**

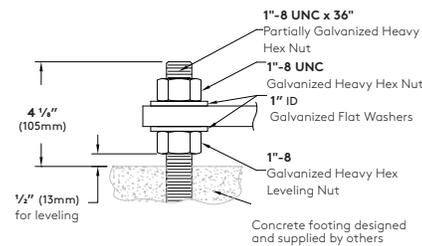


**Bolt Circle for AT74**

Use caution when setting anchor bolts. Bolts must be vertically straight and centered on dimensions shown



**Anchor Bolt Detail for AT74**



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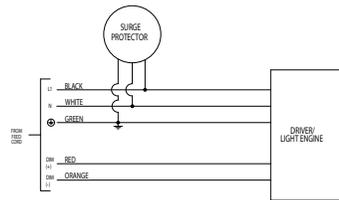
**selux**

Type:  
**ALP02**  
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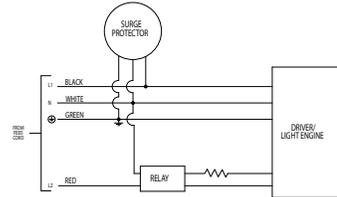
ELECTRICAL SPECIFICATIONS									
CCT	3000K/4000K								
CYLINDER	CL Cylinder Standard						FL Cylinder Standard		
OPTICS	R1, R2, R3, and R4			RSR and R55			DB		
Light Engine/ Electrical Specs	Delivered Lumens (lm)	Wattage (W) 120-277 / 347-480	Efficacy (lm/W)	Delivered Lumens (lm)	Wattage (W) 120-277 / 347-480	Efficacy (lm/W)	Delivered Lumens (lm)	Wattage (W) 120-277 / 347-480	Efficacy (lm/W)
5G150	1316	14.2 / 18	92.9	1488	14.2 / 18	105.0	1327	14.2 / 18	93.5
5G250	2193	23.6 / 27	92.9	2480	23.6 / 27	105.0	2211	23.6 / 27	93.5
5G350	3070	33.1 / 35	92.9	3471	33.1 / 35	105.0	3096	33.1 / 35	93.5
5G450	3948	42.5 / 44	92.9	4463	42.5 / 44	105.0	3981	42.5 / 44	93.5

**Wiring**

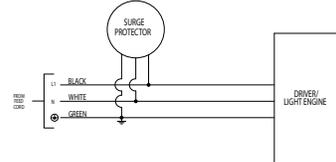
0-10V Dimming Option (DM) Wiring for 120-277V  
100% light output at 10V, down to 1% light output at 0V.



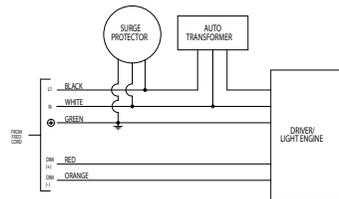
Hi-Lo Switching Option (HL30/HL50) Wiring  
120/240/277V. When red is energized, light output will be  
at 'Lo' level.



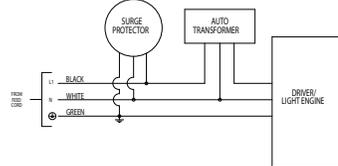
Standard Wiring for 120-277V  
Standard wiring for 120-277V with no additional options.



0-10V Dimming Option (DM) Wiring for 347/480V  
100% light output at 10V, down to 1% light output at 0V.



Standard Wiring for 347/480V  
Standard wiring for 347/480V with no additional options.



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**ARUP**  
Project Number: 271565  
Phone: 1 212 896 3000

Lanova LED

**selux**

Type:  
**ALP02**

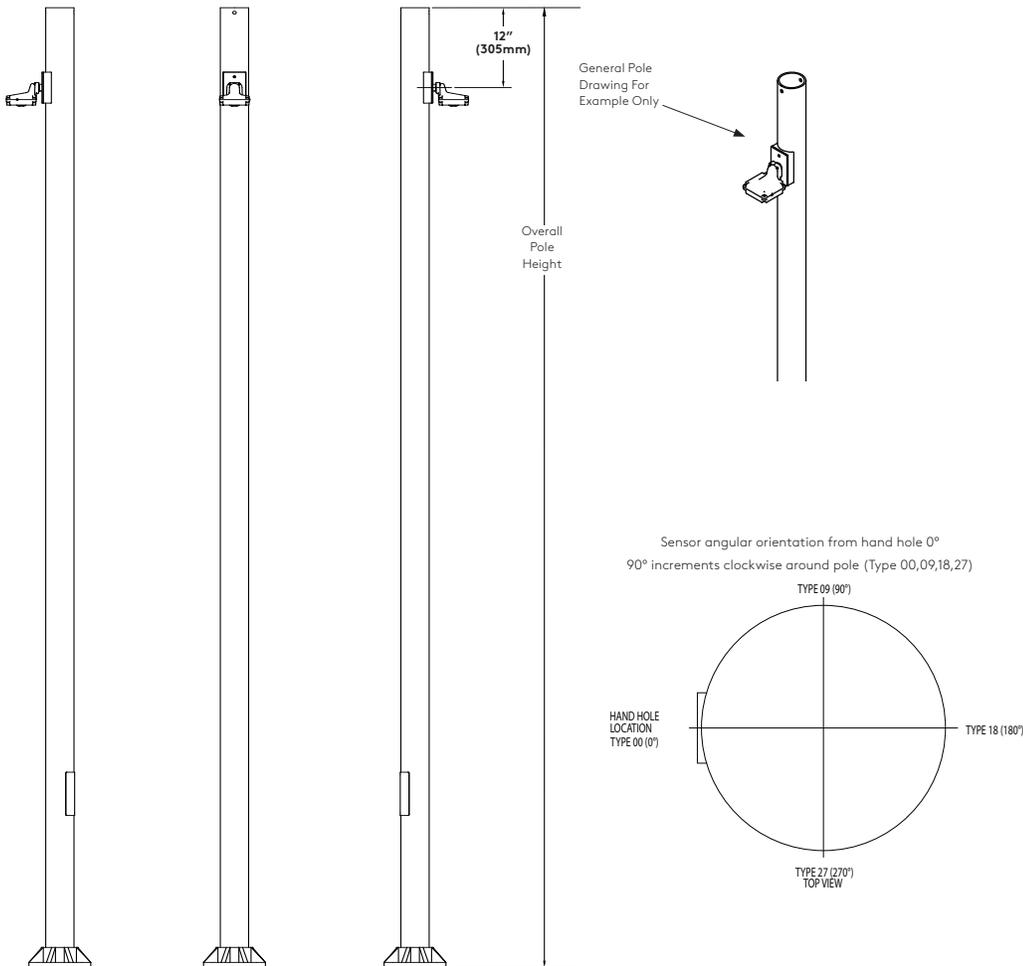
Page 8 of 8

**Pole Motion Sensor**

The Selux outdoor rated sensor incorporates Passive Infrared (PIR) technology for motion sensing and also includes a built in photocell. Designed to mount directly through a 1/2" KO in a single gang faceplate on pole/column, the SBO utilizes 100% Digital Passive Infrared (PIR) technology that is tuned for walking size while preventing false tripping from the environment.

Series	Optics	Hand Hole Orientation	Program	Color	Photocell Feature	Voltage
MS Motion Sensor	1 270° coverage - Single Sensor	00	D0 (0V=0%)	WH White	Y Yes	UNV
		09	D1 (1V=10%)	BK Black	N No	347
		18	D3 (3V=30%)	BZ Bronze		480
		27	D5 (5V=50%)			

NOTE: Motion sensor comes programmed at 30% dimmed level with a 5 min. delay as default. All programming required after shipping by others.



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**ARUP**  
Project Number: 271565  
Phone: 1 212 896 3000

**Manufacturer:** Selux : Lenova LED Pole Mount  
**Description:** 14ft Pole Light R5R Type Distribution

**Fixture Wattage:** 24 W  
**Lumen Output:** 2477 lumen  
**Lamp CRI:** 80+

**Lighting Controls:** 0-10V Dimming

**Voltage:** 120 V  
**Fixture Finish:** Dark Grey  
**Lamp CCT:** 2700K  
**Assembly Code:** LAL-R5R-X-CL-5G250-XX-30-SP-120-DM-MOD

Date: \_\_\_\_\_ Customer: \_\_\_\_\_  
Project: \_\_\_\_\_  
Type: \_\_\_\_\_ Qty: \_\_\_\_\_

**selux**

Type: **ALP03**  
Page 1 of 6

**Lanova LED Pole Mount**



Order Code: LAL - - - - -

LAL	Pole Order Code:							
	Series	Height	Finish	Options				
Series	LAL Lanova LED							
Optics	R1 Type I Distribution	R2 Type II Distribution	R3 Type III Distribution	R4 Type IV Distribution	R5S Type V Square	R5R Type V Round	DB Diffuse Bowl	
Mounting	1 Single	2 Double	W Wall					
Cylinder	CL Clear long	FL <sup>1</sup> 1/2 Frosted Long	CT Clear Tapered				<sup>1</sup> DB optics only	
Light Engine	5G150 <sup>2</sup> 1556lm, 15W	5G250 <sup>2</sup> 2477lm, 24W	5G350 3468lm, 33W	5G450 4459lm, 42W			<sup>2</sup> Not Available with DM, HL30, or HL50 <sup>*</sup> Based on R2 distribution and 3000K CCT	
Power Cord Length	8 8'	10 10'	12 12'	14 14'	16 16'	18 18'	XX <sup>3</sup> XX'	<sup>3</sup> Add length of arm + height of pole to determine power cord length
CCT	30 3000K	40 4000K					for other CCT please consult factory	
Finish	WH White	BK Black	BL Semi-Matte Black	BZ Bronze	SV Silver	SP Specify Premium Color		
Voltage	120	208	240	277	347 <sup>4,5</sup>	480 <sup>4,5</sup>	<sup>4</sup> Not available with HL30 or HL50 <sup>5</sup> Requires stepdown transformer, 60 Hz only	
Options	DM Dimming (0-10V)	HL30 <sup>6,7</sup> Hi-Lo Switching 30-100%	HL50 <sup>6,7</sup> Hi-Lo Switching 50-100%	HS* House Side Shield			<sup>6</sup> 120, 240, and 277V Only <sup>7</sup> Not available with DM option <sup>*</sup> Not available with R5S, R5R, or DB optics	

**Lighting Notes:**

1. Finish to be confirmed by architect.
2. Contractor to coordinate pole mounting with civil scope and other services according to manufacturer recommendations.
3. Modifications include (a) Straight Arms (b) power receptacles hidden in base (c) one circuit per pole.
4. Landscape Architect to Specify Base Cover.
5. Height of pole to be 14'.
6. Refer to drawing to determine single or double mount.
7. Add alternate: Standard Finish

**Product Modifications**

Please list modification requirements for review by factory:

**Straight arm, power receptacle hidden in base - one circuit per pole**

**Approvals**

\_\_\_\_\_

Date: \_\_\_\_\_



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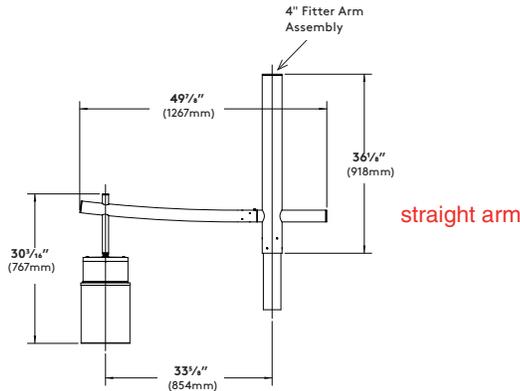
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**ARUP**  
Project Number: 271565  
Phone: 1 212 896 3000

Lanova LED

**selux**

Type:  
**ALP03**  
Page 2 of 6



Net Weight (19.5 lbs)  
EPA = 0.68 ft<sup>2</sup>

**Specifications**

**Luminaire Housing**

Die cast aluminum housing made from low copper marine grade aluminum.

**Gasketing**

(not shown) Continuous UV resistant silicone gasket provides weatherproofing, dust and insect control at all fixture connections.

**LED Array**

(not shown) High Flux LEDs mounted to metal core PCB and attached to aluminum heat sink for maximum LED performance and life. CCT tolerance within a 3 step bin and provided with a minimum CRI of 80. LED light engine has a reported lumen maintenance of 93% at 50,000 hours. L70 calculated greater than 100,000 hours.

**LED Optics**

Clear half frosted, or tapered UV stabilized acrylic outer cylinder creates the optical chamber. Technical Optics (R1, R2, R3, R4, R5S and R5R) use Selux signature light pattern acrylic lens holder to secure proprietary silicone optics. Diffuser Bowl (DB) option made of highly diffuse UV stabilized acrylic hides LED source and provides a pleasant/soft light quality.

**LED Driver**

LEDs are driven by RoHS compliant constant current programmable LED driver. Driver includes 0-10V dimming to 10%, meets the requirements of IP65 and includes a 5 Year warranty.

**Surge Protector**

(not shown) Independent surge protector device designed to protect luminaire from electrical surge up to 20kA.

**Power Cord**

(not shown) UV resistant black SJ power cord pre-installed at factory. Please specify power cord length available in 1' increments from 5' - 30'.

Standard exterior colors are White (WH), Black (BK), Semi-Matte Black (BL), 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 Lanova 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. For details, see "Selux Terms and Condition of Sale."

**Listings and Ratings:** Luminaire tested to IP65 and LM-79 standards. LEDs tested to LM-80 standards.

**Luminaire suitable for ambient temperatures from 40°C (104°F) maximum to -40°C (-40°F) minimum.**

**NRTL Listed (i.e. UL, CSA)**

**Visit selux.us for our LED End of Life recycling policy.**

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**ARUP**  
Project Number: 271565  
Phone: 1 212 896 3000

Lanova LED

Mounting

selux

Type:  
**ALP03**

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1 - Single Arm

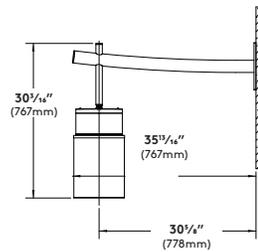
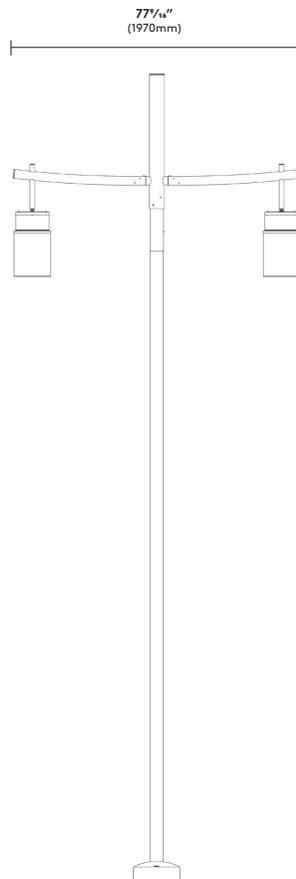
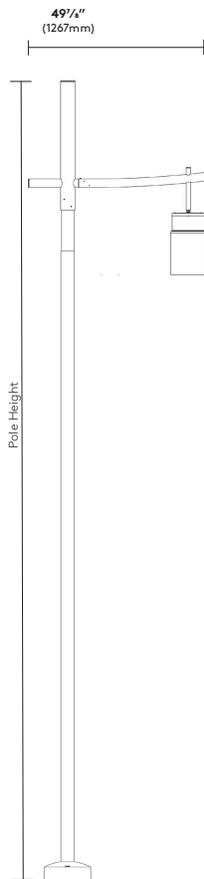
EPA = 1.57ft<sup>2</sup>  
Weight = 32lbs. (15kg)

2 - Double Arm

EPA = 1.3ft<sup>2</sup>  
Weight = 55lbs. (25kg)

W - Wall Mount Arm

EPA = N/A  
Weight = 24lbs. (11kg)



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**ARUP**  
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Phone: 1 212 896 3000

Lanova LED

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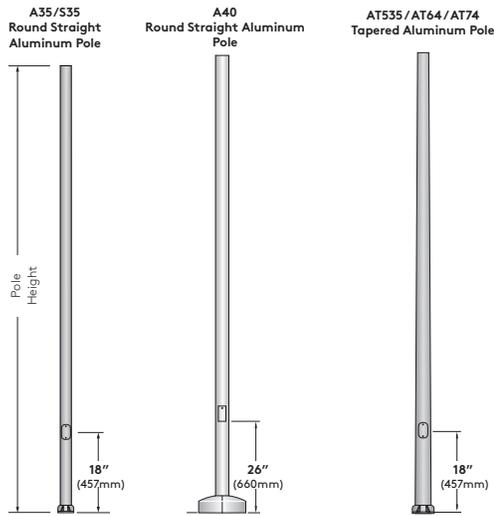
Type:  
**ALP03**

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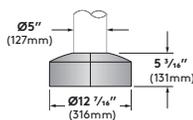
**Pole Information**

Refer to pole specification sheets for construction details, anchorage information and additional options.

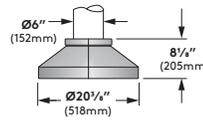
**Optional Base Covers for Poles**  
Die cast aluminum.



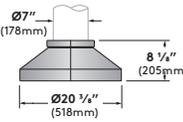
**BC3 Optional Base Cover (AT535)**  
Die cast aluminum, two-piece field installable base cover.



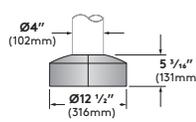
**BC9 Optional Base Cover (AT64)**  
Die cast aluminum, two-piece field installable base cover.



**BC10 Optional Base Cover (AT74)**  
Die cast aluminum, two-piece field installable base cover.



**BC13 Optional Base Cover (A40)**  
Die cast aluminum, two-piece field installable base cover.



Pole Data Chart Pole Series	Bolt Circle	Wind Speed (mph)										Height	Finish	Options
		90	100	110	120	130	140	150	160	170	180			
A35 3/2" Round Straight Aluminum Pole	7 1/2"	4.8	3.5	2.6	1.8	1.3	0.9	0.7	0.6	-	-	12 12ft	WH White	BC3 Decorative Cast Aluminium Base Cover (AT535)
A40 4" Round Straight Aluminum Pole	7 1/2"	9.3	7.2	5.6	4.5	3.7	3.1	2.7	2.3	2.0	1.7			
AT535 5" to 3 1/2" Round Tapered Aluminum Pole	8 1/2"	13.4	10.5	8.4	6.9	5.8	4.9	4.2	3.6	3.2	2.8			
AT64 6" to 4" Round Tapered Aluminum Pole	9 1/2"	20.3	16.1	13.1	10.9	9.2	7.9	6.8	5.9	5.2	4.5	14 14ft	BL Semi-Matte Black	BC10 Decorative Cast Aluminium Base Cover (AT74)
A35 3/2" Round Straight Aluminum Pole	7 1/2"	3.5	2.4	1.6	1.0	0.5	-	-	-	-	-			
A40 4" Round straight Aluminum Pole	7 1/2"	10.3	7.9	6.1	4.9	4.0	3.4	2.9	2.5	2.1	1.8	16 16ft	BZ Bronze	BC13 Decorative Cast Aluminium Base Cover (A40)
AT535 5" to 3 1/2" Round Tapered Aluminum Pole	8 1/2"	11.2	8.7	6.9	5.5	4.6	3.8	3.3	2.8	2.4	2.1			
AT64 6" to 4" Round tapered Aluminum Pole	9 1/2"	17.2	13.6	11.0	9.1	7.6	6.5	5.6	4.8	4.2	3.7			
A35 3/2" Round Straight Aluminum Pole	7 1/2"	2.1	1.2	0.6	-	-	-	-	-	-	-	18 18ft	SV Silver	T35 Supplied with 3/4" diameter tenon, 4/8" high (use for A40, AT64, AT74 only)
A40 4" Round straight Aluminum Pole	7 1/2"	8.3	6.2	4.7	3.6	3.0	2.5	2.1	1.7	1.5	1.2			
AT535 5" to 3 1/2" Round tapered Aluminum Pole	8 1/2"	9.1	6.9	5.4	4.3	3.4	2.9	2.4	2.0	1.7	1.5			
AT64 6" to 4" Round tapered Aluminum Pole	9 1/2"	14.3	11.2	9.0	7.4	6.2	5.2	4.4	3.8	3.3	2.9	18 18ft	SP Specify Premium Color	REC1 GFCI Receptacle with weather-proof cover
A40 4" Round straight Aluminum Pole	7 1/2"	6.6	4.8	3.5	2.6	2.1	1.7	1.4	1.1	0.9	0.7			
AT535 5" to 3 1/2" Round tapered Aluminum Pole	8 1/2"	9.2	7.0	5.4	4.2	3.4	2.8	2.5	2.0	1.7	1.4			
AT64 6" to 4" Round tapered Aluminum Pole	9 1/2"	11.9	9.2	7.3	6.0	4.9	4.2	3.5	3.0	2.6	2.2	18 18ft	REC2 GFCI Receptacle with weather-proof padlockable in-use cover	REC3 USB and Duplex Receptacle with weather-proof cover
AT74 7" to 4" Round tapered Aluminum Pole	10 1/2"	17.5	13.8	11.2	9.2	7.7	6.5	5.6	4.8	4.1	3.5			

Allowable EPA calculated according to AASHTO 1994 and include allowance for 1/3 gust factor. See Mounting Configuration pages for fixture arm weight and EPA values.

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Project Number: 271565  
Phone: 1 212 896 3000

Lanova LED

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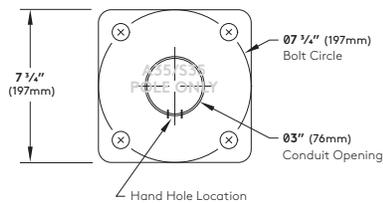
Type:  
**ALP03**  
Page 5 of 6

**Pole Information**

Refer to pole specification sheets for construction details, anchorage information and additional options.

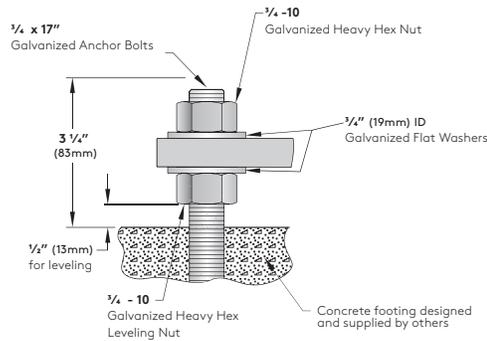
**Bolt Circle for A35 & S35**

Use caution when setting anchor bolts. Bolts must be vertically straight and centered on dimensions shown



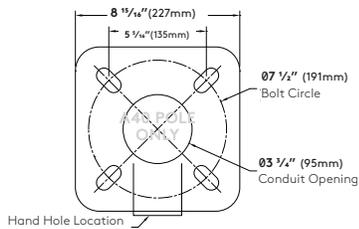
Note: Adequate drainage must be provided in concrete foundation.

**Anchor Bolt Detail for A35 & S35**



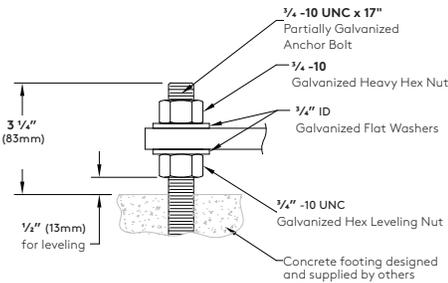
**Bolt Circle for A40**

Use caution when setting anchor bolts. Bolts must be vertically straight and centered on dimensions shown



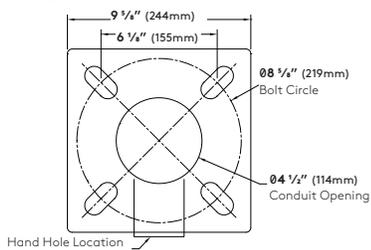
Note: Adequate drainage must be provided in concrete foundation.

**Anchor Bolt Detail for A40**

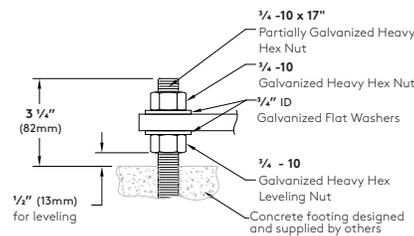


**Bolt Circle for AT535**

Use caution when setting anchor bolts. Bolts must be vertically straight and centered on dimensions shown



**Anchor Bolt Detail for AT535**



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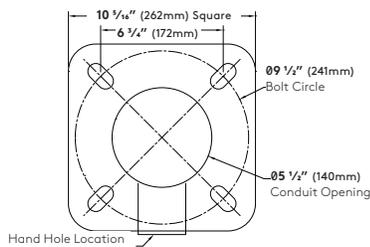
Type:  
**ALP03**  
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**Pole Information**

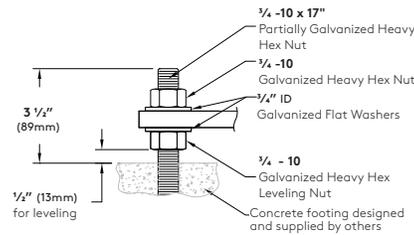
Refer to pole specification sheets for construction details, anchorage information and additional options.

**Bolt Circle for AT64**

Use caution when setting anchor bolts. Bolts must be vertically straight and centered on dimensions shown

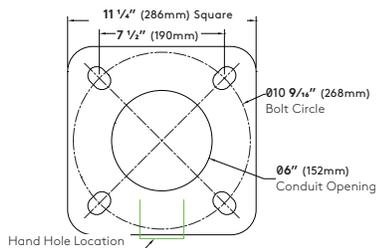


**Anchor Bolt Detail for AT64**

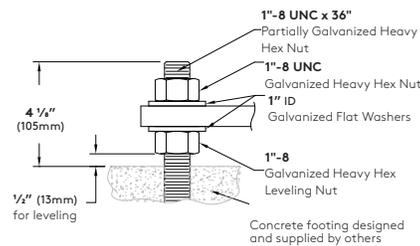


**Bolt Circle for AT74**

Use caution when setting anchor bolts. Bolts must be vertically straight and centered on dimensions shown



**Anchor Bolt Detail for AT74**



Storm King Lighting Controls Narrative														
Space Type	LPD	Target Illuminance (fc)	Lighting Control Intent									Narrative	CCT	CRI
			Local Control	Restricted to manual ON	Restricted to partial automatic ON	Bilevel lighting control	Automatic Daylight Responsive Controls for sidelighting	Automatic Daylight Responsive Controls for toplighting	Automatic Partial Off	Automatic Full Off	Scheduled Shutoff			
<b>External Ligthing</b>														
<b>Space</b>														
Pavilion	0.1 W/ft2	1 - 5	External Lighting shall be programmed to operate automatically under timeclock control at a centralized location, with access and permissions to be agreed with the client. Timing and programming sequences shall be determined together with the Client and Building Facilities Manager. The astronomical timeclock shall operate so that lighting switches ON during Storm King operating hours 15 minutes before sunset, and shall be programmed to switch OFF or dim to 50% a a curfew time of 8.30pm or such time as is determined appropriate by the Occupant.										3000K	80+
Building Entries	30 W/ft (main entry) 20 W/ft (secondary)	0.5 - 1											3000K	80+
Parking	0.1 W/ft2	0.1 - 0.5 (ADA)											3000K	80+
Walkways (≥10ft wide / plaza)	0.16 W/sq.ft	0.1 - 0.5											3000K	80+
Walkways (< 10ft wide)	0.8 W/ft	0.1 - 1											3000K	80+

SECTION 311100

CLEARING AND GRUBBING

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

- A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

- A. Work of this Section includes all labor, materials, equipment and services necessary to complete the clearing and grubbing as shown on the drawings and/or specified herein, including but not necessarily limited to the following:
  1. Clearing site of debris, grass and other plant life in preparation for Site or building earthwork.
  2. Protection of existing structures, trees or vegetation indicated in contract documents to remain.
  3. Removal of existing sidewalks, drives, curbs, etc.
  4. Removal of asphalt pavement where indicated on contract documents and as specified herein.
  5. Stripping topsoil, if necessary, from areas that are to be incorporated into limits of project.
  6. Disposal of cleared, grubbed and stripped materials in accordance with all applicable codes and ordinances.

1.3 RELATED SECTIONS

- ~~A. Selective Tree and Shrub Removal and Trimming - Section 311300.~~
- ~~B. Site Excavating, Backfilling and Compacting - Section 312300.~~
- C. Erosion and Sediment Control - Section 312500.
- ~~D. Bituminous Paving - Section 321216.~~
- ~~E. Portland Cement Concrete Paving - Section 321313.~~

A. Temporary Tree and Plant Protection - Section 015639

B. Earthwork - Section 310000

1.4 JOB CONDITIONS

- A. Protection of Existing Improvements
  1. Provide protections necessary to prevent damage to existing improvements indicated to remain in place.
  2. Protect improvements on adjoining properties and on the Owner's property.

3. Restore damaged improvements to their original condition, as acceptable to parties having jurisdiction.

#### 1.5 ENVIRONMENTAL REQUIREMENTS

- A. Construct temporary erosion control systems to protect adjacent properties and water resources from erosion and sedimentation.
- B. Owner will obtain the erosion and sedimentation (E&S) related permit from local authorities, governing the discharge of stormwater from the construction site.
- C. Contractor shall be totally responsible for conducting soil erosion and sediment control and the storm water management practices in accordance with Owner's E&S permit and for enforcement action taken or imposed by federal, state and local agencies, including cost of fines, construction delays, and remedial actions resulting from Contractor's failure to comply with all provisions of the E&S permit.

#### 1.6 PROJECT CONDITIONS

- A. Contractor to provide a thorough inspection of the site prior to bidding and accept the site as is.
- B. Variations to conditions or discrepancy in actual or described as proposed conditions as they apply to site preparation operations are to be brought to the attention of the Owner prior to commencement of sitework.

### PART 2 PRODUCTS

#### 2.1 MATERIALS

- A. Off-site materials shall be transported to project using well maintained and operating vehicles. Once on site, transporting vehicles shall stay on designated haul roads and shall at no time endanger improvements by rutting, overloading or pumping.

### PART 3 EXECUTION

#### 3.1 PREPARATION

- A. Site Inspection
  1. Prior to all work of this Section, carefully inspect the entire site and all objects designated to be removed and to be preserved.
  2. Locate all existing utility lines and determine all requirements for disconnecting and capping.
  3. Locate all existing active utility lines traversing the site and determine the requirements for their protection.
- B. Clarification
  1. The drawings do not purport to show all objects existing on the site.
  2. Before commencing the work of this Section, verify by inspection all objects to be removed and all objects to be preserved.
- C. Scheduling

1. Schedule all work in a careful manner with all necessary consideration for neighbors and the public.
  2. Avoid interference with the use of, and passage to and from, adjacent buildings and facilities.
- D. Disconnection of Utilities: Before starting site operations, disconnect or arrange for the disconnection of all utility services designated to be removed, performing all such work in accordance with the requirements of the utility company or agency involved.

### 3.2 PROTECTION

- A. Locate and identify existing utilities that are to remain and protect from damage.
- B. Protect trees, plant growth, wetlands and features not designated for removal.
- C. Conduct operations with minimum interference to public or private accesses and facilities. Maintain ingress and egress at all times and clean or sweep roadways daily as required by the governing authority. Dust control shall be provided with sprinkling systems or equipment provided by Contractor.
- D. Protect benchmarks, property corners, and other survey monuments from damage or displacement. If marker needs to be removed it shall be referenced by a licensed land surveyor and replaced, as necessary, by same at Contractor's cost.
- E. Provide traffic control as required, per local and county requirements.
- F. Protection of Utilities: Preserve in operating condition all active utilities traversing the site and designated to remain.

### 3.3 DEMOLITION AND REMOVAL

- A. Demolish and remove all concrete slabs, asphaltic concrete pavement designated to be removed, septic tanks, fuel lines, utility lines designated for abandonment, and all other items designated to be removed or necessary to be removed prior to construction of this work.

### 3.4 CLEARING, GRUBBING AND STRIPPING

- A. General
1. Remove vegetation, improvements, or obstructions interfering with installation of new construction. Remove such items elsewhere on the site or premises as specifically indicated. Removal includes stumps and roots.
  2. Carefully and cleanly cut roots and branches of trees indicated to be left standing where such roots and branches obstruct new construction.
- B. The Contractor shall strip all asphalt within the building footprint area and 10 ft. beyond, and from any other areas to receive new fill. Removed asphalt can be milled by the Contractor and asphalt millings can be reused as subbase material beneath new pavements. Asphalt to be used as recycled material shall be milled to form a well-graded material having a maximum particle size of two inches. The Contractor shall provide dust control measures during any milling process. Excess asphalt materials shall be properly disposed of in accordance with all applicable codes and ordinances.
- C. Topsoil

1. Topsoil is defined as friable clay loam surface soil found in a depth of not less than four (4) inches. Satisfactory topsoil is reasonably free of subsoil, clay lumps, stones and other objects over two (2) inches in diameter, and without weeds, roots, and other objectionable material.
2. Strip topsoil to whatever depths encountered in a manner to prevent intermingling with the underlying subsoil or other objectionable material.
3. Remove heavy growths of grass from areas before stripping.
4. Where trees are indicated to be left standing, stop topsoil stripping a sufficient distance to prevent damage to the main root system.
5. Stockpile topsoil in storage piles in areas directed by the Architect. Construct storage piles to freely drain surface water. Cover storage piles if required to prevent wind blown dust.

D. Clearing and Grubbing

1. Clear the site of trees, shrubs, and other vegetation, except for that indicated to be left standing.
2. Completely remove stumps, roots, and other debris protruding through the ground surface.
3. Use only hand methods for grubbing inside the drip line of trees indicated to be left standing.
4. Fill depressions caused by clearing and grubbing operations with soil material meeting the requirements of Section ~~312000~~, unless further excavation or earthwork is indicated.
5. Place fill material in horizontal layers not exceeding eight (8) inches loose depth, and thoroughly compact to a density equal to adjacent original ground.

3.5 DISPOSAL OF WASTE MATERIALS

- A. Burning is not permitted on the Owner's property.
- B. Removal all debris from the site and dispose of all removed material legally. Leave the site in a neat and orderly condition to the approval of the Architect.

310000 - Earthwork

END OF SECTION

## SECTION 321216

## BITUMINOUS PAVING

## PART 1 GENERAL

## 1.1 GENERAL REQUIREMENTS

- A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

## 1.2 SECTION INCLUDES

- A. Work of this Section includes all labor, materials, equipment and services necessary to complete the bituminous paving as shown on the drawings and/or specified herein, including but not necessarily limited to the following:
1. Hot-mixed asphalt paving over prepared subbase and pavement marking.
  2. Bonded gravel paving.
  3. Patching of existing asphalt paving.
  4. Pavement markings.
  5. Precast concrete car stops.

## 1.3 RELATED SECTIONS

- A. ~~Earthwork - Section 312300~~, for aggregate subbase and base courses.
- B. Concrete curbs - Section 321313.

Base Courses  
(Pavement) - Section  
321100



## 1.4 DEFINITIONS

- A. Hot-Mix Asphalt Paving Terminology: Refer to ASTM D 8 for definitions of terms.
- B. NYS DOT: New York State Department of Transportation.

## 1.5 SYSTEM DESCRIPTION

- A. Provide hot-mix asphalt paving according to materials, workmanship, and other applicable requirements of Standard Specifications of the NYS DOT.
1. Standard Specification: Hot-mix asphalt paving shall conform to Section 400 Bituminous Pavements of the NYS DOT Standard Specifications and as amended.

## 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer who has completed hot-mix asphalt paving similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
- B. Manufacturer Qualifications: A qualified manufacturer. Manufacturer shall be a paving-mix manufacturer registered with and approved by authorities having jurisdiction or the NYS DOT.

- C. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated, as documented according to ASTM E 548.
- D. Regulatory Requirements: Comply with Hot-mix Asphalt Paving as per Section 400 Bituminous Pavements of the NYS DOT Standard Specifications and as amended.
- E. Asphalt-Paving Publication: Comply with AI MS-22, "Construction of Hot Mix Asphalt Pavements," unless more stringent requirements are indicated.
- F. Preinstallation Conference: Conduct conference at Project site to comply with requirements related to asphalt paving including, but not limited to, the following:
  - 1. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.
  - 2. Review condition of substrate and preparatory work performed by other trades.
  - 3. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.
  - 4. Review and finalize construction schedule for paving and related work. Verify availability of materials, paving Installer's personnel and equipment required to execute the Work without delays.
  - 5. Review inspection and testing requirements, governing regulations and proposed installation procedures.
  - 6. Review forecasted weather conditions and procedures for coping with unfavorable conditions.

#### 1.7 SUBMITTALS

- A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.
- B. Color samples, 12" x 12".
- C. Job-Mix Designs: Certification prior to mixing at any bituminous mixing plant, signed by the material Producer and the Contractor certifying that each material complies with the specified requirements.
- D. Qualification Data: For firms and persons specified in the "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 specified.
- E. Material Test Reports: Indicate and interpret test results for compliance with Section 400 Bituminous Pavements of the Standard Specifications.
- F. Material Certificates: For each paving material, signed by manufacturers.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.

## 1.9 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. Asphalt Base Course: Minimum surface temperature of 40 deg F (4 deg C) and rising at time of placement.
  - 3. Asphalt Surface Course: Minimum surface temperature of 50 deg F at time of placement.
- B. Pavement Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg. F. for oil-based materials, 50 deg. F. for water-based materials, and not exceeding 95 deg. F.

## PART 2 PRODUCTS

## 2.1 BASE COURSE

- A. All hot-mix asphalt shall be constructed on a dense graded coarse aggregate base course.

## 2.2 AGGREGATES

- A. General: Use materials and gradations that have performed satisfactorily in previous installations.
- B. Coarse Aggregate: ASTM D 692, sound; angular crushed stone, crushed gravel, or properly cured, crushed blast-furnace slag, in accordance with NYS DOT standards.
- C. Fine Aggregate: ASTM D 1073, sharp-edged natural sand or sand prepared from stone, gravel, properly cured blast-furnace slag, or combinations thereof, in accordance with NYS DOT standards.
  - 1. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.
- D. Mineral Filler: ASTM D 242 rock or slag dust, hydraulic cement, or other inert material, in accordance with NYS DOT standards.

## 2.3 ASPHALT MATERIALS

- A. Bituminous Materials: Type and grade of bituminous materials shall be as specified in Table 401-1 of the NYS DOT Standard Specifications.
- B. Tack Coat: ASTM D 977 emulsified asphalt or ASTM D 2397, cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.
- C. Water: Potable.
- D. Color: As selected by Landscape Architect.

## 2.4 MIXES

- A. Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mixes conforming to NYS DOT standards designed according to procedures in AI MS-2, "Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types", and complying with the following requirements.

1. Top Course: NYS DOT Type 7F: 6 to 8 percent of asphalt.
2. Binder Course: NYS DOT Type 3: 4.5 to 6.5 percent asphalt.

## 2.5 PAVEMENT MARKINGS

- A. Pavement Marking Paint: Factory-mixed, quick-drying non-bleeding paint specifically formulated for marking asphaltic concrete surfaces, white color equal to "Setfast Acrylic Waterborne Traffic Marking Paint (TM226)" made by Sherwin Williams or approved equal.

## 2.6 PRECAST CONCRETE CAR STOPS

- A. Provide 3500 psi air entrained pre-cast concrete car stops with absorption rates not exceeding 5% and reinforced with two - Sitework Concrete materials shall conform to the requirements of Section 033000.

## 2.7 FORMWORK AND EXPANSION JOINT FILLER

- A. Provide "Homex 300" by Homasote Company, or approved equal, and complying with ASTM D 1751, AASHTO Designation M213-65 and ICC-ES ESR-1374.

## 2.8 JOINT SEALANTS

- A. Joint sealants and fillers at paving terminations and edges.
- B. Color(s): As selected and approved by the Landscape Architect.

## 2.9 EQUIPMENT

- A. Paving Equipment: Spreading, self-propelled asphalt paving machines capable of maintaining line, grade, and thickness shown.
- B. Compacting Equipment: Self-propelled rollers, minimum 10 ton weight.
- C. Hand Tools: Rakes, shovels, tampers, and other miscellaneous equipment required to complete the work.
- D. Pavement Marking Equipment: Provide spray machines specifically designed for pavement marking.

## PART 3 EXECUTION

### 3.1 INSPECTION

- A. Examine the areas and conditions where bituminous pavement is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.
  1. Verify that subgrade is dry and in suitable condition to support paving and imposed loads.
  2. Verify gradients and elevations of subbase are correct.
  3. Proof-roll subbase using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction.

4. Proceed with paving and patching and repairs only after unsatisfactory conditions have been corrected.

### 3.2 REPAIRS AS REQUIRED

- A. Leveling Course: Install and compact leveling course consisting of hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch in existing pavements.
  1. Install leveling wedges in compacted lifts not exceeding 3 inches thick.
- B. Crack and Joint Filling: Remove existing joint filler material from cracks or joints to a depth of 1/4 inch.
  1. Clean cracks and joints in existing hot-mix asphalt pavement.
  2. Use emulsified-asphalt slurry to seal cracks and joints less than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.
  3. Use hot-applied joint sealant to seal cracks and joints more than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.

### 3.3 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. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd.
  1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
  2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillage and clean affected surfaces.

### 3.4 HOT-MIX ASPHALT PLACING

- A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
  1. Place hot-mix asphalt binder course in number of lifts and thicknesses indicated.
  2. Place hot-mix asphalt surface course in single lift.
  3. Spread mix at minimum temperature of 250 deg F.
  4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes, unless otherwise indicated.
  5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
- B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.

1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete a section of asphalt base course before placing asphalt surface course.
- C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.
- D. For thickness of each course, conform to the following, unless otherwise shown on drawings:
  1. Aggregate Base: 6" thick.
  2. Asphaltic Binder Course: 5" thick.
  3. Asphaltic Top Course: 3" thick.

### 3.5 JOINTS

- A. 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.
  3. Offset transverse joints, in successive courses, a minimum of 24 inches.
  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.

### 3.6 COMPACTION

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or vibratory-plate compactors in areas inaccessible to rollers.
  1. Complete compaction before mix temperature cools to 185 deg F.
- B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.
- C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
  1. Average Density: 97 percent of reference laboratory density according to ASTM D 1559.
- D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

- E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.
- F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.
- G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
- H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

### 3.7 INSTALLATION TOLERANCES

- A. Thickness: Compact each course to produce the thickness indicated within the following tolerances:
  - 1. Base Course: Plus or minus 1/2 inch
  - 2. Surface Course: Plus 1/4 inch, no minus
- B. Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:
  - 1. Base Course: 1/4 inch
  - 2. Surface Course: 1/8 inch

### 3.8 PAVEMENT MARKING

- A. Do not apply pavement marking paint until layout, colors, and placement have been verified with Architect.
- B. Sweep and clean surface to eliminate loose material and dust.
- C. Apply paint with mechanical equipment to produce pavement markings of dimensions indicated with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

### 3.9 CAR STOPS

- A. Install car stops in locations noted exposed evenly between parking stalls. Hold stop securely in place by pouring haunch with three embedded pipe anchors for each stop. Anchors shall be set flush with top of stop.

### 3.10 FIELD QUALITY CONTROL

- A. Testing Agency: The 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. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to ASTM D 979.
  - 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.
- F. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.11 DISPOSAL

- A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.
  - 1. Do not allow excavated materials to accumulate on site.

END OF SECTION

## SECTION 321223

## RUSTIC SURFACE (CHIP SEAL) PAVING

## PART 1 GENERAL

## 1.1 GENERAL REQUIREMENTS

- A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

## 1.2 SECTION INCLUDES

- A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the rustic surface ("chip seal") paving as shown on the drawings and/or specified herein, including, but not necessarily limited to, the following:
1. Pedestrian Application: "Chip Seal" topping on an asphaltic concrete binder course.
  2. Vehicular Application: "Chip Seal" topping on an asphaltic concrete top course over asphaltic concrete binder course.

## 1.3 RELATED SECTIONS

- A. ~~Site Excavating, Backfilling and Compacting - Section 312300.~~
- B. Bituminous Paving - Section 321216.

Base Courses  
(Pavement) - Section  
321100



## 1.4 DEFINITIONS

- A. Hot-Mix Asphalt Paving Terminology: Refer to ASTM D 8 for definitions of terms.
- B. NYS DOT: New York State Department of Transportation.

## 1.5 QUALITY ASSURANCE

- A. Unless otherwise specified, work and materials for construction of the asphaltic concrete paving shall conform to Section 321216 "Bituminous Paving" and the applicable portions of the following:
1. Standard Specification: Asphaltic concrete paving shall conform to Section 400 Bituminous Pavements of the NYS DOT Standard Specifications and as amended.
- 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:** 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.
- H. **Testing Agency Qualifications:** Qualified according to ASTM D 3666 for testing indicated, as documented according to ASTM E 548.
- I. **Asphalt-Paving Publication:** Comply with AI MS-22, "Construction of Hot Mix Asphalt Pavements," unless more stringent requirements are indicated.
- J. **Preinstallation Conference:** Conduct conference at Project site in accordance with Section 013119 Project Meetings."
  - 1. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.
  - 2. Review condition of subgrade and preparatory work.
  - 3. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.
  - 4. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

#### 1.6 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, and defined parking spaces. Indicate, with international graphics symbol, spaces dedicated to people with disabilities.
- D. **Sample Panel:** Construct two sample panels of chip seal paving on the specified asphaltic concrete binder before start of any chip seal paving work. One panel shall exhibit a straight 6 ft. long section of full proposed width. Second panel shall exhibit a 6 ft. radius section of full proposed width.
  - 1. Sample panels shall exhibit proposed aluminum edging, color range, texture, and workmanship.
  - 2. Notify Architect seven days in advance of dates and times when sample panel will be constructed.
  - 3. Obtain Architect's approval of mockups before starting installation.
  - 4. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
  - 5. Demolish and remove mockups when directed.
  - 6. Sample panel shall be inspected by the Architect. If the sample is not acceptable, construct additional panels at no cost to the Owner until an acceptable panel is

constructed. Accepted panel shall become the standard for the entire job and shall remain undisturbed until completion of all work.

## 1.7 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

### 2.1 ASPHALT CONCRETE

- A. 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 Section 321216 "Bituminous Paving" for binder course only.

### 2.2 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. Bituminous material for tack coat shall be emulsified asphalt rapid-setting type conforming to AASHTO M 140, Grade RS-1.
- C. Bitumen shall be a rapid-setting type emulsified asphalt conforming to AASHTO M 140, Grade RS-1.
- D. Bituminous crack sealer shall be a hot-applied bituminous sealer conforming to Fed. Spec. SS-S-1401.

### 2.3 METAL EDGING

- A. Type 1 Metal Edge: Provide "Permaloc Asphalt Edge" with 0.210" thick exposed top lip x 2.5" high x 9 feet long, manufactured by Permaloc, Inc. (800) 356-9660 or (616) 399-9600. Horizontal connections shall be designed to integrate restraint and connections. Section shall have holes in base space.
1. Connection method: Section ends shall splice together with horizontal 0.060" thick x 1" wide, or 0.53" wide for 1" high edging x 4" long aluminum sliding connector.

**Refer to 055901,  
MANUFACTURED  
METAL EDGING**

2. Anchors: 3/8" x 10" bright spiral steel spike, 3/16" x 1-1/2" or longer Ardox concrete nail, or drive pin fastener equal to Hilti DX 40 powder actuated pin or Ramset Trakfast Automatic Fastening System pin.
  3. Finish: Mill Finish. Paint finish shall comply with AAMA 2603 for electrostatically baked-on paint.
- B. Type 2 Metal Edge: Provide "Permaloc Asphalt Edge" with 0.210" thick exposed top lip x 4" high x 8 feet) long, extruded aluminum, alloy 6005, T-5 hardness as manufactured by Permaloc Corporation, Holland MI 49424, telephone (800) 356-9660 or (616) 399-9600. Horizontal base to have upward facing angle profile designed to integrate restraint and asphalt surfaces for straight-line and curvilinear applications. Section shall have holes in base spaced 4" apart along its length to receive anchors.
1. Connection Method: Section ends shall splice together with horizontal 0.060" thick x 1" wide, or 0.53" wide for 1" high edging x 4" long aluminum sliding connector.
  2. Anchors: 3/8" x 10" bright spiral steel spike, 3/16" x 1-1/2" or longer Ardox concrete nail, or drive pin fastener equal to Hilti DX 40 powder actuated pin or Ramset Trakfast Automatic Fastening System pin.
  3. Finish: Mill Finish. Paint finish shall comply with AAMA 2603 for electrostatically baked-on paint.

Formatting

## 2.4 "CHIP SEAL" TOPPING MATERIALS

- A. Asphalt Emulsion for "Chip Seal" Topping: ASTM D 2397, CRS-2 Rapid Setting Cationic Emulsified Asphalt with Latex

- B. Embedment Stone for "Chip Seal" Topping: Provide 3 native stone selections with a range of natural colors and tones conforming to NYS DOT Specifications section 703-02-01 "Crushed Stone". Color and size to match Architect's sample.

## PART 3 EXECUTION

### 3.1 INSPECTION

- A. Examine the areas and conditions under which rustic surface (chip seal) paving is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

### 3.2 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 Section 321216 "Bituminous Paving."
- B. Asphalt pavement shall be allowed to cure for a minimum period of 30 days prior to application of chip seal surface treatment.

### 3.3 EDGING

- A. Metal Edge: Install edging leaving 3/8" between sections for expansion. Drive spikes through edging holes in base of asphalt restraint edging (or drive nails through aluminum base when using powder actuated fastening system) at spaces for following applications:

1. Anchor each section end with anchor.
2. Aggregate Base: Spiral steel spikes at 4" to 12" on center.
3. Softer or Thinner Asphalt Base: 3/8" x 10" spiral steel spikes at 4" to 12" o.c. spacing.

#### 3.4 CHIP SEAL TOPPING

- A. Chip Seal Topping: Spray top wearing course with asphalt emulsion with latex. Chip seal stone shall be evenly spread by means of box type or mechanical spreader. Spreading shall not be done with a power grader or directly from trucks. Stone and emulsion shall be applied at a rate to assure proper bonding before cooling takes place.
1. Rolling shall be performed with a steel wheel roller weighing not less than 240 lbs. per inch of tread.
  2. No vehicle traffic shall be permitted on finished surface for at least 12 hours after stone has been placed.
  3. After pavement has received stone topping, pavement shall be swept and inspected for uniform coverage. Any areas which fail to show uniform coverage shall be resprayed and stone topped to establish acceptable coverage. Final surface shall be swept to remove all loose stone.
- B. 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 roadway and parking pavement 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 that exceed these tolerances or that retain water on surface shall be corrected by removing defective work and replacing with new material conforming to this Section.

END OF SECTION

## SECTION 321313

## PORTLAND CEMENT CONCRETE PAVEMENT

## PART 1 GENERAL

## 1.1 GENERAL REQUIREMENTS

- A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

## 1.2 SECTION INCLUDES

- A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the Portland cement concrete pavement as shown on the drawings and/or specified herein, including, but not necessarily limited to, the following:
  - 1. Concrete curbs and walks.
  - 2. Reinforcement.
  - 3. Joint fillers.

## 1.3 RELATED SECTIONS

- A. Concrete - Section 033000.
- B. Prepared sub-base - ~~Section 312300.~~

321100 Base Courses  
(Pavement)

## 1.4 SYSTEM DESCRIPTION

- A. Provide Portland cement concrete paving according to materials, workmanship, and other applicable requirements of Standard Specifications of the NYS DOT.
  - 1. Standard Specification: Portland cement concrete paving shall conform to Section 500 Portland Cement Concrete of the NYS DOT Standard Specifications and as amended.

## 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Installations of work specified in this section shall be by firm(s) which can exhibit proof of a minimum of twenty years prior successful experience with installations of equivalent type and similar scope of this Project.
  - 1. Foreman: Installation firm for work of this Section of this Project shall have on staff a supervising Foreman assigned full time to this Project, from time of mock-up installations, who shall have at least 20 years total installation experience and with at least 10 years experience in installations of equivalent or more extensive type and scope to this Project. Submit detailed resume of past experience with dates, duration and scope identification, Project Name and location, and work function of previous projects worked on.
  - 2. Use numbers of skilled workmen equal to work requirement or occasion. The skilled workmen shall be thoroughly trained and experienced in the necessary crafts and shall be completely familiar with specific requirements and methods needed for performance of the work of this Section.

## 1.6 SUBMITTALS

- A. Submit test reports and materials certification as required in Section 033000.
- B. Samples: Joint Filler, 12" long, in color as selected and approved by the Landscape Architect.

## PART 2 PRODUCTS

## 2.1 FORMS

- A. Provide steel or wood of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects.
- B. Use flexible spring steel forms or laminated boards to form radius bends.

## 2.2 REINFORCEMENT

- A. Provide welded wire mesh conforming to ASTM A 185, 6 x 6, ten gauge.

## 2.3 CONCRETE

- A. Concrete Materials
  - 1. Comply with the applicable requirements of Section 033000.
  - 2. All concrete work of this Section shall contain five percent to seven percent entrained air and shall be air entrained with "Air-Mix" air entraining agent by Euclid Chemical Company or approved equal by Master Builders or Grace. Agent shall conform to ASTM C 260 and shall be mixed with concrete in accordance with manufacturer's instructions.
- B. Concrete Mix, Design and Testing: Comply with applicable requirements of Section 033000 for concrete mix design, sampling and testing, and quality control, and as herein specified. Design the mix to produce standard-weight concrete consisting of Portland cement, aggregate, air-entraining admixture and water to produce the following properties:
  - 1. Compressive Strength: Five thousand psi, minimum at twenty-eight days, with a water cement ratio not to exceed 0.45 by weight.
  - 2. Slump Range: Two inches to four inches.
  - 3. Air Content: Five percent to seven percent.

## 2.4 JOINT SEALANTS AND FILLERS

- A. Subject to compliance with ASTM C 920, Type M, Grade P, Class 25 Use T, provide one of the following or approved equal:
  - 1. "Sikaflex-2CNS" by Sika Corporation.
  - 2. "Sonolastic SL2" (slope grade) by Sonneborn Building Products Div., ChemRex, Inc.
  - 3. "Vulkem 245/255" by Tremco Inc.
- B. Backer Materials: Provide joint-sealant backer materials that are closed cell, non-absorbent and non-staining; are compatible with joint substrates, sealants, primers, and other joint

fillers; and are approved for applications indicated by joint sealant manufacturer based on field experience and laboratory testing.

1. Backer Strips for Sealants: ASTM D 5249, Type 2, of thickness and width required to control sealant depths, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.
- C. Gasket: For joint fillers in concrete work, provide closed cell extruded neoprene gasket conforming to ASTM C 509, Grade 4, black.
- D. Back-up rod for sealant shall be "Ethafoam" by Dow Chemical Co. or approved equal.

## 2.5 CURING

- A. Cure concrete with "Kurez W VOX" curing compound conforming to ASTM C 309 and Fed. Spec. TT-C-800A, modified with thirty (30) percent solids, as manufactured by the Euclid Chemical Company or equal made by Master Builders, Grace or approved equal.

## 2.6 WATER REDUCING MIXTURE

- A. Provide "Eucon WR-75" water reducing and densifying admixture, by Euclid Chemical Company or equal by Master Builders, Grace, or approved equal. The admixture shall conform to ASTM C 494, Type A, and not contain any lignosiliconates nor more than one percent chloride ions.

## PART 3 EXECUTION

### 3.1 INSPECTION

- A. Examine the areas and conditions under which concrete walks and curbs are to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

### 3.2 SURFACE PREPARATION

- A. Remove loose material from the compacted sub-base surface immediately before placing concrete.
- B. Proof roll prepared sub-base surface to check for unstable areas and the need for additional compaction. Do not begin paving work until such conditions have been corrected and are ready to receive paving.

### 3.3 FORM CONSTRUCTION

- A. Set forms to the required grades and lines, rigidly braced and secured. Install sufficient quantity of forms to allow continuous progress of the work and so that forms can remain in place at least twenty-four hours after concrete pavement.
- B. Check completed formwork for grade and alignment to the following tolerances:
1. Tops of forms not more than 1/8" in ten feet.
  2. Vertical face on longitudinal axis, not more than 1/4" in ten feet.
- C. Clean forms after each use and coat with form release agent as often as required to ensure separation from concrete without damage.

## 3.4 REINFORCEMENT

- A. Locate, place, and support reinforcement as specified in Section 033000.

## 3.5 CONCRETE PLACEMENT

- A. Comply with the requirements of Section 033000 for mixing and placing concrete.
- B. Do not place concrete until sub-base and forms have been checked for line and grade. Moistened sub-base if required to provide a uniform dampened condition at the time concrete is placed. Do not place concrete around manholes or other structures until they are at required finished elevation and alignment.
- C. Placing Concrete
1. Place concrete using methods that prevent segregation of the mix. Consolidate concrete along the face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square faced shovels for hand spreading and consolidation.
  2. Deposit and spread concrete in a continuous operation between transverse joints, as far as possible. If interrupted for more than 1/2 hour, place a construction joint.
- D. Curbs: Automatic machine may be used for curb placement. If machine placement is to be used, submit revised mix design and laboratory test results that meet or exceed the minimums herein specified. Machine placement must produce curbs to the required cross section, lines, grades, finish, and jointing as specified for formed concrete. If results are not acceptable, remove and replace with formed concrete.

## 3.6

## 3.6 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.

- B. 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.

## C. 3.7 EXPANSION JOINTS

- A. Expansion joints shall be placed where pavement meets curbing or structures, including light bases, hydrants and at other conditions as shown on the Drawings.

1. Place expansion joints twenty feet (20') on center and/or as indicated on the Drawings. Follow the manufacturer's application recommendations for joint filler and sealer.

- D. Expansion joints shall be on-half inch (1/2") wide. Joint alignment shall be straight and true.

2. Clean joint surfaces immediately before application of primer and installation of sealant or caulking compound. Remove dirt, insecure coatings, moisture and other substances which interfere with bond of sealant. Do not proceed unless all joint surfaces are completely dry. Use primer for joints as recommended by sealant manufacturer.

- B. Install expansion dowels and sleeves perpendicular to and across all expansion joints in the concrete paving at two feet (2') on center minimum, or as shown on the Drawings.

1. Forms shall not be moved for 72 hours after the concrete has been placed, or for a longer period if directed by the Engineer. Extreme care shall be taken in removing forms in order that no damage will be done to the concrete. Under no condition shall any bar, pick or other tool be used which depends upon leverage on the concrete for removal of the forms.

## 3.8 CONTROL JOINTS

- A. Control joints indicated shall be sawn by using a special soft-type early entry 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.

- B. Sawing shall cut into slab surface at least 1 in., but in no case not less than 25% of slab depth.

1. Sawed Joints: Form 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.

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5. Protect the top edge of the joint filler during concrete placement with a metal cap or other temporary material. Remove protection after concrete has been placed on both sides of joint.
6. Fillers and Sealants: Apply sealant over expansion joint where occupied space occurs below the walk. Comply with the requirements of ASTM C1193 and manufacturer for preparation of joints and installation, including priming of joints and backer rod.

3.9

3.7

**CONCRETE FINISHING**

- A. After consolidating and striking off concrete, level the surface by darbying or bull floating. After the concrete has stiffened sufficiently to permit the operation and the surface sheen has disappeared, the surface shall be floated. Use hand methods only where mechanical floating is not possible. Adjust the floating to compact the surface and produce a uniform texture.
- B. After floating, test surface for trueness with a ten feet long straight edge. Distribute concrete as required to remove surface irregularities, and refloat repaired areas to provide a continuous smooth finish.
- C. Work edges of slabs, gutters, back top edge of curb, and formed joints with an edging tool, and round to 1/2" radius, unless otherwise indicated. Eliminate any tool marks on concrete surface.
- D. After completion of floating and when excess moisture or surface sheen has disappeared, complete surface finishing by drawing a fine hair broom across concrete surface, perpendicular to line of traffic from full edge to edge. There shall be no border. Repeat operation if required to provide a fine line texture acceptable to the Landscape Architect.

1/4"

3.10

3.8

**CURING**

- E. Do not remove forms for twenty-four hours after concrete has been placed. After form removal, clean ends of joints and point up any minor honeycombed areas. Remove and replace areas or sections with major defects, as directed by the Landscape Architect.
- A. Protect and cure finished concrete paving, complying with applicable requirements of Section 033000. Use curing compound specified herein applied in accordance with manufacturer's instructions.

3.11

3.9

**REPAIRS AND PROTECTION**

- A. Repairs: Where pavement has been cracked or damaged, remove the entire panel wherein the damage occurs and install a new panel of pavement. No patching within a panel is permitted.
- B. Protection
1. Protect concrete from damage until acceptance of work. Exclude traffic from pavement for at least fourteen days after placement. No construction traffic is permitted.
  2. Sweep concrete pavement and wash free of stains, discolorations, dirt, and other foreign material just prior to final inspection.

END OF SECTION

## SECTION 321314

## EXPOSED AGGREGATE CONCRETE PAVEMENT

## PART 1 GENERAL

## 1.1 GENERAL REQUIREMENTS

- A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

## 1.2 SECTION INCLUDES

- A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the exposed aggregate concrete pavement as shown on the drawings and/or specified herein, including, but not necessarily limited to, the following:
  - 1. Exposed aggregate concrete paving work.

## 1.3 RELATED SECTIONS

- A. Cast-in-Place Concrete - Section 033000.
- B. Clearing and Grubbing - Section 311100.
- C. ~~Site Excavating, Backfilling and Compacting - Section 312300.~~
- D. Portland Cement Concrete Pavement - Section 321313.
- E. Granite Curb - Section 321640.



Earthwork - Section  
310000

## 1.4 SYSTEM DESCRIPTION

- A. Provide exposed aggregate concrete paving according to materials, workmanship, and other applicable requirements of Standard Specifications of the NYS DOT.
  - 1. Standard Specification: Portland cement concrete paving shall conform to Section 500 Portland Cement Concrete of the NYS DOT Standard Specifications and as amended.

## 1.5 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
- 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. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

- 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.
- H. Testing and Inspection: The Owner reserves the right to test and inspect materials and construction of crushed stone surfacing in accordance with the requirements of Section 014523 "Testing and Inspection."
- I. Mock-Up
  - 1. General
    - a. Schedule mock-up casting for acceptance 30 days prior to casting of concrete surfaces represented by the mockups.
    - b. Locate mock-up panels in non-public areas accepted by the Architect.
    - c. 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.
    - d. Mock-up sequence of forming, placing, form removal, curing, and finishing shall be reviewed and accepted by the Architect.
    - e. Mock-up formwork shall be inspected and accepted by the Architect before placing of concrete.
    - f. Use the same concrete mixes and placement procedures, accepted in mock-ups, in the final work, unless otherwise directed by the Architect.
    - g. Protect accepted mock-ups from damage until completion and acceptance of the work represented by the mock-up.
    - h. Remove mock-up panels from site at completion of project, as directed by the Architect.
  - 2. Construct mock-up panels or areas as indicated to demonstrate the ability to cast concrete for concrete paving to achieve shape, color, and ground/sandblast textured finish required. Mock-ups shall include or meet the following requirements:
    - a. Provide full scale mock-up panels and areas.
    - b. 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.
    - c. 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.
    - d. Demonstrate in the construction of the mock-up formwork the sealer material, form release agent, and curing materials and methods to be used.
  - 3. Source of Materials: Use the same source, stock, or brand of stabilizer material for all decomposed granite surfacing. 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.

## 1.6 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. Manufacturers' product data shall be submitted for the following items:
  - 1. Admixtures.
  - 2. Aggregate, including sieve analysis.
  - 3. Concrete sealer.
  - 4. Curing material.
  - 5. Preformed joint filler.
  - 6. Form release agent.
  - 7. Sealants.
- C. Shop drawings of exposed aggregate paving shall be submitted. Drawings shall indicate expansion joint, control joint and decorative joint locations.
- D. Samples: Submit samples of the following:
  - 1. Preformed joint filler, two pieces, full depth and width, 4 in. length.
  - 2. Color chart for selection of sealant color.
  - 3. A 10 lb. minimum sample of aggregate proposed for use on the exposed aggregate paving shall be submitted for approval. Accompanying the sample shall be information from the aggregate supplier indicating source, type, color, and gradation of aggregate.

provide crushed bluestone and 2 additional native stone selections with range of natural tones and colors conforming to NYS DOT Specifications section 703-02-01 "Crushed Stone".

## 1.7 PROJECT CONDITIONS

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

## 1.8 DESIGN OF CONCRETE MIX

- A. The Contractor shall be responsible for the design of the concrete mixture. Mix design shall be certified by an independent testing laboratory. The statement of materials constituting the design mix shall be submitted to the Architect for approval within one week following award of Contract. The 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.
  - 4. Type of aggregates including sieve analysis.
  - 5. Type and dosage of all admixtures.
  - 6. Special requirements for pumping.

7. Range of ambient temperature and humidity for which the design is valid.
  8. Any special characteristics of the mix which require precautions in the mixing, placing, finishing, or curing methods to achieve the finished product specified.
- B. No concrete shall be delivered to the job site until the Architect has reviewed and approved the design mix.

## PART 2 PRODUCTS

### 2.1 AGGREGATE BASE COURSE

- A. Refer to Section 312300, SITE EXCAVATING, BACKFILLING AND COMPACTING

### 2.2 FORMWORK

- A. Formwork: The dimensions of the lumber used to form concrete pavements shall not be less than 2" (nominal thickness) by the required pavement depth.
- B. Forms for Unexposed Finish: Plywood, lumber or metal, with lumber dressed on at least two edges and one side.
- C. Form Coatings: Commercial formulation compounds that will not bond with, stain or adversely affect concrete.
- D. 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.

### 2.3 STEEL REINFORCEMENT

- A. Steel reinforcing bars shall conform to the following requirements:
1. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420); deformed.
- 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.
  2. Deformed-Steel Welded Wire Reinforcement: ASTM A 497, flat sheet.
- 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. Tie Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
- E. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete.

## 2.4 CONCRETE

- A. Concrete to receive an exposed-aggregate surface shall contain a minimum of 610 lb. of cementitious material content per cubic yard of concrete, and a water-cement ratio no greater than 0.53 by weight. Minimum compressive strength shall be 4,500 psi at 28 days. Supplementary Cementitious Materials to be limited as required for Concrete Assigned to Exposure Class F3 as Defined by ACI 318.
- B. Maximum slump shall not exceed 4 in. and air entrainment shall be 7 percent  $\pm$  1 percent.
- C. Maximum size of coarse aggregate of the base mix shall be 1/2 in.
- D. Ready mixed concrete, if used, shall meet ASTM C 94.
- E. An oversanded base mix may be used, and if so, the water-cement ratio specified above shall govern the mix design, and the cement content shall be raised accordingly. Aggregate source and cement type and brand shall not be altered once construction begins.

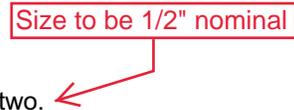
## 2.5 CHEMICAL ADMIXTURES

- 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.

## 2.6 AGGREGATE

- A. Aggregate to be exposed shall be hard, sound, durable peastone, and free of all deleterious materials and staining qualities.
- B. The select aggregate shall be stored off the ground and protected from contamination and moisture.
- C. Aggregate shall match Architect-approved sample.
- D. Peastone aggregate shall be of one sieve size or no more than two.
- E. Shape of aggregate shall resemble spheres and cubes. Flat, slivery stones that may become dislodged easily shall not be used.

Size to be 1/2" nominal



## 2.7 CLEANER

- A. Chemically neutral cleaner with pH factor between 7 and 10 that is biodegradable, phosphate free, and recommended by cleaner manufacturer for use on exposed aggregate pavement type indicated.

## 2.8 SEALER

- A. Sealer shall be a methyl methacrylate acrylic resin suitable for sealing of exposed aggregate horizontal concrete surfaces. Sealer shall be subject to the approval of the Architect.
- B. Sealer shall be Enviroseal 20, manufactured by Hydrozo, or approved equal.

## 2.9 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.

## 2.10 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M [ and ASTM C 1116]. Furnish batch certificates for each batch discharged and used in the Work.
- B. When air temperature is between 85 deg F (30 deg C) and 90 deg F (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.
- C. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.

## 2.11 EXPANSION JOINTS

- A. Expansion joints shall be located as indicated on the Drawings
- B. Expansion joints shall be 3/8" wide. Expansion joint filler shall be flexible foam expansion joint filler composed of a unique synthetic foam of isomeric polymers in a very small, closed-cell structure conforming to ASTM D 1752, similar to Ceramar Flexible Foam Expansion Joint Filler, manufactured by W.R. Meadows, Inc., or preformed, nonbituminous type joint filler conforming to ASTM D 1752, Type II, similar to Sealtight Cork or Self-Expanding Cork Expansion Joint Filler, manufactured by W.R. Meadows, Inc., or approved equal.
  - a. Premolded filler shall be one piece for the full depth and width of the joint.
  - b. Use of multiple pieces ~~c~~ **Delete this section** take up required depth and width of joint will not be permitted.
  - c. Except as otherwise noted on the Drawings, joint filler shall be 3/8 in. thick.
  - d. Doweled at each expansion joint. One end of the dowel shall be greased.
- C. Where indicated, concrete slab-on-grade shall be doweled at each expansion joint. One end of the dowel shall be greased.
- D. Round Expansion Joint Dowels: ASTM A615, Grade 60, epoxy-coated, smooth, billet-steel bars, clean and free of rust and scale.
- E. Dowel Caps for Round Dowels: Plastic caps approximately 4" long, designed and manufactured to fit over ends of expansion joint dowels to allow longitudinal movement of dowels after concrete has hardened.

- F. ~~.Dowel Aligners for Round Dowels, PNA Dowel Aligners, or accepted substitute.~~  
*Delete this section*
- G. Snap Cap, manufactured by W.K. Meadows, Inc., or approved equal.

## PART 3 EXECUTION

## 3.1 INSPECTION

- A. Examine the areas and conditions under which exposed aggregate concrete paving is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

310000, EARTHWORK

## 3.2 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 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. Subgrade shall be compacted as required to bring the top 6 in. of subgrade material immediately below the concrete pavement to a density of not less than 97 percent at optimum moisture content as determined by ASTM D 698. Subgrade compaction shall extend for a distance of at least 1 ft. beyond edge of pavement.
1. 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 this Section.
- 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% density, as determined by ASTM D 698. 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. 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 conform to the following.
1. Material shall be legally disposed of off-site.
- H. Subgrade shall be kept clean and uncontaminated. Portions of subgrade which becomes 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.

- I. 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.

3.3 AGGREGATE BASE COURSE

- A. Refer to Section ~~312300, SITE EXCAVATING, BACKFILLING AND COMPACTING~~
- 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.

3.4 STEEL REINFORCEMENT

- A. 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.
- B. 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.
- C. 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.

### 3.5 CONCRETE PLACEMENT

- 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. 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 require 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. Concrete shall be placed in accordance with ACI 304.
- D. Concrete shall be consolidated by suitable means to eliminate voids and pockets.
- E. The strike-off and darby or bullfloat operations should be such that a level surface is obtained sufficiently below the final finish grade to allow for volume growth due to the addition of the seeding aggregate.
- F. Expansion joints shall be formed in the concrete to required width with preformed joint filler in place. Depth of filler shall be as required to form a 5/8 in. deep sealant and backer rod recess below finished surface of walkway.

### 3.6 COLD WEATHER CONCRETING

- A. Materials for concrete shall be heated when concrete is mixed, placed, or cured when the mean daily temperature is below 40oF. or is expected to fall to below 40 degrees 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.

### 3.7 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 (95oF., or above), ingredients in the concrete shall be cooled insofar as possible and cold mixing water shall be used to maintain the temperature of the concrete at permissible levels all in accordance with the provisions of ACI 305R. Any concrete with a temperature above 95oF., 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.

### 3.8 SEEDED EXPOSED-AGGREGATE FINISH

- A. Prior to the concrete placing operation, all select seeding aggregate shall be washed thoroughly so that it is free of all dust, dirt, and clay particles. The aggregate shall be in a damp condition but without free surface water at the time of seeding application. There shall be sufficient select aggregate on hand to complete the seeding once it has started.
  - 1. Work shall be planned so that the concrete-placing and aggregate-seeding procedures are coordinated with the capabilities of the washing and brushing crew.
- B. The seeding operation shall start immediately after the placement of concrete as described above. The select aggregate shall be carefully and uniformly seeded by suitable means so that the entire surface is completely covered with one layer of stone. Stacked stone and flat and slivery particles shall be removed at this time. The aggregate shall be embedded by suitable means, and float finished to entirely embed aggregate with mortar cover of 1/16 inch (1.6 mm). Care shall be taken not to overembed and deform the surface. Under no circumstances shall areas lacking sufficient mortar be filled with small quantities of the base concrete mix.
  - 1. Spray-apply chemical surface retarder to pavement according to manufacturer's written instructions.
  - 2. Cover pavement surface with plastic sheeting, sealing laps with tape, and remove sheeting when ready to continue finishing operations.
  - 3. Without dislodging aggregate, remove excess mortar by lightly brushing surface with a stiff, nylon-bristle broom.
  - 4. Fine-spray surface with water and brush. Repeat water flushing and brushing cycle until cement film is removed from aggregate surfaces to depth required.

### 3.9 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.

### 3.10 EXPANSION JOINTS

- A. Expansion joints shall be placed where pavement meets curbing or structures, including light bases, hydrants and at other conditions as shown on the Drawings.

1. Place expansion joints twenty feet (20') on center and/or as indicated on the Drawings. Follow the manufacturer's application recommendations for joint filler and sealer. Expansion joints shall be on-half inch (1/2") wide. Joint alignment shall be straight and true.
  2. Clean joint surfaces immediately before application of primer and installation of sealant or caulking compound. Remove dirt, insecure coatings, moisture and other substances which interfere with bond of sealant. Do not proceed unless all joint surfaces are completely dry. Use primer for joints as recommended by sealant manufacturer.
- B. Install expansion dowels and sleeves perpendicular to and across all expansion joints in the concrete paving at two feet (2') on center minimum, or as shown on the Drawings.
1. Forms shall not be moved for 72 hours after the concrete has been placed, or for a longer period if directed by the Engineer. Extreme care shall be taken in removing forms in order that no damage will be done to the concrete. Under no condition shall any bar, pick or other tool be used which depends upon leverage on the concrete for removal of the forms.

### 3.11 CONTROL JOINTS

- A. Control joints indicated shall be sawn by using a special soff-type early entry 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.
- B. Sawing shall cut into slab surface at least 1 in., but in no case not less than 25% of slab depth.
1. Sawed Joints: Form 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.

### 3.12 DECORATIVE SAW CUT JOINTS

- A. Unless otherwise indicated, decorative saw cut joints shall be sawn into the concrete slab using a special soff-type early entry concrete power saw, at intervals and patterns indicated on the Drawings. 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.
1. Saw cut joints shall be sawn flush to vertical surfaces.
- B. ~~Decorative saw cut joints shall be located 16 in. o.c. each way to create scoring patterns indicated on the Drawings.~~
- C. Depth of decorative saw cut joint shall be 3/4 in.  ←

### 3.13 CURING

- A. As soon as the washing operation ceases, the curing operation shall begin. The concrete shall be kept in continuously moist condition by covering with curing paper for 5 days in warm weather (70 deg. F. or higher) or 7 days in cooler weather (50-70 deg. F.). The temperature of the concrete shall not be allowed to fall below 50 deg. F. during the curing period.

- B. During periods of excessively hot weather (95oF., or above) ingredients in the concrete shall be cooled insofar as possible and cold mixing 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 95oF. when ready for placement will not be acceptable and will be rejected.

### 3.14 FINISHING

- A. Finishing – Ground/Sandblast Finish:
  - 1. Seed additional aggregates in matrix to uniformly distribute granular material on surface.
  - 2. Delay fine grinding until heavy trade work is complete and construction traffic through area is restricted.
  - 3. Fine Grinding: Grind with stones 120 grit or finer until all grout is removed from surface. Repeat rough grinding, grout coat, and fine grinding if large voids exist after initial fine grinding. Produce surface with a minimum of 70 percent aggregate exposure.
  - 4. Sandblast: Provide light sandblast finish following fine grinding operations. Match approved sample panel.
- B. Cleaning:
  - 1. Remove grinding dust from installation and adjacent areas.
  - 2. Wash surfaces with cleaner according to manufacturer's written instructions; rinse surfaces with water and allow to dry thoroughly.

### 3.15 SEALING OF JOINTS

- A. Fillers and Sealants: Apply sealant over expansion joint where occupied space occurs below the walk. Comply with the requirements of Section 079200 for preparation of joints and installation, including priming of joints and backer rod.

### 3.16 SEAL COAT

- A. After the slab is washed and is completely dry, the sealer shall be uniformly applied to the surface at the application rate and methods recommended by the sealer manufacturer.

### 3.17 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.

END OF SECTION

Formatting errors

SECTION 321440

STONE PAVING

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

- A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

- A. Provide all equipment and materials, and do all work necessary to construct the stone paving, as indicated on the Drawings and as specified, including but not limited to:
  1. Bluestone pavers on a sand setting bed over compacted aggregate base with sand swept joints
  2. Bluestone pavers on a sand setting bed over a concrete base with sand swept joints

1.3 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 033000, CAST-IN-PLACE CONCRETE; Concrete slab
  2. ~~Section 312300, SITE EXCAVATING, BACKFILLING AND COMPACTING;~~ Establishment of subgrade elevation.

Section 310000, EARTHWORK

1.4 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 97	Absorption and Bulk Specific Gravity of Natural Building Stone
C 170	Compressive Strength of Natural Building Stone
C 241	Abrasion Resistance of Stone Subjected to Foot Traffic
C 616	Quartz-Based Dimension Stone
C 880	Flexural Strength of Natural Building Stone

1.5 SUBMITTALS

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

<u>Item</u>	<u>Quantity and Size</u>
-------------	--------------------------

Bluestone Paver One, full size, full thickness, specified color, cut and finish.

- B. 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.
- C. 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)
- 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 stone supplier, and that he is in agreement that the selected materials and construction are proper, compatible, and adequate for the application shown.
- E. 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

#### 1.6 SAMPLE PANEL

- A. Construct a sample panel of stone paving on the specified base and setting bed before start of any paving.
  1. Sample panel shall exhibit proposed color range, texture, bond, jointing, pattern, and workmanship.
  2. Size of panel shall be 10'x10', minimum.
- B. Before installing stone pavers, build mockups for each stone paving type required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for the completed Work, including same base construction, special features for expansion joints, and contiguous work as indicated:
  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.

#### 1.7 LAYOUT

- A. The stone paving layout indicated on the Drawings is approximate. The final configuration of the paving will be determined in the field by the Architect.

1.8 DELIVERY, HANDLING, AND STORAGE

- A. Stone shall be carefully packed and banded by the supplier for shipment. Following shipping stone 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 stone materials and to prevent breakage, cracking, and damage to stone pieces. Stone materials shall be stored in such a manner as to allow air to circulate around the stone material. Stone shall not be permitted to be in direct contact with the ground any time during storage.
- B. Stone damaged in any manner will be rejected and replaced with new materials at no additional cost to the Owner.

1.9 PROTECTION OF FINISHED SURFACES

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

1.10 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.

1.10 JOB CONDITIONS

- A. Cold Weather Protection:
  - 1. Remove any ice or snow formed on stone or setting bed by carefully applying heat until top surface is dry to touch.
  - 2. Remove stone work determined to be damaged by freezing conditions.
- B. Cold Weather Protection for Completed Stone Work:
  - 1. Do not use frozen materials or materials mixed or coated with ice or frost.
  - 2. Do not build on frozen work; remove and replace stone work damaged by frost or freezing.
  - 3. During all seasons, protect partially completed stone work against weather when work is not in progress.

PART 2 PRODUCTS

2.2 STONE PAVERS

- A. Bluestone shall conform to ASTM C 616 and be of the sizes and dimensions indicated on the Drawings.
- B. Stone: "NY Bluestone", supplied by Gault Stone, Bridgeport CT, (203)-227-5181
  - 1. Sizes: As indicated on the Drawings.
  - 2. Finish: Thermal top; sawn edges.
  - 3. Coloration: Uniform blue-gray

or approved equal.



- C. Use only one source for each type of stone throughout the entire Project. Other sources will be reviewed according to substitution requirements specified in the Conditions of the Contract.
- D. Stone 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.
- E. Back of stone which will be concealed in the finished work shall be sawn to approximately true planes. Maximum variation in thickness shall be 1/8 in. Sawn backs shall be cleaned of rust stains and iron particles.
- F. All faces shall be at right angles to the plane of the top.

2.2 AGGREGATE BASE COURSE

- A. Refer to Section ~~312300, SITE EXCAVATING, BACKFILLING AND COMPACTING.~~

2.3 SAND SETTING BED

321100, BASE COURSES (PAVEMENT)

- A. Sand shall be a clean, sharp, natural sand conforming to ASTM C 33, except that the fineness modulus shall be  $2.25 \pm 0.10$ .

- 1. Gradation for setting bed sand shall be as follows:

<u>Sieve Size</u>	<u>% Passing by Weight</u>
3/8 in.	100
No. 4	95 - 100
No. 8	80 - 100
No. 16	50 - 85
No. 50	10 - 30
No. 100	5 - 15
No. 200	0 - 10

2.4 SAND JOINT FILLER

- A. Joint filler between paver joints shall be sand.
  - 2. Sand shall be a clean, washed, uniformly well graded masonry sand with 100 percent passing No. 16 (1.18-mm) sieve and no more than 10 percent passing No. 200 (0.075-mm) sieve, conforming to ASTM C 144, except that the fineness modulus shall be  $2.25 \pm 0.10$ . Sand shall be from a single source. Source of supply shall not be changed during course of job without written permission of the Architect.
  - 3. Provide sand of color needed to produce required joint color.

310000, EARTHWORK

PART 3 EXECUTION

3.1 PREPARATION OF SUBGRADE

- 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 to form a firm, uniform, accurate, and unyielding subgrade at required elevations and to required lines, shall be done under this Section.

310000, EARTHWORK

B. Existing subgrade material which will not readily compact 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.~~

310000, EARTHWORK

C. Subgrade of areas to be paved shall be recompacted 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.~~

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, 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 conform to the following:

1. Material shall be legally disposed of off-site.

H. Prepared subgrade will be inspected and tested by an independent testing agency, provided and paid for by the Contractor, prior to installation of paving base course. Disturbance to subgrade caused by inspection procedures shall be repaired under this Section of the specification.

321100, BASE COURSES (PAVEMENT)

1. Contractor shall submit a minimum of six (6) Proctor compaction test results indicating conformance to compaction density requirements specified herein.

3.2 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.

1. Refer to Section ~~312300, SITE EXCAVATING, BACKFILLING AND COMPACTING.~~

3.3 SETTING STONE PAVERS - SAND BED

A. All setting shall be done by competent stone setters under adequate supervision.

B. Stone pavers with chips, cracks, stains, or other defects which might be visible in the finished work shall not be used.

C. Before setting, stone pavers shall be clean and free of dirt, and foreign matter on all sides. Stone block shall be dry before setting.

D. Place leveling course and screed to a thickness of 1 to 1-1/2 inches (25 to 38 mm), taking care that moisture content remains constant and density is loose and constant until pavers are set and compacted.

- E. Pavers: Unless otherwise directed by stone supplier, vibrate pavers into leveling course with a low-amplitude plate vibrator capable of a 3500- to 5000-lbf (16- to 22-kN) compaction force at 80 to 90 Hz. Perform at least three passes across paving with vibrator. Vibrate under the following conditions:
1. After edge pavers are installed and there is a completed surface or before surface is exposed to rain.
  2. Before ending each day's work, fully compact installed stone pavers to within 36 inches (900 mm) of the laying face. Cover open layers with nonstaining plastic sheets overlapped 48 inches (1200 mm) on each side of the laying face to protect it from rain.
- F. Planting Soil Filled Joints:
1. Set pavers with a minimum joint width indicated on the Drawings, being careful not to disturb leveling base.
  2. Pavers: Spread dry planting soil and fill joints immediately after vibrating pavers into leveling course. Surface shall be misted with water to settle filler and joints shall be refilled by sweeping planting soil into them. Vibrate pavers and add planting soil until joints are completely filled, then remove excess planting soil, careful not to stain pavers.

#### 3.4 ADJUST AND CLEAN

- A. Remove and replace stone 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 stone work. Provide new matching units, install as specified and refill with planting soil to eliminate evidence of replacement. Repair defective and unsatisfactory joints as required to provide a neat, uniform appearance.
- B. Clean stone 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.
- C. Finished pavers shall not be sealed.

END OF SECTION

## SECTION 321443

## GRASS PAVER SYSTEM

## PART 1 GENERAL

## 1.1 GENERAL REQUIREMENTS

- A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

## 1.2 SECTION INCLUDES

- A. The Work of this Section includes all labor, materials, equipment, and services necessary to complete the grass paver system as shown on the drawings and/or specified herein, including, but not necessarily limited to, the following:
  - 1. Grass block pavers with lawn.
  - 2. Aggregate setting bed for pavers.

## 1.3 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of paver from single source that has resources to provide materials and products of consistent quality in appearance and physical properties
- B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
  - 1. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

## 1.4 SUBMITTALS

- A. Manufacturer's Data: Submit copies of manufacturer's specifications and installation instructions for pavers required. Include data substantiating that materials comply with specified requirements. Indicate that installer has received copy of manufacturer's instructions.
- B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for unit pavers, indicating compliance with requirements.
  - 1. Include test data for freezing and thawing according to ASTM C 67.
- C. Samples
  - 1. Pavers: Submit three sets of 1' x 1' samples of each type and each finish of grass block paver.
  - 2. Submit a three (3) pound bag of sand to the Landscape Architect for approval, with a sieve analysis and the name of supplier attached.

## 1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Protect pavers during storage and construction against moisture, soiling, staining, and physical damage.

- B. Handle pavers to prevent chipping, breakage, soiling, or other damage. Do not use pinch or wrecking bars without protecting edges of pavers with wood or other rigid materials. Lift with wide-belt type slings wherever possible; do not use wire rope or ropes containing tar or other substances which might cause staining. If required, use wood rollers and provide cushion at end of wood slides.
- C. Store pavers on wood skids or pallets, covered with non-staining, waterproof membrane. Place and stack skids and pavers to distribute weight evenly and to prevent breakage or cracking of pavers. Protect stored pavers from weather with waterproof, non-staining covers or enclosures, but allow air to circulate around units.
- D. All grass seed shall be delivered in sealed standard size bags of the vendor, showing weight, analysis, and name of vendor. It shall be stored as directed by the Architect, in such a manner that its effectiveness will not be impaired.
- E. All commercial fertilizer 10-6-4, (50% slow release) shall be delivered in standard size bags, showing weight, analysis, and name of manufacturer. It shall be stored, as stored, as directed by the Architect, in such a manner that its effectiveness will not be impaired.

#### 1.6 JOB 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.

### PART 2 PRODUCTS

#### 2.1 GRASS PAVER SYSTEM

- A. Grass Pavers: Provide "Grasspave2" as manufactured by Invisible Structures or approved equal.

#### 2.2 MATERIALS

- A. Sand: Sand shall consist of clean, hard, durable, uncoated stone particles, free from lumps of clay and all deleterious substances. Sand shall be so graded that, when dry, one hundred percent (100%) shall pass a one-quarter inch (1/4") square opening sieve, and not more than thirty-five percent (35%) by weight shall pass a No. 50 sieve and not more than ten percent (10%) by weight shall pass a No. 100 sieve.

1. Sand may be rejected if it contains more than ten percent (10%) by weight of loam and silt.

- B. Grass Seed: Grass seed shall be fresh, re-cleaned seed of the latest crop mixed in the proportions by weight indicated below and meeting the following standards of pure live seed content (Purity & Germination) and maximum allowable weed seed content. All seed shall be free of noxious weeds.

**Grass Seed: Refer to Section  
329200, Lawns and Grasses**

1. Grass Seed Mixture: 50% tall fescue, 20% bluegrass and 30% perennial rye grass.
2. Rate of seeding shall be five pounds (5 lbs.) per one thousand (1,000) square feet.

- C. Commercial Fertilizer: Commercial Fertilizer 10-6-4 (50% slow release) shall have the following composition by weight: Nitrogen ten percent (10%) Phosphoric Acid (P205) six percent (6%); Potash four percent (4%). The guaranteed analysis shall have a minimum of fifty percent (50%) of total Nitrogen, derived from Ureaform, furnishing 3.5% minimum water insoluble Nitrogen. The balance of Nitrogen shall be present as Methylene urea, water-soluble urea nitrate, and ammoniacal compounds.

- D. Superphosphate: Superphosphate shall contain twenty percent (20%) by weight of available phosphoric acid. The Architect reserves the right to request tests on the material at any time, and acceptance or rejection shall be based upon the results of these tests. All samples are to be taken by the Engineer. The Engineer will designate where the superphosphate shall be stored on the job.

- E. Topsoil: See **Structural Soil and Reinforced Soil: Refer to Section 329115, Planting Soil**

### PART 3 EXECUTION

#### 3.1 INSPECTION

- A. Examine the areas and conditions under which pavers are to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

#### 3.2 INSTALLATION, GENERAL

- A. Do not use pavers with chips, cracks, voids, discolorations, and other defects which might be visible or cause straining in the 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. Tolerances

1. Variation in Plane between Adjacent Units (Lipping): Do not exceed 1/16" in unit-to-unit offset from flush.
2. Variation from Level or Indicated Slope: Do not exceed 1/8" in 24" and 1/4" in 10'-0" or a maximum of 1/2".

#### E. Fertilizer

1. Two (2) applications of acceptable commercial fertilizer 10-6-4 (50% slow release) shall be applied by machine, each application at the rate of twenty (20) pounds per 1,000 square feet. The first application shall be incorporated into screened topsoil prior to the installation of Seed.
2. The second application shall be made approximately six (6) months after the first application. This treatment shall take place during the next appropriate fertilizing season, this is, the following spring or fall, and shall be subject to the direction of the Construction Supervisor and/or Landscape Architect.
3. The second application shall be applied to the surface only. Incorporation shall be achieved by thoroughly watering the entire area after application. The Contractor shall provide all labor and materials, including water, if not available from site sources.

- F. Superphosphate shall be applied at the rate of twenty (20) pounds per 1,000 square feet and shall be incorporated into the screened topsoil mix as specified in "Installation" article.

- G. Grass seed shall be sown in the summer during August and September or in the spring during March, April, and May or at such other times as are approved by the Landscape Architect. All seeding shall be done in moderately dry to moist (not wet) soil and at a time when the wind does not exceed a velocity of five (5) miles per hour.

## 3.3

## 3.3 Paver Installation:

A. Aggregate Base Course: Refer to Section 321100, Base Courses (Pavement)

B. Structural Soil:

- 1 Install Structural Soil in 6 inch lifts and compact each lift.
- 2 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 Structural Soil during delays in compaction with plastic or plywood as directed by the engineer.
- 3 Bring Structural Soil to finished grades as shown on the drawings. Immediately protect the 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.
- 4 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 Structural Soil. If the engineer determines that the delivered structural soil varies significantly from the approved samples, the engineer shall contact the licensed producer.
- 5 Engineer shall ensure that the delivered structural soil was produced by the approved structural soil licensee by inspecting weight tickets showing source of material.
- 6 Structural soil should not be stockpiled long-term. Any soil not installed immediately should be protected by a tarp or other waterproof covering.

C. Grass Paver: Install Grass Paver system per manufacturers requirements. Fill voids with sand.

D. Reinforced Soil: Install reinforced soil to depths shown on Drawings. Compact to 85% Proctor Density.

## 3.4

## PROTECTION

- A. Maintain all seeded areas until acceptance of the contract. Properly water as required to maintain a moist seed bed for optimum germination and as often as required to maintain optimum growing conditions for the new stand of grass until acceptance of the Contract.
- B. Reseed and water any areas that fail to show a satisfactory stand of grass and with specified mixture of seed and fertilizer, as many times as necessary, at no additional cost to the Owner, until final acceptance of the Contract. The Contractor shall properly mow and otherwise maintain the grass at a maximum height of 3", or as directed by the Landscape Architect, until final acceptance on completion of the whole work under this Contract.
- C. All automobile traffic shall be kept off grass ~~block~~ pavers until final acceptance of the Contract.

END OF SECTION



Edging	12 in. length, including 1 stake
Filter fabric	1 sq. ft.

- C. Manufacturer's Product Data: Manufacturer's product data shall be submitted for the following materials:
1. Filter Fabric
  2. Edging

#### 1.6 TESTING AND INSPECTION

- A. The Owner reserves the right to inspect and test paving and associated work in accordance with Section 01 40 00, QUALITY REQUIREMENTS.

#### 1.7 Quality Control

- A. Mockups:
1. Splash Pad: Minimum size to be 4' x 4'
  2. Drip Edge: Minimum Size to be 4' long run.

### PART 2 - PRODUCTS

#### 2.1 AGGREGATE BASE COURSE

- A. Refer to 32 11 00, BASE COURSES (PAVEMENT)

#### 2.2 CRUSHED STONE

- A. Refer to 31 00 00, EARTHWORK

#### 2.3 RIVERSTONE

- A. Riverstone shall be "Vineyard Pebbles" Connecticut Stone Supplies, Inc. 138 Woodmont Road Milford, CT. or approved equal.
1. Size: 2"-3"

#### 2.4 DECORATIVE AGGREGATE

- A. Decorative aggregate shall be native crushed stone showing a range of natural colors and tones.
1. Size: ½"

#### 2.5 EDGING

- A. Refer to 055901, MANUFACTURED METAL EDGING

### PART 3 - EXECUTION

## 3.1 GRADING

- A. Areas to be paved will be filled, fine graded and compacted to subgrade elevation under Section 310000, EARTHWORK before work of this section is performed.
- B. 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 310000, EARTH MOVING. Completed subgrade after filling such areas shall be uniformly and properly graded.

## 3.2 BASE COURSE

- A. Base course material shall be placed, graded and compacted to required elevation under Section 310000, EARTHWORK before work of this section is performed.

## 3.3 EDGING

- A. Refer to 055901, MANUFACTURED METAL EDGING

## 3.4 RIVERSTONE SURFACING

- A. Peastone surfacing 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.
- B. Riverstone surfacing shall be constructed on a crushed stone base.
- C. Riverstone shall be spread evenly over the base at a depth noted in drawings.

## 3.5 DECORATIVE AGGREGATE

- A. Decorative aggregate surfacing 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.
- B. Decorative stone surfacing shall be constructed on a compacted aggregate base.
- C. Riverstone shall be spread evenly over the base at a depth noted in drawings.

END OF SECTION 32 15 40

## SECTION 321543

## STABILIZED STONE DUST PAVING

## PART 1 GENERAL

## 1.1 GENERAL REQUIREMENTS

- A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

## 1.2 SECTION INCLUDES

- A. The Work of this Section includes all labor, materials, equipment, and services necessary to complete the stabilized stone dust paving as shown on the drawings and/or specified herein, including, but not necessarily limited to, the following:
  - 1. Stone dust (decomposed granite) paving with stabilizer material, topped with peastone aggregate, including aggregate base and edging.

## 1.3 RELATED SECTIONS

- A. Clearing and Grubbing - Section 311100.
- B. ~~Site Excavating, Backfilling and Compacting - Section 312300.~~

Base Courses  
(Pavement) - Section  
321100.



## 1.4 QUALITY ASSURANCE

- A. Crushed granite sample of sufficient quantity shall be submitted to stabilizer manufacturer for recommended blending proportions and procedures to be followed by crushed granite supplier. Blending operations shall be performed at crushed granite supplier facility and provided to Contractor pre-blended in accordance with stabilizer manufacturer's recommendations.
- B. Installer shall provide evidence to indicate successful experience in providing crushed granite surfacing containing stabilizer binder/additive or ability to follow installation instructions.
- C. Installer shall provide documentation of at least three (3) installations similar in scale (all reference projects to be equal or greater than 75% of the total square footage of the project being bid on) using specified stabilizer solution material, completed over the past five (5) years. If Contractor is not able to meet experience qualifications, Contractor shall be required to have a representative from Stabilizer Solutions be present on site for pre-construction training, installation of mockup, and at least 25% of the project installation. Contractor shall be responsible for any and all costs associated with this requirement. If contractor is unable to meet these requirements a qualified replacement contractor will be located subject to all qualifications listed above and Owner approval.
- D. Testing and Inspection: The Owner reserves the right to test and inspect materials and construction of crushed stone surfacing in accordance with the requirements of Section 014523 "Testing and Inspection."

## E. Mock-Up

## 1. General

- a. Schedule mock-up for acceptance 30 days prior to constructing decomposed granite surfaces represented by the mockups.
- b. Locate mock-up panels in non-public areas accepted by the Architect.
- c. Continue to construct mock-ups until acceptable mock-up is produced. Accepted mock-up shall be the standard for color, texture, mix ratio, and workmanship for the work.
- d. Use the same decomposed granite /stabilizer mix and placement procedure, accepted in mock-ups, in the final work, unless otherwise directed by the Architect.
- e. Protect accepted mock-ups from damage until completion and acceptance of the work represented by the mock-up.
- f. Remove mock-up panels from site at completion of project, as directed by the Architect.

2. Sample panel shall be 5 ft. x 5 ft. minimum.

3. Source of Materials: Use the same source, stock, or brand of stabilizer material for all decomposed granite surfacing. 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.

## 1.5 SUBMITTALS

- A. Manufacturer's Product Data: Submit Manufacturer's product data for stabilizer.
- B. Test Results: Submit test results for stabilized crushed stone surfacing indicating compliance with ADA Requirements for accessibility and slip resistance.
- C. Samples: Submit 1 lb. of each item indicated below, for color approval:
  1. Decomposed granite.
  2. Peastone aggregate topping.

## 1.6 PERFORMANCE REQUIREMENTS

- A. Perform gradation of decomposed granite material or 3/8" or 1/4" minus crushed aggregate in accordance with ASTM C 136 "Method for Sieve Analysis for Fine and Course."

## 1.7 JOB CONDITIONS

- A. Field Measurements: Each bidder is required to visit the site of the Work to verify the existing conditions. No adjustments will be made to the Contract Sum for variations in the existing conditions.
  1. Where surfacing is indicated to fit with other construction, verify dimensions of other construction by field measurements before proceeding with the work.
- B. Environmental Limitations: Do not install decomposed granite or crushed 3/8" or 1/4" minus aggregate paving during rainy conditions or below 40 degrees F and falling.

1.8 WARRANTY

- A. Provide written warranty signed by stabilizer manufacturer, installer, and Contractor, agreeing to repair or replace all work of this section which exhibits defects in materials or workmanship. Warranty shall cover stabilizer, decomposed granite and aggregate base work. "Defects" is defined to include, but not limited to, differential settlement, ponding of water, abnormal aging or deterioration of stabilized paving system, and failure to perform as required.
  - 1. Warranty Period: 90 days from date of Substantial Completion.
  - 2. Contractor shall provide unconditional maintenance and repairs as required through the warranty period.

PART 2 PRODUCTS

2.1 MATERIALS

Section 321100, BASE COURSES (PAVEMENT).

- A. Aggregate Base Course: Refer to ~~Section 312300, SITE EXCAVATING, BACKFILLING AND COMPACTING.~~
- B. Decomposed Granite: Decomposed granite or 3/8 in. or 1/4 in. crushed aggregate screenings.
  - 1. Crushed Stone Sieve Analysis Percentage of Weight Passing a Square Mesh AASHTO T11-82 and T2782. Gradation requirements shall be as follows:

3. Decomposed Granite shall be supplied by Read Custom Soils, 158 Tihonet Rd., Wareham, MA 02571, (888) 475-5526 or approved equal.

<u>Sieve Size</u>	<u>% Passing by Weight</u>
3/8 in.	100
No. 4	90 - 100
No. 8	75 - 80
No. 16	55 - 65
No. 30	40 - 50
No. 50	25 - 35
No. 100	15 - 20
No. 200	10 - 15

- 2. Decomposed granite color shall be as selected by the Architect.

- C. Stabilizer: Stabilizer shall be "Organic-Lock" by Envirobond Products Corporation; 2100 Bloor St. W. Suite 6191, Toronto, ON Canada M6S5A5, or approved equal.

- 1. Material shall be provided by supplier pre-mixed with stone dust (decomposed granite) material specified herein.

- D. Peastone Topping Aggregate: Peastone aggregate for topping course shall be washed, rounded 3/8" peastone in color to match Architect's approved sample.

- E. Edging: Steel edging shall be Border Concepts Edging, "Border King", manufactured by Border Concepts, Inc., P.O. Box 471185, Charlotte, NC 28247 or approved equal. Steel edging shall be shop fabricated, 1/4 in. thick x 6 in. deep, primed and painted Black. Edging shall be furnished in 16 ft. lengths.

1/2"

- F. Filter Fabric: 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.
- G. Pre-Emergent Herbicide: Herbicide shall be LESCO Ornamental Herbicide 5G, pre-emergent grassy and selected broadleaf weed control for ornamental plants, nursery stock and ground covers, #019515, manufactured by LESCO, Rocky River, OH 44116; Sierraron, manufactured by Scotts; Preen, manufactured by Lebanon Seaboard Corporation, or approved equal.

### PART 3 EXECUTION

#### 3.1 INSPECTION

- A. Examine the areas and conditions under stabilized stone dust paving is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

#### 3.2 GRADING

- A. Areas to be paved will be compacted and brought approximately to subgrade elevation under Section ~~312000~~, EARTHWORK 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 this Section.
- 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 ~~312000~~, EARTHWORK. 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. Contractor shall dispose of, off site, 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.
- 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.

## 3.3 AGGREGATE BASE COURSE

- A. Refer to Section ~~312300, SITE EXCAVATING, BACKFILLING AND COMPACTING~~

## 3.4 FILTER FABRIC

321100, BASE COURSES (PAVEMENT)



- A. Filter fabric shall be placed on compacted subgrade in accordance with manufacturer's printed instructions. Line trench on bottom and up the sides as indicated on the Drawings. Where fabric edges meet, they shall overlap a minimum of 12 in.

## 3.5 EDGING

- A. Install as detailed.

## 3.6 STONE DUST (DECOMPOSED GRANITE) SURFACING

- A. Stabilizer shall be provided thoroughly and uniformly pre-blended with decomposed granite by local supplier, at rate, and by method in strict accordance with manufacturer's printed instructions.
1. Blend 12 to 16-lbs (contact manufacturer for exact blend) of Stabilizer per 1-ton of decomposed granite or crushed aggregate screenings. It is critical that Stabilizer be thoroughly and uniformly mixed throughout decomposed granite or crushed aggregate screenings.
  2. Bucket blending is not acceptable. Blending with a rake and or shovel is not acceptable.
  3. Blend material dry.
- B. Decomposed granite surfacing shall be done only after excavation and construction work which might injure it has been completed. Damage caused during construction shall be repaired before acceptance.
- C. Decomposed granite surfacing shall be constructed on a compacted aggregate base or sand-based structural soil mix as indicated on the Drawings.
- D. Pre-blended stabilized decomposed granite or crushed aggregate screenings shall be spread evenly over the base in 1-1/2 in. maximum lifts, rolled and compacted to 85% of maximum density as determined by ASTM D 1557. Final compacted thickness shall be 3 in.
1. Contractor shall wait a minimum of 24 hours after placing stabilized decomposed granite material prior to compaction. Longer periods may be required for material to adequately dry. Consult manufacturer to make determination.
- E. Water shall be added to decomposed granite for full-depth moisture penetration prior to compacting.
1. Minimum 25 to 45-gallons of water per 1-ton must be applied to achieve saturation of stabilized pathway profile.
  2. During water application randomly test for depth using a probing device, which reaches full depth.
- F. Upon thorough moisture penetration, compact stabilized decomposed granite to 85% relative compaction with 2 to 4 ton durable drum roller or 1000 lb. single drum roller as required to achieve a dense, hard packed surface conforming to the finish grades indicated.
1. Do not use vibratory rollers or compactors.

2. Do not begin compaction for 12 hours after placement and up to 72 hours.
  3. Contractor shall hand tamp areas adjacent to irrigation or plantings with 8 in. or 10 in. hand tamper.
  4. If surface aggregate dries significantly quicker than subsurface material, lightly mist surface before compaction operations.
- G. Variations in smoothness of finished stone dust surface shall be less than or equal to 1/4 in. when tested with a 10 ft. straightedge, applied both parallel to and at right angles to centerline of stone dust surface areas. Irregularities exceeding these requirements or that retain water on surface shall be corrected by removing defective work and replacing with new material conforming to this specification.
- H. Crushed stone surface shall comply with ADA Requirements for slip resistance and accessibility, with a minimum static coefficient of friction of 0.6 for accessible routes and 0.8 for ramps, when tested in accordance with ASTM C1028.
- I. Allow finished surface to dry completely before applying peastone topping.

### 3.7 PEASTONE TOPPING COURSE

- A. Peastone topping course shall be done only after excavation and construction work which might injure it has been completed. Damage caused during construction shall be repaired before acceptance.
- B. Peastone topping course shall be constructed over stabilized decomposed granite surfacing as indicated on the Drawings.
- C. Peastone topping shall be spread evenly over the stabilized decomposed granite surfacing in 1-1/2 in. maximum lifts, rolled and compacted to 85% of maximum density as determined by ASTM D 1557. Final compacted thickness shall be as indicated on the Drawings.
- D. Variations in smoothness of finished peastone surface shall be less than or equal to 1/4 in. when tested with a 10 ft. straightedge, applied both parallel to and at right angles to centerline of surface areas. Irregularities exceeding these requirements or that retain water on surface shall be corrected by removing defective work and replacing with new material conforming to this specification.

### 3.8 INSPECTION

- A. Finished aggregate surfacing shall be smooth, uniform and solid. Cured and compacted aggregate shall be firm throughout profile with no spongy areas. Loose material shall not be present on the surface after installation but may appear after use and according to environmental conditions. Aggregate shall remain stable underneath loose decomposed granite on top. Surfacing shall appear "natural" yet stable throughout. Any significant irregularities in surfacing shall be repaired to the uniformity of the entire installation.

### 3.9 MAINTENANCE

- A. Remove debris, such as paper, grass clippings, leaves or other organic material by mechanically blowing or hand raking the surface as needed. Any plowing program required during winter months shall involve the use of a rubber baffle on the plow blade or wheels on the plow that lifts the blade 1/4" off the paving surface.

### 3.10 REPAIRS TO STABILIZED STONE DUST

- A. Excavate damaged area to the depth of the stabilized aggregate and square off sidewalls.

- B. If area is dry, moisten damaged portion lightly.
- C. Pre-blend the dry required quantity of stabilizer powder with the proper quantity of aggregate in a concrete batch mixer.
- D. Add water to the pre-blended aggregate and stabilizer. Thoroughly moisten mix with 25 to 45 gallons per 1 ton of pre-blended material or to approximately 10% moisture content.
- E. Apply moistened, pre-blended aggregate to excavated area to finish grade.
- F. Compact with an 8 in. to 10 in. hand tamper or 250 lb. to 300 lb. roller. Keep traffic off areas for 12 to 48 hours after repair has been completed.

END OF SECTION

## SECTION 321640

## GRANITE CURB

## PART 1 GENERAL

## 1.1 GENERAL REQUIREMENTS

- A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

## 1.2 SECTION INCLUDES

- A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the granite curb as shown on the drawings and/or specified herein, including, but not necessarily limited to, the following:

1. Vertical granite curb.

2. Mountable granite curb.  
3. Granite Curb Inlet

## 1.3 RELATED SECTIONS

- A. Cast-in-Place Concrete (Site) - ~~Section 033055.~~

Section 033000; for  
concrete haunch.

- B. ~~Site Excavating, Backfilling and Compacting - Section 312300.~~

Earthwork - Section  
310000

- C. Bituminous Paving - Section 321216.

## 1.4 QUALITY ASSURANCE

- A. Unless otherwise indicated, granite curb materials and construction shall conform to the applicable portions of the New York State Department of Transportation standards, Sheet 609-01.

## 1.5 SUBMITTALS

- A. Shop drawings of curb types and curb layout shall be submitted for Architect's approval. Drawings shall indicate joint locations.
- B. Submit sample section of each type of curb, including regular, transition, end, inlet, corner, etc. for Architect's approval.

## 1.6 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

## 2.1 GRANITE CURBS

- A. Granite shall be a structural granite conforming to ASTM C 615, Class I Engineering Grade, suitable for curbstone use. Granite curb shall be similar to that produced by Williams Stone Company, East Otis MA, or approved equal.

1. Curb color shall be "Blue Sky"
  2. Curb shall be free from seams which impair structural integrity, and with percentage of wear less than 32%, as determined by ASTM C 131.
  3. Finish shall be sawn top and split sides.
- B. All curb sections in radial layout shall be radiused sections. Straight tangent sections shall not be permitted in any curved layout of any dimension.

## 2.2 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.

## 2.3 CONCRETE

- A. Concrete for foundation shall conform to ~~Section 033055, "Cast-in-Place Concrete (Site)."~~

Section 033000, "Cast-in-Place Concrete"

## PART 3 EXECUTION

### 3.1 INSPECTION

- A. Examine the areas and conditions under which granite curbs are to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

### 3.2 SETTING CURBS

- A. Curbs shall be set in accordance with NYS DOT 609-01 standard for granite curbs.
- B. Vertical face of vertical curb shall be plumb, with curb top parallel to adjacent surface.
- C. Granite edging shall be installed in accordance with NYS DOT 609-01.
- D. 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.
- E. 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.
- F. 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 323113  
CHAIN LINK FENCING AND GATES

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

- A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

- A. Work of this Section includes furnishing and installing chain link fence and gate at boat storage area, as indicated on the Drawings and as specified herein.

1.3 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 033000, CAST-IN-PLACE CONCRETE; Concrete.
  - 2. Section 323129, WOOD, WIRE AND MESH FENCING AND GATES.

1.4 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):

A 120	Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Ordinary Uses
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)
F 567	Installation of Chain-Link Fence

2. Chain Link Fence Manufacturers Institute (CLFMI):

Manual

Product Manual

1.5 QUALITY ASSURANCE

- A. Chain link fencing shall be manufactured in accordance with the requirements of the CLFMI Manual. Fence manufacturer shall be a CLFMI member.
- B. Fence manufacturer shall have at least ten years of experience in the manufacture of galvanized steel chain link fencing.

1.6 SUBMITTALS

- A. Submit sample of fence fabric for Architects review prior to installation.
- B. Engineered shop drawings shall be submitted for all fence materials, including related hardware, for Architects review.
- C. Submit manufacturer's certification that all fence materials conform to specification requirements.

PART 2 PRODUCTS

2.1 METALLIC COATED FENCE FABRIC

- A. Fabric shall be a good commercial quality of steel wire of 2-1/2 in. mesh and 9 gage, galvanized wire with a minimum breaking strength of 1290 lb. in accordance with ASTM F 668.
- B. Fabric shall be zinc-coated by the hot-dip process after fabrication in accordance with ASTM A 392. Weight of the zinc coating shall be not less than 2.0 oz. per sq. ft. Zinc used for coating shall conform to ASTM B 6.

2.2 FENCE POSTS, HARDWARE, AND FITTINGS - GENERAL

- A. Fittings shall be of best quality malleable iron casting, wrought iron forgings, or pressed steel and provided with pin connections. Equipment shall be designed to carry 100% overload.
  - 1. Malleable iron castings shall be hot-dipped galvanized in accordance with ASTM A 153.
  - 2. Wrought iron forgings or pressed steel fitting and appurtenances shall be hot-dipped galvanized in accordance with ASTM A 123.
  - 3. Fence hardware coatings shall match galvanized fence fabric coating.
- B. Piping shall be steel conforming to ASTM A 120 except that pipe shall be unthreaded and untested for water pressure.

- C. Galvanized items shall be galvanized in accordance with ASTM A 123, A 153, or A 385, as applicable.
- D. Bolts which are installed 6 ft. or less above grade shall not protrude more than 1/4 in. beyond the nut after tightening. Rough edges shall be filed smooth to the satisfaction of the Architect. Peen ends of all bolts after tightening.

## 2.4 POSTS

### A. Fence Posts:

1. Line post shall be 2.375 in. O.D., Schedule 40 galvanized steel pipe weighing 3.65 lb./ft.
2. End and corner posts shall be 2.875 in. O.D. Schedule 40 galvanized steel pipe weighing 5.79 lb./ft.
3. Gate posts shall be 4.0 in. O.D., Schedule 40 pipe weighing 9.10 lb./ft.

## 2.5 RAILS AND POST BRACES

- A. Fence top rail, bottom rail, mid-rail, and post braces shall be 1.66 in. O.D. Schedule 40 galvanized steel pipe weighing 1.35 lb./ft.

## 2.6 STRETCHER BARS

- A. Stretcher bars shall not be less than 3/16 in. x 3/4 in. and be full height of the fabric with which they are being used.
  1. Provide stretcher bars for each end, corner, and pull post.
- B. Stretcher bar bands and clips shall be heavy pressed steel, or malleable iron. At square post provide special design clips.

## 2.7 CAPS

- A. Posts shall have caps which shall be designed to exclude water from post. Caps shall have holes suitable for the through passage of the top rail where necessary.

## 2.8 TENSION AND TIE WIRE

- A. Tension wire shall be 7 gauge galvanized wire.
- B. Tie wire shall be 9 gauge O.D. galvanized steel wire spaced 12 in. apart on rails and 12 in. apart on posts; ends shall be wound in a telegraph twist two and one-half turns.

## 2.9 GATES AND GATE FRAMES

- A. Fabrication: Assemble gate frames by welding connections. Use same fabric as for fence, unless otherwise indicated. Install fabric with stretcher bars at edges, (and tie wire at top and bottom edges, if stretcher is not used). Attach stretcher bars to gate frame at not more

than 15 in. o.c. Attach hardware with rivets or by other means which will provide security against removal or breakage.

1. Framing:
  - a. 6 ft. high, up to 8 ft. wide: Fabricate perimeter frames of minimum 1.660 in. O.D. Schedule 40 pipe weighing 2.27 lb./ft., or SS-40 pipe weighing 1.84 lb./ft., or 1.50 in. square steel tubing conforming to ASTM A 500, Grade B, hot-dip galvanized with a minimum 2.0 oz. zinc per sq. ft. of surface area.
  - b. 6 ft. high, over 8 ft. wide: Fabricate perimeter frames of minimum 1.90 in. O.D. Schedule 40 pipe weighing 2.72 lb./ft., or SS-40 pipe weighing 2.28 lb./ft. or 2.00 in. square steel tubing conforming to ASTM A 500, Grade B, hot-dip galvanized with a minimum 2.0 oz. zinc per sq. ft. of surface area..
2. Bracing:
  - a. Provide diagonal cross-bracing consisting of 3/8 in. diameter adjustable length truss rods on gates where four sided tension rods are not used. Provide frame rigidity without sag or twist.
3. Over 8 ft. ht. and 10 ft. wide provide additional horizontal and vertical members to ensure proper gate operation and for attachment of fabric, hardware and accessories.

B. Gate Hardware: Galvanize per ASTM A 153 (each gate)

1. Hinges: Pressed steel or malleable iron to suite gate size, non-lift-off type, offset to permit 180<sup>o</sup> gate opening. Provide one pair of hinges for each leaf. (Up to 12 ft. ht.)
2. Latch: Forked type to permit operation from either side of gate: Provide padlock eye as integral part of latch.
3. Keeper: Provide keeper for gates, which automatically engages the gate leaf and holds it in the open position until manually released.
4. Double gates: Provide drop rod to hold inactive leaf. Provide pipe to engage the center drop rod. Provide locking device and padlock eyes as an integral part of the latch, requiring one padlock for locking both gate leaves.
5. Comply with ASTM F 654.

2.10 CONCRETE

A. Concrete shall be air-entrained type, conforming to Section 033000, CAST-IN-PLACE CONCRETE, except as modified below:

1. Minimum 28 day compressive strength shall be 2500 psi.
2. Maximum size of aggregate shall be 1-1/2 in.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Chain link fence installation shall conform to ASTM F 567, except as modified below.
- B. Fence shall be of height and dimension as shown on Drawings, from finish grade to top rail.

- C. Install fabric on security side of fence. Wire fabric shall be attached to frame, and tightly stretched such that it is flat, in uniform tension with no bulges or warping of fence after pulling force is released. Ties shall be spaced at 15 in. on horizontal rails and braces and 12 in. on posts. Bend ends of wire to minimize hazard to person or clothing. Top of fence shall approximately follow grade and shall have no abrupt changes in slope. Height of fence shall be constant.
  - 1. Fasteners: Install nuts for tension band and hardware bolts on side of fence opposite fabric side.
  - 2. Bolts: Used in the construction of fence shall be thoroughly peened.
- D. Tension Wire: Provide tension line at bottom of fabric and at top (if top rail is not specified). Install tension wires before stretching fabric and tie to each post with ties or clips. Attach to fabric with hog rings 24 in. o.c.
- E. Stretcher Bars: Extend through fabric and secure to end, corner, and pull posts with bands or clips spaced not over 15 in. o.c.

### 3.2 FOUNDATIONS

- A. Unless otherwise indicated on approved shop drawings, footing diameter shall be four times the largest cross section of the post. Post hole footing shall not be smaller than 10 in. diameter and 42 in. deep. Footing shall be bell-shaped.
- B. Concrete shall be crowned at top to shed water.
- C. Post hole footings shall be allowed to cure 72 hours prior to any additional work.

### 3.3 POSTS

- A. Layout:
  - 1. End, corner and pull post: Provide at each termination and change in horizontal or vertical direction of 30 degrees or more.
  - 2. Line Posts: Space uniformly at 10 ft. on center, unless otherwise indicated.
- B. Concrete Set Posts: (Corner, End and Pull posts) Drill holes (after final grading) in firm, undisturbed or compacted soil. Holes shall have a diameter equal to four times the diameter of the post, and depths approximately 6 in. deeper than post bottom. Excavate deeper as required for adequate support in soft and loose soils, and for posts with heavy lateral loads.
  - 1. Set post not less than 42 in. below surface when in firm, undisturbed soil.
  - 2. Place concrete around posts in a continuous pour, tamp for consolidation. Trowel finish tops of footings, and slope or dome to direct water away from posts, except at walks.
- C. Check each post for vertical and top alignment, and hold in position during placement and finishing operations.

### 3.4 BRACING AND FRAMING

- A. Bracing: Install horizontal pipe brace at mid height, on each side of corner posts and at end and pull posts. Firmly attach with proper fittings. Install diagonal tension rods at these points. Install braces so posts are plumb when diagonal rod is under proper tension.
- B. Top rail:
  - 1. Random length, averaging not less than 18 ft.
  - 2. Pressed steel sleeve joints, for rigid connections and expansion/contraction.
- C. Center Rails: Only install center rails between posts spaced 12 ft. apart. Use with acceptable fittings and accessories.

### 3.5 GATES

- A. Install gates plumb, level, and secure for full opening without interference.
- B. Gate dimension is the center to center spacing of gate posts.
- C. Gates shall work freely and shall have adequate clearance of the bottom. Adjust for smooth operation.

### 3.6 ADJUSTING

- A. Gate: Adjust gate to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

### 3.7 TOUCH UP

- A. Touch up damaged galvanized surfaces with galvanized paint.

END OF SECTION

## SECTION 323129

## WOOD, WIRE AND MESH FENCING AND GATES

## PART 1 GENERAL

## 1.1 GENERAL REQUIREMENTS

- A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

## 1.2 SECTION INCLUDES

- A. Provide all equipment and materials, and do all work necessary to construct the wood, wire and mesh fence with wood posts, as indicated on the Drawings and as specified herein. Fencing types include:
1. Steel wire mesh fence and gate with cedar posts.
  2. Steel wire mesh fence with timber posts and rails.
  3. PVC coated steel wire mesh fence with cedar posts.

## 1.3 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 033000, CAST-IN-PLACE CONCRETE; Concrete footings.
  2. Section 323113, CHAIN LINK FENCING AND GATES; Galvanized steel chain link fence and gates.

## 1.4 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):

A 153	Zinc - Coating (Hot-Dip) on Iron and Steel Hardware
F 537	Design, Fabrication, and Installation of Fences Constructed of Wood and Related Materials
  2. Federal Specifications (Fed. Spec.):

FF-T-276B	Thimbles, Rope
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FF-C-450D (1)

Clamps, Wire Rope

## 1.5 SUBMITTALS

- A. Shop drawings of each fence type specified shall be submitted.
  - 1. Show locations of fence, posts, braces, tension wires, details of hardware and accessories. Indicate materials, dimensions, sizes, weights, and finishes of components. Include plans, sections, details of mesh and post anchorage, attachment, bracing, and other required installation and operational clearances.
  - 2. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- B. Submit duplicate samples of fence posts, braces, and mesh representing actual product with finished color and texture for Architect's approval.
- C. Manufacturer's data sheets on each product to be used, including:
  - 1. Preparation instructions and recommendations.
  - 2. Storage and handling requirements and recommendations.
  - 3. Installation methods.
- D. Wood shall be Forest-Safe™, indicating that the supplier buys only from those mills who's forestry practices have been independently certified to conform with the most rigorous standards as set by the Forest Stewardship Council (FSC).
  - 1. Furnish evidence indicating that source of wood used is a plantation farm or other designated source practicing sustain yield concept in forestry, and regulated by governing authorities regarding the growing, harvesting, and replanting of tropical hardwood trees.
    - a. All lumber shall come stamped with the mills Forest Stewardship Council (FSC) chain-of-custody certification number, which allows it to be traced back to the originating well-managed forest.

## 1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer shall be capable of providing all cedar and metal fence materials specified in this section.
- B. Installer Qualifications:
  - 1. Installer shall have five (5) years experience installing fencing on the type and size of project specified by this section.
  - 2. Installer shall be licensed, registered or otherwise approved by the local jurisdiction to install fencing.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Inspect the materials upon delivery to assure that specified products have been received. Store materials in safe area, away from construction traffic; store under cover and off ground, protected from moisture.
- B. Keep materials clearly separated and identified with grade marks legible. Keep damaged material identified as damaged and stored separately.

## 1.8 PROJECT CONDITIONS

- A. 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.

## 1.9 SUPPLEMENTAL MATERIALS

- A. Fasteners and supports shall conform to the requirements set forth by this section.

## PART 2 - PRODUCTS

## 2.1 CEDAR LUMBER

- A. Fence lumber shall be selected Northern White Cedar of sound stock, conforming to ASTM F 537, Architectural Class I Sawn Posts and Rails.
- B. Fence Posts, ~~Rails~~, Gate Frames and Braces: Lumber shall be clear natural Northern White Cedar, ((*Thuja Occidentalis*), surfaced S4S-E4E (surfaced four sides-eased four edges) of sound stock, new, straight, of consistent size, free of stains and mildew, and kiln dried to a moisture content of not more than 12%, by weight. Wood members shall be selected for best possible appearance from the grade of stock specified.
  - 2. Northern White Cedar: Acceptable Manufacturer/Supplier: True North Cedar, Inc., P.O. Box 16065 Duluth, MN 55816; Ph: 360-201-1211; [info@truenorthcedar.com](mailto:info@truenorthcedar.com); Liberty Cedar, 325 Liberty Lane, West Kingston, RI 02892; Tel. 1-800-882-3327; [www.libertycedar.com](http://www.libertycedar.com), Kerber Farms and Mill Lumber Company, 3550 Coolidge Highway, Guilford, VT 05301; ph: 802-451-6920; fax: 802-257-7068; alt: 802-257-0614; [kerbervt2000@yahoo.com](mailto:kerbervt2000@yahoo.com), or other approved source.
  - 2. Grade: Premium.
  - 3. Color shall be "White Blonde".
- C. Lumber shall bear a mark of mill identification and shall bear the grade - trademark of the association under the rules or standards of which they were produced.

## 2.2 STEEL MESH MATERIALS

- A. Steel Mesh: shall be Tornado Wire Titan 2096-12 or 2096-6, 12.5 ga. deer fence.

- B. PVC Coated Wire Mesh: Trident Black PVC coated steel 1 in. hex fencing; thermally fused and bonded to a primer which is thermally cured onto galvanized steel core wire conforming to ASTM F 668.
- C. Zinc for galvanized coating shall conform to ASTM B 6, galvanized by hot dipped method AISI Type I, before vinyl coating; coating shall be smooth. Minimum weight of zinc coating shall be 1.2 oz. per sq. ft.
- D. PVC Coated Tension Wire: Trident Black PVC coated 8 ga. steel steel wire; thermally fused and bonded to a primer which is thermally cured onto galvanized steel core wire conforming to ASTM F 668.
- E. Provide all anchors, bolts, sockets, sleeves, and other parts required for securing each item of work of this Section of the construction. Furnish required inserts and sleeves for installation in concrete under Section 033000, CAST-IN-PLACE CONCRETE.
- F. Exposed fastenings shall be galvanized steel to match material and finish of the metal to which applied, or PVC coated black to match wire mesh, unless otherwise noted.

### 2.3 GATES AND GATE FRAMES

- A. Fabrication: Assemble gate frames with mortise and tenon joints, sandwiching wire mesh between frame boards. Use same wire mesh as for fence, unless otherwise indicated.
- B. Gate Hardware: Galvanize per ASTM A 153 (each gate)
  - 1. Hinges: Stainless steel to suite gate size, non-lift-off type, offset to permit 180° gate opening. Provide three hinges for each leaf.
  - 2. Latch: Stainless steel as approved by Architect: Provide padlock eye as integral part of latch.

### 2.4 FASTENERS AND ACCESSORIES

- A. Tie Wires, Clips, and Fasteners: According to ASTM F 626.
  - 1. Standard Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, complying with the following:
    - a. Hot-Dip Galvanized Steel: galvanized coating thickness matching coating thickness of steel mesh.
- B. Nails: Provide one of the following:
  - 1. Material: No. 304 stainless steel.
  - 2. Material: Hot-dipped galvanized in accordance with ASTM A 153.
- C. Screws: provide one of the following:
  - 1. Material: No. 304 stainless steel.
  - 2. Material: Double Hot-Dipped Galvanized in accordance with ASTM A 153.

- D. Turnbuckles: Shall be galvanized and of the Eye and Eye type HG-226, or threaded eyebolt type, as required, manufactured by Crosby Group, Inc. Jacksonville, AR 72071 or approved equal. Size shall be 3/8 in, 6 in takeup with safe working load of 1,200 lbs. Ultimate loads must be at least five times safe working load. Turnbuckles shall meet requirements of Fed Spec FF-T-791b, Type 1, Form, 1, Class 8.
- E. Wire clips shall be hot dipped galvanized, meeting Federal Specification FF-C-450, Type 1, Class 1. Cable thimbles shall be standard duty stainless steel and meet Fed Spec FF-T-276b, Type 2. Screw eye bolts shall be forged. Clips, thimbles and eyebolts shall be supplied by Crosby Group, Inc., sized as indicated on the Drawings.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, and other conditions affecting performance.
  - 1. Do not begin installation before final grading is completed, unless otherwise permitted by Architect.
  - 2. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Stake locations of fence lines and terminal posts. Do not exceed intervals of 500 feet (152.5 m) or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.
- B. Coordinate work with related trades.
- C. Discard wood members that are warped, twisted, bowed, crooked or otherwise defective.

#### 3.3 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. Exposed sheared edges shall be eased.
- B. Fasten all permanent connections as indicated on the Drawings.
- C. Attach steel mesh to wood posts as indicated on the Drawings.
- D. 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.

- E. Do all cutting, punching, drilling, and tapping required for attachment of hardware and of work of other Sections where so indicated or where directions for same are given prior to, or with approval of, shop drawings.

### 3.4 SHOP COATINGS

- A. Immediately before galvanizing, metal mesh materials shall have all rust, loose mill scale, dirt, weld flux, weld spatter, and other foreign material removed with wire brushes and/or steel scrapers. Power tool clean in accordance with SSPC SP 3. Remove grease and oil by use of recommended solvent.
- B. Galvanizing: Components shall be hot-dip galvanized, including all bolts, nuts, washers, and other related ferrous metal items used therewith.
  - 1. 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.
  - 2. Furnish certified statement that galvanizing complies fully with this Specification.

### 3.5 FENCE INSTALLATION

- A. Materials shall be carefully handled and stored under cover in manner to prevent deformation and damage to the materials and to shop finishes. Prevent rusting and the accumulation of foreign matter on the metal work, and warping or staining of wood materials. 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 shall be furnished loose by this trade to be built-into concrete by that trade as the work progresses. Later cutting or drilling shall be avoided wherever possible.
- C. Install wire mesh on security side of fence. Wire fabric shall be attached to frame, and tightly stretched such that it is flat, in uniform tension with no bulges or warping of fence or gate after pulling force is released. Unless otherwise indicated on the Drawings, ties shall be spaced at 15 in. on horizontal rails and braces, and 12 in. on posts. Bend ends of wire to minimize hazard to person or clothing. Top of fence shall follow slope and alignment indicated on the Drawings. Height of fence shall be constant.
- D. Wood and metal fence shall be rigidly braced and secured to surrounding construction, and shall be tight and free of rattle, vibration, or noticeable deflection after installation.
- 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.

## 3.6 FOUNDATIONS

- A. Footing diameter shall be four times the largest cross section of the post. The depth shall be a minimum of 24 in. plus an additional 3 in. for each 1 ft. increase in fence height over 4 ft.
- B. Post hole footing shall not be smaller than 12 in. in diameter and 36 in. deep.
- C. Concrete shall be crowned at top to shed water.
- D. Post hole footings shall be allow to cured 72 hours prior to any additional work.
- E. Where fencing is installed on concrete structures, use galvanized sleeve and grout posts.

## 3.7 POSTS

- A. Concrete Set Posts: Drill holes (after final grading) in firm, undisturbed or compacted soil. Holes shall have a diameter equal to four times the diameter of the post, and depths approximately 6 in. deeper than post bottom. Excavate deeper as required for adequate support in soft and loose soils, and for posts with heavy lateral loads.
  - 1. Set post not less than 35 in. below surface when in firm, undisturbed soil.
  - 2. Place concrete around posts in a continuous pour, tamp for consolidation. Trowel finish tops of footings, and slope or dome to direct water away from posts.

## 3.8 ADJUSTING AND CLEANING

- A. As work proceeds, maintain premises free of unnecessary accumulation of tools, equipment, surplus materials, and debris related to this work.

## 3.9 MAINTENANCE

- A. Explain proper maintenance procedures to Owner or Owner's Representative at project closeout.
- B. Visually inspect finish condition. Re-apply coating as necessary.
- C. The use of pressure washers is not recommended.

END OF SECTION

## SECTION 329115

## PLANTING SOIL

## PART 1 GENERAL

## 1.1 GENERAL REQUIREMENTS

- A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

## 1.2 SECTION INCLUDES

- A. Work of this Section includes all labor, materials, equipment and services necessary to complete the soil preparation as shown on the drawings and/or specified herein, including, but not necessarily limited to, the following:
  - 1. Soil amendments.
  - 2. Fertilizers and conditioners.
  - 3. Topsoil.

## 1.3 RELATED SECTIONS

- ~~A. Rough grading - Section 312000.~~
  - ~~B. Reinforced turf - Section 321443.~~
- A. Earthwork - Section 310000
  - B. Landscape Grading - Section 329119
  - C. Lawns and Grasses - Section 329200
  - D. Planting - Section 329300
  - E. Tree Transplanting - Section 329643

## 1.4 QUALITY ASSURANCE

- A. Standards: Follow the specifications and recommendations of the American Association of Nurserymen (AAN) and applicable local agencies.
- B. Laboratory Qualifications: Soil testing shall be conducted by Testing Agency approved by the Owner.
- C. Required Analysis: Manufacturer's literature and laboratory tests are required to determine that the following soil quality and additives meet requirements of this Section for the following:
  - 1. Organic amendments.
  - 2. Commercial fertilizers.
  - 3. Chemical additives.
  - 4. Soil fertility recommendations in the form of application rates of individual chemical amendments for each soil tested.
  - 5. Soil Mechanical Analysis: Soil particle size analysis (% sand, % silt, % clay).
  - 6. Soil organic content.

## 1.5 SUBMITTALS

- A. Samples: Submit, as required by laboratory, directly to laboratory. Identify each sample by soil mix type and intended plant material.
- B. Soil Testing Analysis: Submit results of analysis.
- C. Manufacturer's Certified Analysis: Submit with packaged standard products.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products in manner to protect them from damage and contamination.
- B. Store products in manner to protect them from damage and contamination, and to comply with manufacturer's storage instructions.

## 1.7 PROJECT CONDITIONS

- A. Site Familiarization: Contractor is responsible for becoming familiar with site in relation to work of this Section and associated work in other parts of the Contract Documents.
- B. Finish Grades: Contractor is responsible for bringing all areas to finished grades as indicated on Construction Drawings. Any variations or disturbances to the fine grading shall be corrected by the Contractor.

## PART 2 PRODUCTS

## 2.1 ORGANIC MATTER

- A. Sphagnum moss.
- B. Leaf Mold: Thoroughly shredded, composted leaf material.
- C. Local Product: As approved by the Landscape Architect.

## 2.2 CHEMICAL AMENDMENTS

- A. Dolomite Lime: Agricultural grade mineral soil conditioner containing **[35]** percent minimum magnesium carbonate and **[49]** percent calcium carbonate, 100 percent passing #65 sieve.
- B. Iron Sulfate (Ferric or Ferrous): **[30-35]** percent iron, **[35-50]** percent sulphur; supplied by commercial fertilizer supplier.
- C. Sulphate of Potash: Agricultural grade containing **[50 percent to 53 percent]** of water-soluble potash.
- D. Single Superphosphate: Commercial product containing **[18-20]** percent available phosphoric acid.
- E. Calcium Nitrate: Agricultural grade containing **[15-1/2]** percent nitrogen.
- F. Urea Formaldehyde: Commercial product containing **[38]** percent nitrogen.

## 2.3 MINERAL AMENDMENTS

- A. Sand
  - 1. Grading Dry Weight Basis:

<u>Percent Passing</u>	<u>Sieve Designation</u>
100	10 mm (3/8 inch)
95-100	2.00 mm (#10)
20-80	0.41 mm (#40)
0-5	0.075 mm (#200)

2. Chemical Properties:

- Salinity: Saturation extract conductivity shall not exceed 3.0 millimhos/cm.
- Boron: Concentration in saturation extract shall not exceed 1.0 parts per million.
- Sodium Absorption Ratio (SAR), as calculated from analysis of saturation extract, shall not exceed 6.0.

2.4 SOIL MIXES

A. General

- Nutrient Analysis and Amendment: Unless specific amounts of chemical amendments are given in specification, the mix shall be tested for levels of pH, iron magnesium, potassium, phosphorous, salts, carbon, and nitrogen, and shall be adjusted to required fertility levels. The following are acceptable results for all soil types.

pH Range	5.0-7.0
Magnesium-Mg	100+ units
Phosphorous-P205	150+ units
Potassium-K20	120+ units
Carbon Nitrogen Ration- C/N	Max 30:1
Soluble Salts/Conductivity	Not to exceed 500 ppm/0.5 mmhos/cm (organics less than 5%), not to exceed 3000 ppm/2.5 mmhos/cm (organics greater than 5%)

- Soil fractions shall be those defined by local Soil Conservation Service or similar entity. Soil fractions are by weight of mineral fraction without organics.
- Organic content shall be tested by combustion test.
- Unit weights shall be measured as wet density at 100 percent compaction and optimum moisture; reference ASTM D698.
- Thoroughly combine all ingredients to create homogeneous mixtures prior to placement on subgrade.

B. Lawn Mix: On-site or imported material naturally occurring or amended to meet the following:

- Loam, sandy loam, or clayey loam, reasonably free of subsoil, clay lumps, stones, or gravel of any dimensions, and debris. Free of excessive weeds, roots, and root mats, and any substance detrimental to plant growth. Imported topsoil shall be from an identifiable source.

2. Composition of Mineral Fraction:
    - a. Sand: 20-60 percent.
    - b. Silt: 12-50 percent.
    - c. Clay: 7-40 percent.
  3. Organic Content: 3-5 percent.
  4. General requirements as defined for general soil mixes.
- C. Shrub and Tree Mix Ratio: Approximately 3:1 by volume mixture of loam or sandy loam and organic amendment meeting the following requirements:
1. Composition of Mineral Fraction:
    - a. Sand: 23-73 percent.
    - b. Silt: 16-50 percent.
    - c. Clay: 7-27 percent.
  2. Organic Content: 4-8 percent.
  3. General requirements as defined for general soil mixes.

D. ~~Sand Based Structural Soil. Base Loam, Sand and Compost, each as specified above, shall be Structural Soil~~

1. ~~Base Loam, Sand and Compost shall be combined in an approximate mix ratio of four parts by volume Sand to one part by volume Base Loam to one and one-half parts by volume Compost (4S:1L:1.5C) to create a uniform blend which meets the following requirements.~~
2. ~~Gradation for Material Passing the Number 10 Sieve:~~

U.S. Sieve Size Number	Minimum	Maximum
10	100	-
18	68	90
35	38	63
60	18	39
140	9	18
270	7	10
0.002mm	1	2
3. ~~Maximum size shall be one-inch largest dimension. The maximum retained on the #10 sieve shall be 15% by weight of the total sample.~~
4. ~~Ratio of the particle size for 70% passing (D70) to the particle size for 20% passing (D20) shall be 3.5 or less, (D70/D20 <3.5).~~
5. ~~Saturated hydraulic conductivity of the mix: not less than 4 inches per hour according to ASTM D 2434 when compacted to a minimum of 96% Standard Proctor, ASTM 698.~~
6. ~~Chemical analysis shall be undertaken for Ammonium Nitrogen, Phosphorus, Potassium, Calcium Magnesium, Aluminum, Iron, Manganese, Lead, Cation Exchange Capacity, Soluble Salts, organic matter content, acidity (pH) and buffer~~
7. ~~pH.~~
8. ~~Organic content: between 2.0 and 3.0 percent by weight.~~
9. ~~The pH shall be between 6.0 and 6.5.~~
10. ~~Shall be supplied by Read Custom Soils, Wareham, MA~~

~~E. Reinforced Soil~~

1. ~~Shall be Reinforced Soil manufactured by Read Custom Soils, Wareham, MA~~

2.5 MULCH

A. Standards: Mulch shall meet the highest standards set by the National Bark and Soil Products Institute. Refer to Section 329300, PLANTING; well-aged, uniform in size, and free from foreign matter.

1. Surface mulch shall be well-aged fine shredded hardwood bark. It shall be dark brown in color, uniform in size, and free from foreign matter.

2. Pine needle mulch shall be top grade natural pine needles.

2.6 PREPLANT FERTILIZER

A. Components: 50 percent of nitrogen shall be derived from natural organic resources of urea-formaldehyde. Available phosphoric acid shall be from superphosphate, bone, or tankage. Potash shall be derived from muriate of potash containing 60 percent potash for each use. Fertilizer shall consist of the following percent by weight, or as determined by soil test, and shall be mixed by commercial fertilizer supplier:

1. Trees, Shrubs, Groundcovers, and Perennials:

- a. 10 percent nitrogen.
- b. 10 percent phosphorous.
- c. 10 percent potash.

2. Lawn Areas:

- a. 10 percent nitrogen.
- b. 10 percent phosphorous.
- c. 10 percent potash.

PART 3 EXECUTION

3.1 INSPECTIONS

- A. Verify that subgrade compaction and grades, landscape walls, steps, planters, and other hardscape elements are in place, and have been accepted by the Landscape Architect.
- B. Examine subgrade and rough grading before soil preparation. Alert Project Director/COR to unacceptable rough grading or subgrade.

3.2 SITE PREPARATION

A. General: Within the entire area to be landscaped, the Contractor shall complete the following site topsoil preparation items to eradicate existing weeds and natural groundcover. Initiate site topsoil preparation as stated herein, and coordinate work with irrigation system and utility lines.

B. Prepare areas to be landscaped by clearing weeds and groundcover, stumps, stones larger than 25 mm in diameter, roots, and debris or materials that may hinder proper grading, tillage, planting, or subsequent maintenance operations by approved means. Cleared material shall be totally removed from project site and properly disposed off of the property.

6"

C. Subgrade Preparation: Subgrade of planting areas shall be loosened or scarified to a minimum of 75 mm (3 in.) depth prior to spreading planting soil. Subgrade shall be brought to true and uniform grade, and shall be cleared of stone greater than 50 mm (2 in.), sticks, and other deleterious and extraneous materials.

with the teeth of an excavator

3.3 SOIL PLACEMENT

A. General

- 1. Place soil in locations and to depths shown on drawings or on schedules. Select placement and compaction methods that will not damage or dislodge drainage or irrigation systems.

2. ~~Do not use muddy or frozen material.~~

All planting soil and subsoil shall never be moved or worked when wet or frozen.

- 3. Layering: If depth of planting soil exceeds ~~300 mm~~, place in multiple layers of ~~300 mm~~ or less. Tamp each layer only enough to eliminate air pockets and to control settling. Do not over-compact; soil shall be free draining. Overfill deep placements to allow for settlement. Repair settled areas and uneven areas at end of guarantee period.

B. Lawns

- 1. Verify subgrade elevations, and correct discrepancies.
- 2. Apply chemical additives to soil at rate specified.
- 3. Mix soil amendments uniformly into soil by tilling, disking, or harrowing to ~~125 mm~~ depth.
- 4. Rake topsoil to smooth, even surface, removing debris and stones exceeding ~~25 mm~~ in any dimension.

3.4 MULCHING

- A. Immediately install minimum ~~25 mm~~ temporary mulch layer as erosion control. In areas where final mulch materials match requirements of this Section, the temporary layer may remain in place as part of the final mulch layer.

3.5 PRE-PLANTING FERTILIZATION

- A. General: Apply preplant fertilizer at the following rates. Apply not more than seven days before planting. Work well into soil:

Trees	0.5 kg per 50 mm of trunk diameter, mixed throughout tree pit backfill
Shrubs	0.1 kg per 300 mm of height or spread; or 2.5 kg per 9 sq meters of bed for massed plantings
Groundcovers and Herbaceous Plants	0.5 kg per 3 sq meters of bed area
Lawns	450 kg per 4,000 sq meters (1 kg per 9 sq meters)

3.6 PROTECTION

A. PROTECTION AND ADJUSTMENTS

- A. Refer to Sections 329119, 329200 and 329300
- B. Protect newly graded areas from traffic, freezing and erosion. Keep free of trash, debris or construction materials from other work
- C. Place erosion protection fabric immediately after approval of final grade by Landscape Architect. See Section 32 92 00 Lawns and Grasses.
- D. Repair and re-establish grades to specified tolerances where completed or partially completed surfaces become rutted, settled or compacted 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.
- E. 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 PLACEMENT SCHEDULE

Location

Lawn Areas

Shrub and Groundcover Beds

Tree Pits

Mix

Lawn Mix

Shrub and Tree Mix

Shrub and Tree Mix

Depth

~~200 mm~~

Per Drawing detail

Per Drawing detail

Per Drawing detail

END OF SECTION

## SECTION 329119

## LANDSCAPE GRADING

## PART 1 GENERAL

## 1.1 GENERAL REQUIREMENTS

- A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

## 1.2 SECTION INCLUDES

- A. Work of this Section includes all labor, materials, equipment and services necessary to complete the landscape grading as shown on the drawings and/or specified herein, including, but not necessarily limited to, the following:
  - 1. Site grading.

## 1.3 RELATED SECTIONS

- A. Planting Soil - Section 329115.

- B. ~~Plants and~~ Planting - Section 329300.

C. Earthwork - Section 310000

## 1.4 QUALITY ASSURANCE

- 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. ASTM D 1556 Density of Soil in Place by the Sand-Cone Method.
    - b. ASTM D 2167 Density and Unit Weight of Soil In Place by the Rubber-Balloon Method.
  - B. The Landscape Architect reserves the right to perform on-site observation during the grading operations. The observations may include, but not be limited to the following.
    - 1. Observation of subgrade preparation for slab-on-grade and paved areas.
    - 2. Observation of rough and finish grading operations.
  - C. Perform field density tests in accordance with Section 329115, "Planting Soil."
    - 1. If, in the opinion of the Landscape Architect, based on reports of the testing service and inspection, the subgrade or fills which have been placed are below the specified density, additional compaction and testing will be required until satisfactory results are obtained.
  - D. The Landscape Architect's presence does not include supervision or direction of the actual work by the Contractor, his employees, or agents. Neither the presence of the Landscape Architect, nor any observations and testing performed by him shall excuse the Contractor from defects discovered in his work.

## 1.5 SUBMITTALS

- A. Samples: Submit, as required by laboratory, directly to laboratory. Identify each sample by soil mix type and intended plant material.
- B. Soil Testing Analysis: Submit results of analysis.
- C. Manufacturer's Certified Analysis: Submit with packaged standard products.

## 1.6 PROJECT CONDITIONS

- A. Site Familiarization: Contractor is responsible for becoming familiar with site in relation to work of this Section and associated work in other parts of the Contract Documents.
- B. Finish Grades: Contractor is responsible for bringing all areas to finished grades as indicated on Construction Drawings. Any variations or disturbances to the fine grading shall be corrected by the Contractor.

## PART 2 PRODUCTS

### 2.1 SOURCE OF MATERIALS

- A. Material shall be obtained from required on-site excavation, to the extent that suitable material is available, and from off-site sources, to the extent that suitable material is not available from on-site excavation. Refer to Section 329115, "Planting Soil."

## PART 3 EXECUTION

### 3.1 EXISTING CONDITIONS

- A. By submitting a bid, the Contractor affirms that he has carefully examined the site and all conditions affecting work under this Section. No claim for additional costs will be allowed because of lack of full knowledge of existing conditions.

### 3.2 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, benchmarks and other public and private property.
- B. In case of any damage or injury caused in the performance of the grading 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 grading work shall be repaired or replaced to their original condition at the completion of operations. The Contractor shall replace, at his own cost, existing benchmarks, monuments, and other reference points which are disturbed or destroyed.

### 3.3 COORDINATION

- A. Prior to start of grading operations, the Contractor shall arrange an on-site meeting with the Landscape 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 Landscape Architect prior to start of grading 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.

### 3.4 GRADING

- A. Uniformly grade areas within the limits of site grading under this section, including adjacent transition areas. Smooth finished surfaces within specified tolerances, and between points where elevations are shown, or between such points and existing grades.
- B. The degree of finish required will be that ordinarily obtainable from either blade-grader or scraper operations.
  - 1. Ditches: Finish ditches to ensure proper flow and drainage. Conduct final rolling operations to produce a hard, uniform, and smooth cross-section.
  - 2. Finish Grading - Lawn or Unpaved Areas: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch (13 mm) of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in the immediate future.
  - 3. Grade Breaks located on the plans indicate crisp transitions, not blended or rounded edges. These should be clean, sharp, and uniform in line and curve as indicated on the plans.
  - 4. Walks: Shape the surface of areas under walks to line, grade and cross-section, with the finish surface not more than 0.00 ft. above or 0.10 ft. below the required subgrade elevation, compacted as specified, and graded to prevent ponding of water after rains.
  - 5. Pavements: Shape the surface of the areas under pavement to line, grade and cross-section, with the finish surface not more than 1/2 in. above or below the required subgrade elevation, compacted as specified, and graded to prevent ponding of water after rains. Include such operations as plowing, discing, and any moisture or aerating required to provide the optimum moisture content for compaction. Fill low areas resulting from removal of unsatisfactory soil materials, obstructions, and other deleterious materials, using satisfactory soil material. Shape to line, grade, and cross-section as shown on the Drawings.

### 3.5 MAINTENANCE

- A. Protect newly graded areas from traffic and erosion. Keep free of trash and debris.
- B. Repair and re-establish grades in settled, eroded, and rutted areas to the specified tolerances.
- C. Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify the surface, re-shape, and compact to the required density prior to further construction.

END OF SECTION

SECTION 329200  
LAWNS AND GRASSES

Please fix formatting errors  
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section

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

- A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

- A. Provide all materials and equipment, and do all work required to complete the seeding and sodding to establish lawn areas, and seeding and plugging of native meadow areas, as indicated on the Drawings and as specified.

1.3 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.
  2. Section 329115, PLANTING SOIL.
  3. Section 329119, LANDSCAPE GRADING.
  4. Section 329300, PLANTING; New plantings.

Section 310000,  
EARTHWORK

1.4 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 136	Sieve Analysis of Fine and Coarse Aggregates
D 422	Particle-Size Analysis of Soils
E 11	Wire-Cloth Sieves for Testing Purposes

1.5 SUBMITTALS

- A. Samples: The following samples shall be submitted:
 

Material	Quantity (lb.)
Seed, each mix	1

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

Cellulose fiber mulch  
Soil stabilization fibers

- C. Certificates: Labels from the manufacturer's container certifying that the product meets the specified requirements shall be submitted for the following materials:

Grass seed  
Meadow seed

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Digging Sod/plugs:

1. Sod/plugs shall not be dug at the nursery or approved source until ready to transport sod/plugs to the site of the work or acceptable storage location.
2. Before stripping, sod/plugs shall be mowed at a uniform height of 2 in.
3. Cut sod/plugs to specified thickness and to standard width and length desired.

- B. Transportation of Sod/plugs:

1. Sod/plugs transported to the Project in open vehicles shall be covered with tarpaulins or other suitable covers securely fastened to the body of the vehicle to prevent injury. Closed vehicles shall be adequately ventilated to prevent overheating of the sod/plugs.
2. Evidence of inadequate protection following the digging, carelessness while in transit, or improper handling shall be cause for rejection.
3. Sod/plugs shall be kept moist, fresh, and protected at all times. Such protection shall encompass the entire period during which the sod/plugs is in transit, being handled, or are in temporary storage.
4. Upon arrival at the temporary storage location or the site of the work, sod/plugs material shall be inspected for proper shipping procedures. Should the sod/plugs be dried out, the Architect will reject the sod/plugs. When sod/plugs has been rejected, the Contractor shall at once remove it from the area of the work and replace it with acceptable material.
5. Unless otherwise authorized by the Architect, the Contractor shall notify the Architect at least two working days in advance of the anticipated delivery date of sod/plugs material. Certificate of Inspection when required shall accompany each shipment.

- C. Handling and Storage of Sod/plugs:

1. Sod/plugs material shall be handled with extreme care to avoid breaking or tearing strips.
2. Sod/plugs shall not be stored for longer than 30 hours prior to installation. Sod/plugs shall be stored in a compact group and shall be kept moist. Sod/plugs shall be prevented from freezing.
3. Sod/plugs that has been damaged by poor handling or improper storage will be rejected by the Architect.

- D. Deliver seed in original sealed containers, labeled with analysis of seed mixture, percentage of pure seed, year of production, net weight, date of packaging, location of packaging, and name of seed grower. Damaged packages will not be accepted.

- E. Seed shall be stored under cool and dry conditions so that the endophytic seed in the mixture is capable of maintaining a high level of endophytes

#### 1.7 PLANTING SEASON

## A. Planting season shall be as follows:

Material	Planting Season	
	Spring	Fall
Sodding	3/15 to 5/15	8/15 to 10/15
Seeding (Lawn)	3/15 to 5/15	8/15 to 10/15

## B. Planting shall only be performed when weather and soil conditions are suitable for planting the material specified in accordance with locally accepted practice.

## C. Planting season may be extended with the written permission of the Architect.

## 1.8 ACCEPTANCE

## A. Acceptance:

1. The Architect will inspect all work for Substantial Completion upon written request of the Contractor. The request shall be received at least ten calendar days before the anticipated date of inspection.
2. Acceptance of material by the Architect will be for general conformance to specified requirements, and shall not relieve the Contractor of responsibility for full conformance to the Contract Documents.
3. Upon completion and reinspection of all repairs or renewals necessary in the judgement of the Architect, the Architect will recommend to the Owner that the work of this Section be accepted.

## B. Sod and seed areas will be accepted when in compliance with all the following conditions:

1. Roots are thoroughly knit to the soil;
2. Absence of visible joints (sodded areas);
3. All areas show a uniform stand of specified grass in healthy condition;
4. At least 60 days have elapsed since the completion of work under this Section.

## C. Plugs areas will be accepted when in compliance with all the following conditions:

1. Roots are thoroughly knit to the soil;
2. All areas show a uniform stand of specified grass in healthy condition;
3. At least 60 days have elapsed since the completion of work under this Section.

## D. Native Seed Acceptance

1. The Contractor shall guarantee seeded areas will meet or exceed the following performance criteria one full year after Provisional Acceptance.
  - a. Within three months of seeding, total vegetation cover in all zones shall exceed 50% (by areal cover).
  - b. Total vegetation cover in all zones combined shall exceed 75% (by areal cover), and 5% of all species present shall be native.  
Seedlings from 10% of seeded grass species shall be present in all zones combined.
  - c. Seedlings from 20% of seeded forb species shall be present in all zones combined.
  - d. The Contractor shall guarantee seeded areas will meet or exceed the following performance criteria two full years after Provisional Acceptance.
  - e. Total vegetation cover in all zones combined shall exceed 70% (by areal cover).

## 1.9 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful establishment of plants.
  1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
  2. Experience: Five years' experience in landscape installation in addition to requirements in Division 01 General Requirements.
  3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress
- B. Seeding and Meadow Seeding Work: Contractor shall have a minimum of five years experience in work of the type required by this Section.
- C. All native seed species shall be supplied as pure live seed.
- D. All native seed mixes to be applied at the rates and quantities of seeds per acre specified on the Plans.

## PART 2 PRODUCTS

## 2.1 LAWN SEED

- A. Seed mixture: Standard grade seed of the most recent season's crop. Seed shall be dry and free of mold. Where possible, seed shall be inoculated with endophytes. Seed mixture shall be as follows:
  1. Loft's Premium Gold Tag Seed:
    - a. Shade Mix: Special mixture  
25% Jamestown II Chewing Fescue  
20% Cascade Chewings Fescue  
20% Cindy Creeping Red Fescue  
20% Creeping Red Fescue  
15% Laser Poa Trivialis
    - b. Sun Mix: 70 Blue / 30 Rye Mixture  
24% Certified Baron Kentucky Bluegrass  
23% Certified Georgetown Kentucky Bluegrass  
23% Certified Ram I Kentucky Bluegrass  
15% Certified Yorktown III Perennial Ryegrass

## 15% Certified Repell II Perennial Ryegrass

## 2.2 LAWN SOD

- A. Certified Turfgrass Sod: Superior sod grown from certified, high quality seed of known origin or from plantings of certified grass seedlings or stolons. It shall be inspected by the certification agency of the state in which it is grown to assure satisfactory genetic identity and purity, overall high quality and freedom from noxious weeds as well as excessive quantities of other crop and weedy plants at time of harvest. All seed or original plant material in mixture must be certified. Turfgrass sod shall meet the published state standards for certification.
1. Sod shall be Black Beauty Improved Tall Fescue, or approved equal.
- B. Sod shall be nursery grown on cultivated mineral agricultural soils. Sod shall have been mowed regularly and carefully, and otherwise maintained from planting to harvest.
- C. Thickness of Cut: Sod shall be machine cut at a uniform soil thickness of 5/8 in., plus or minus 1/4 in., at the time of cutting. Measurement for thickness shall exclude top growth and thatch.
- D. Strip Size: Individual pieces of sod shall be cut to the supplier's standard width and length. Maximum allowable deviation from standard widths and lengths shall be plus or minus 1/2 in. on width, and plus or minus 5% on length. Broken strips and torn and uneven ends will not be acceptable.
- E. Strength of Sod Strips: Standard size sections of sod shall be strong enough to support their own weight and retain their size and shape if suspended vertically when grasped in the upper 10% of the section.
- F. Moisture Content: Sod shall not be harvested or transplanted when moisture content (excessively dry or wet) may adversely affect its survival.
- G. Time Limitations: Sod shall be harvested, delivered, and transplanted within a 36 hour period unless a suitable preservation method is approved prior to delivery. Sod not transplanted within this period shall be inspected and approved by the Architect prior to its installation.
- H. Thatch: Sod shall be relatively free of thatch. A maximum of 1/2 in. (uncompressed) thatch will be permitted.
- I. Diseases, Nematodes, and Insects: Sod shall be free of diseases, nematodes, and soil-borne insects. State Nursery and Plant Materials Laws require that all sod be inspected and approved for sale. The inspection and approval must be made by the State Agricultural Department, Office of the State Entomologist.
- J. Weeds: Sod shall be free of objectionable grassy and broad leaf weeds. Turfgrass sod shall be considered free of such weeds if less than five such plants are found per 100 sq. ft. of area.
1. Turfgrass sod shall not be acceptable if it contains any of the following weeds: common bermudagrass (wiregrass), quackgrass, johnsongrass, poison ivy, nutsedge, nimblewill, Canada thistle, bindweed, bentgrass, wild garlic, ground ivy, perennial sorrel and bromegrass.

## 2.3 MEADOW SEED SOURCES

- A. Seed mixture: As indicated on the Drawings. Seed sources shall be one of the following or other Architect approved source:

Ernst Conservation Seeds, Inc.

8884 Mercer Pike  
Meadville PA 16335  
(800) 873  
<http://www.ernstseed.com/seed-mixes>

NESeed  
122 Park Ave, Building H  
East Hartford, CT 06108  
(800) 825 4577  
<https://www.neseed.com/>

New England Wetland Plants, Inc.  
820 West Street  
Amherst, MA 01002  
(413)548 8000  
<http://newp.com/>

## 2.4 MEADOW PLUGS

- A. Certified Native Perennial Plugs and Small Containers: Superior plugs grown from certified, high quality seed of known origin or from plantings of certified grass seedlings or stolons. It shall be inspected by the certification agency of the state in which it is grown to assure satisfactory genetic identity and purity, overall high quality and freedom from noxious weeds as well as excessive quantities of other crop and weedy plants at time of harvest. All seed or original plant material in mixture must be certified. Native perennial plugs and small containers plugs shall meet the published state standards for certification.
1. Meadow Areas: Plugs shall be a mixture of native meadow plants and grasses, as indicated on the Plant Schedule (on the Drawings)
- B. Plugs shall be nursery grown on cultivated mineral agricultural soils. Plugs shall have been mowed regularly and carefully, and otherwise maintained from planting to harvest.
- C. Moisture Content: Plugs shall not be harvested or transplanted when moisture content (excessively dry or wet) may adversely affect its survival.
- D. Time Limitations: Plugs shall be harvested, delivered, and transplanted within a 36 hour period unless a suitable preservation method is approved prior to delivery. Plugs not transplanted within this period shall be inspected and approved by the Architect prior to its installation.
- E. Thatch: Plugs shall be relatively free of thatch. A maximum of 1/2 in. (uncompressed) thatch will be permitted.
- F. Diseases, Nematodes, and Insects: Plugs shall be free of diseases, nematodes, and soil-borne insects. State Nursery and Plant Materials Laws require that all plugs be inspected and approved for sale. The inspection and approval must be made by the State Agricultural Department, Office of the State Entomologist.
- G. Weeds: Plugs shall be free of objectionable grassy and broad leaf weeds. Native perennial plugs and small containers plugs shall be considered free of such weeds if less than five such plants are found per 100 sq. ft. of area.
1. Native perennial plugs and small containers plugs shall not be acceptable if it contains any of the following weeds: common bermudagrass (wiregrass), quackgrass, johnsongrass, poison ivy, nutsedge, nimblewill, Canada thistle, bindweed, bentgrass, wild garlic, ground ivy, perennial sorrel, bromegrass, cogon grass, bluestem, topedo grass, penny wort and live Chinese tallow.

## 2.5 SOD FARM GROWING MEDIUM

- A. Sod farm growing medium shall be as specified in Section 329115, PLANTING SOIL.

## 2.6 PLANTING SOILS

- A. Fiber reinforced soil mix and other turf soil mixes shall be as specified in Section 329115, PLANTING SOIL.

## 2.7 WATER

- A. Water shall be suitable for irrigation and free from ingredients harmful to seeded or sodded areas.

## 2.8 SOIL AMENDMENTS

- A. Soil amendments shall be as specified in Section 329115, PLANTING SOIL.

## 2.9 CELLULOSE FIBER MULCH

- A. Cellulose fiber mulch shall be composed of virgin wood, contain a green color additive, be weed free, and non-polluting, containing no germination or growth - inhibiting factors, similar to Hydro Mulch, manufactured by Conwed Corporation, St. Paul, Minnesota 55113.

## 2.10 WEED CONTROL

- A. Weed control for stockpiled topsoil shall be a non-selective weed killer for control of grassy and broadleaf weeds; weed control shall have short residual, allowing seeding and sodding operations to occur within 7 days of application.

## PART 3 EXECUTION

## 3.1 PREPARATION OF SUBGRADE

- A. Subgrade shall be examined to ensure that rough grading and all other subsurface work in lawn areas and other areas to be seeded or sodded is done prior to start of seeding.
- B. Existing subgrade shall be loosened or scarified to a minimum depth of 3 in. prior to spreading topsoil. Subgrade shall be brought to true and uniform grade, and shall be cleared of stones greater than 3 in., sticks, and other extraneous material.

## 3.2 EXAMINATION

- A. For native seeding:
  1. Examine areas to receive native seeding for compliance with requirements outlined above. Check that finish grades slope to drain, are free of depressions or other irregularities after thorough settlement and compaction of soil, and are uniform in slope between grading controls and the elevations indicated in the Plans. If finish grades are determined by the Architect to be insufficient for seeding, the Contractor shall re-grade areas as directed by the Architect.
  2. Ensure ground layer is cleared of leaf litter and other duff prior to seeding. Submit to the Architect for approval the method for making seed contact with the soil where the soil will not be graded or otherwise disturbed prior to seeding.

3. Proceed with installation only after unsatisfactory conditions have been corrected. Obtain approval from Architect regarding pre-installation conditions before proceeding.

3.3 PLACING AND SPREADING PLANTING SOIL

- A. Planting soil shall not be spread until it is possible to follow immediately or within 24 hours with seeding and sodding operations. If planting soil is spread prior to this time it shall be cultivated to loosen soil prior to seeding and sodding.
- B. Placing and spreading planting soil shall be performed as specified in Section 329115, PLANTING SOIL.
- C. Restore prepared areas if eroded or otherwise disturbed after fine grading and before planting.

3.4 APPLICATION OF SOIL AMENDMENTS

- A. Fertilizer and conditioners shall be applied as specified in Section 329115, PLANTING SOIL.

3.5 FINISH GRADING

- A. Contractor shall set grade lines for Architect's review and approval.
  1. Final surface of topsoil immediately before seeding and sodding shall be within + 1/2 in. of required elevation, with no ruts, mounds, ridges, or other faults, and no pockets or low spots in which water can collect. Stones, roots, and other debris greater than 1 in. in any dimension, which are visible at the surface, shall be removed and the resulting holes filled with topsoil, leaving a uniform planar surface.
- B. Finish grade surface with a drag or rake. Round out all breaks in grade, smooth down all lumps and ridges, fill in all holes and crevices. Rolling with a light roller is acceptable, if the surface is scarified afterward.
  1. Lawn: Compaction of topsoil for finish grade shall be in accordance with Section 329115, PLANTING SOIL.
- C. In the event of settlement, the Contractor shall readjust the work to required finished grade.

3.6 LAWN SEED APPLICATION

- A. Seed shall be applied in two applications; first shall be by mechanical spreader; second shall be by hydroseeding method as specified below.
- B. First Application: Seed shall be broadcast by means of an approved mechanical spreader, to give a uniform application at the following rates:

Seed	Application Rate	
Seed Mixture	lb./1,000 s.f.	
	as per supplier's printed recommendations	

1. Seed shall be applied in two equal applications for uniform coverage; direction of travel of spreader for second pass shall be perpendicular to that of the first pass. Seeding shall not be done when it is raining or snowing, or when wind velocity exceeds 5 mph.
2. Following seeding the area shall be lightly raked to mingle seed with top 1/8 to 1/4 in. of soil. Area shall then be fine graded. Stones and other debris greater than 1 in. in any dimension which are visible on surface shall be removed.

- C. Following seeding and raking, entire area shall be rolled with a hand roller having a weight of 60 to 90 lb./ft. of width, and a minimum diameter of 2 ft. Entire area shall then be watered by use of lawn sprinklers, or other approved means. Initial watering shall continue until the equivalent of a 2 in. depth of water has been applied to entire seeded surface, at a rate which will not dislodge the seed. Watering shall be repeated thereafter as frequently as required to prevent drying of the surface, until the grass attains an average height of 1/4 in. Watering methods and apparatus which may cause erosion of the surface shall not be permitted.
- D. At Contractor's Option: In lieu of mechanical spreader, seed may be spread by the hydroseeding method, utilizing power equipment commonly used for that purpose.
  - 1. Seed, lime, fertilizer, and mulch shall be mixed and applied to achieve application quantities specified herein for the conventional seeding method, with mulch applied at the rate of 1,200 lb./acre. Other provisions specified above for conventional seeding shall apply also to hydroseeding.
  - 2. Mulch shall be applied in two stages with 5% to 10% of the quantity applied with seed and the balance applied separately.
  - 3. Seed shall not be placed in water until immediately before application.
  - 4. Centrifugal pumps shall not be used to apply seed mix without fiber mulch. Hand broadcast or use gear pump.
  - 5. Gelscape shall be incorporated at the rate of 15 lb. per acre.
- E. Rope off entire seeded area to prevent vehicles and pedestrians from entering area.

### 3.7 SODDING

- A. Edges of the sodded areas shall be smooth, and all sodded areas shall conform to the design cross sections and grade. At edges adjacent to curbs, paved areas, etc., top surface of earth in sod shall be 1/2 in. below adjacent hard surface.
- B. Sod shall be placed and all sodding operations completed within 72 hours following stripping from sod source bed.
- C. On slopes steeper than 2 to 1, sod shall be fastened in place with suitable wood pins or other approved methods, spaced at not less than 1 pin per square foot.
- D. Surface of completed sodded area shall be smooth. Sod shall be laid edge-to-edge, with tight-butted, staggered joints. Sod shall be carefully placed to insure that it is neither stretched or overlapped. Immediately after laying sod shall be pressed firmly into contact with sod bed by tamping or rolling, to eliminate air pockets. Following compaction, topsoil shall be used to fill all cracks, and excess soil shall be worked into grass with rakes or other suitable equipment. Sod shall not be smothered with excess fill soil.
- E. Immediately after sodding operations have been completed, entire surface shall be compacted with a cultipacker roller or other approved equipment weighing 100 to 160 lb./ft. of roller.
- F. Completed sod shall immediately be watered sufficiently to uniformly wet the soil to at least 1 in. below the bottom of sod bed.

### 3.8 MAINTENANCE OF SEEDED AND SODDED LAWNS

- A. Except as otherwise specified below, maintenance shall include all operations required to produce an established lawn, including but not limited to:
  - Fertilizing
  - Mowing
  - Replanting
  - Watering

## Weeding

- B. Maintenance of seeded areas shall begin upon completion of seeding and shall continue until acceptance of the building, or until mowing as specified below is completed, or until average height of grass is 1-1/2 in., whichever occurs later.
1. Watering
    - a. Week No. 1: Provide all watering necessary to keep seed bed moist at all times. Perform watering daily or as necessary to maintain moist soil to a depth of 4 in.
    - b. Week No. 2 and until acceptance of the building, or until mowing as specified below is completed, or until average height of grass is 1-1/2 in., whichever occurs later: Water as necessary to maintain adequate moisture in the upper 4 in. of soil to promote seed germination.
  2. Mowing
    - a. Not more than 40% of the grass leaf shall be removed during the first or subsequent mowings.
    - b. Bluegrass and other cool season grasses shall be maintained between 1-1/2 in. and 2-1/2 in.
    - c. All clippings shall be removed.
- C. Maintenance of sodded areas shall begin upon completion of sodding and shall continue for 45 days thereafter, unless sodding is not completed until after September 15, in which case maintenance shall continue until the June 15 following.
1. Watering
    - a. Week No. 1: Provide all watering necessary for rooting of sod. Soil on sod pads shall be kept moist at all times. Perform watering daily or as necessary to maintain moist soil to a depth of 4 in. Watering shall be done during the heat of the day to prevent wilting.
    - b. Week No. 2 and Subsequent Weeks: Water as necessary to maintain adequate moisture in the upper 4 in. of soil to promote deep root growth.
  2. Mowing
    - a. Mowing shall not be attempted until the sod is firmly rooted and securely in place. Not more than 40% of the grass leaf shall be removed during the first or subsequent mowings.
    - b. Bluegrass and other cool season grasses shall be maintained between 1-1/2 in. and 2-1/2 in.
    - c. All clippings shall be removed.
    - d. After 2 mowings, the Contractor shall top dress the sod with an application of fertilizer at the rate of 1 pound of actual nitrogen per 1000 square feet.
- D. After grass has sprouted, seeded areas which fail to show a uniform stand of grass shall be replanted as often as necessary to establish an acceptable stand of grass.
1. Scattered bare spots, shall not exceed 15 sq. in. each.
- E. Weeds and growth other than varieties of grass named in grass seed formula shall be removed. Removal may be accomplished by use of suitable herbicides or by physical removal, in which case top growth and roots shall both be removed, and bare spots exceeding specified limits shall be reseeded.
- F. If lawn or grass is established in the fall and maintenance is required to continue into spring months, lawn and grass shall receive an application of lime and fertilizer in the spring. Lime and fertilizer shall be spread in a uniform layer over the entire lawn surface, at the following rates.

Material

Application Rate

Lime	100 lb./1000 sq. ft.
Fertilizer	20 lb./1000 sq. ft.

- G Remove rope barricades only after second cutting of lawns.

### 3.9 MEADOWS - SITE PREPARATION

- A. Two interrelated and variable actions are needed prior to meadow seeding:

1. Establishment of a temporary cover crop to stabilize the soil and prevent erosion until the correct time for meadow seeding and
2. Weed control.

NOTE: These recommendations may need to be modified depending on the time of season/ weather conditions when the final grading is completed and on the abundance and types of weeds present in the soil – this simply cant be determined before the actual soil is in place, after final grading. On-site consultations to observe agronomic conditions during the planting and establishment periods are strongly recommended.

Because site grading will involve spreading of stockpiled existing/amended soil, most likely there will be a large number of weed seeds present that will germinate rapidly (because some will end up in the perfect soil habitat to germinate) at any time during the growing season.

If these weeds are not controlled, they may out-compete the meadow seedlings, and because these annuals mature rapidly, they will produce a new crop of annual weed seeds, continuing the weed problem into the following year - and preventing the meadow from successful establishment. Failure to control weeds is the most common cause of meadow failure.

- B. After final grading, seed all areas with Annual Ryegrass (*Lolium multiflorum*) (not winter or cereal rye) at 8 pounds per 1000sf. Areas with steep slopes can be mulched lightly with 1-2" of straw (not hay!) to prevent erosion. Annual Rye will prevent erosion and help to control weeds. The annual rye cover will establish quickly during the spring or fall growing season. The Annual Rye will die off the following season without reseeding. The perfect nurse /cover crop.
- C. Inspect the Annual Ryegrass after establishment (30-45 days) to assess the amount of weeds present (growing with the rye grass) see 1 or 2 below:
1. Minimal Weeds Present. If the weeds in the Annual Rye are minimal/few, mow repeatedly at a height of 4-6" to prevent weeds from maturing and setting seed (most are annuals). Continue mowing regularly at 4-6" until late fall then seed the meadow through the Annual Rye using a slit seeder (see meadow seeding).
  2. Significant Weeds Present: If the weeds are significant or dominant within the Annual Rye, herbicide treatment is necessary (agronomic inspection recommended). When the weeds are growing vigorously (May – October) spray with Glyphosphate (Roundup), which is a non-selective foliar herbicide. The Round-up will kill the weeds and the Annual Rye. The dead plants should provide adequate erosion protection – if necessary a small amount of straw can be added(perhaps on the steeper berm slopes). Inspect weekly and spot-treat/spray any surviving, or new weeds again with Glyphosphate until the appropriate planting time. Do not disturb the soil any more than necessary during herbicide treatment, as this will expose new weeds seeds to favorable conditions for germination (better to hand spray than to drive a tractor over it). Just before meadow seeding, mow the dead weeds and rake the debris, again try not to disturb the soil, as this will expose new weed seeds to germination.

### 3.10 MEADOW SEED APPLICATION

- A. Prepare planting sites as discussed above. Be sure to wait a minimum of 2 weeks after the last Glyphosphate treatment before seeding, and cut using a flail mower and rake and remove the dead plants. Remove debris from the planting locations. If seeding into Annual Rye, mow short before seeding.
- B. Timing: Seeding should be done when soil is near normal moisture conditions (moist, not saturated, no puddles). If the soil is too wet, wait until it dries. Germination is not desired in the fall, so irrigation shall not be necessary. Seeding should not be done under windy conditions, as the grass seeds are light and fluffy and may blow away.
- C. Acceptable planting times/seasons include:
  - 1. Fall/Dormant Seeding (Preferred)
    - a. For best results, native meadow seeding should occur in late fall – October to early November - and can take place into the dormant season until the ground is frozen or snow covered. Many of the seeds require cold scarification for germination. If fall seeding is occurs too early in the season, seeds which do not require cold scarification (approximately 10% of most mixes) may germinate before becoming hardened off and may die from the frost.
  - 2. Spring and Early Summer Seeding
    - a. Seeding in the spring and early summer is acceptable. While earlier planting is preferred (after the risk of frost), late spring and early summer seeding will require a light layer of weed free straw mulch to conserve soil moisture. If conditions are drier than usual watering may be required (See section 3.7).
- D. Seeding shall occur no sooner than 24 hours after herbicide application and no greater than 14 days after herbicide application.
- E. Sowing rates vary with mix of species but are usually much lighter than turfgrass seed application rates.
- F. Seeding Methods: Seed mixes shall be applied using one of the following acceptable methods:
  - 1. Drill Seeding
    - a. If using a seed drill or slice/slit seeder and the seeds do not come premixed, the grass and forb seeds should be mixed, weighed, and applied separately. The forb seed is much smaller than the grass seed in quantity and should therefore be very carefully weighed and separated according to the mix rates. Note: if an accurate scale is not available, the seed quantities can be divided in proportion to the total amount of seed to be used for each area. Mix the forb mix with two to four times the volume of damp sand, sawdust, or horticultural vermiculite as an inert “filler” material.
    - b. The slicing seeder should be calibrated to provide the recommended seeding rates. For the grass and forb seed, seed in two perpendicular passes. This assumes that the seeding machine is calibrated for 50% of the recommended seeding rate. Applying the seed in multiple passes will break up the ryegrass more completely, and will help to assure a more uniform distribution of seed throughout the meadow, and will help to assure good soil:seed contact.
  - 2. Broadcasting
    - a. Broadcast seeding can be accomplished by hand or using a hand operated mechanical spreader. If seeds do not come premixed from the supplier, grass and forb seed should be mixed together with two to four times the volume of damp sand, sawdust, or horticultural vermiculite as an inert “filler” material. Seed shall be applied in two perpendicular passes at 50% of the recommended seeding rate. Applying the seed in multiple passes will help to assure a more uniform distribution of seed throughout the meadow. Lightly rake or roll with a cultipacker after seeding.

- G. Do not use wet seed or seed that is moldy or otherwise damaged.
  - H. Seeding operations must occur when soil moisture is appropriate and areas are in a friable condition and neither hard nor muddy
  - I. Lightly roll seeded areas with a cultipack roller and water with fine spray.
  - J. Ensure seeds have proper stratification and/or scarification to break seed dormancy for spring emergence.
- 3.11 MEADOWS - RAKE, ROLL, MULCH
- A. The Meadow should be lightly raked or rolled with a cultipacker after seeding to ensure good soil:seed contact. After the seed mixes have been applied to all areas, rake or roll the seeded areas so they are lightly covered with soil, 1/4 – 1/2" deep.
- 3.12 MEADOW ESTABLISHMENT
- A. Irrigation During Germination (Spring-Summer Planting Only)
    - 1. For optimal germination it is recommended that seeded areas receive a minimum of 0.25 inch of natural rainfall or irrigation within 10 days of seeding. If natural rainfall is not received within 10 days, it shall be the responsibility of the Contractor to irrigate the new seeding with a minimum of 0.25 inch of water, or so that the water penetrates the soil to a uniform minimum depth of 4.0 inches.
    - 2. The soil of the seedbed should be maintained in a moist condition for 6-8 weeks after seeding – as necessary to favor germination and the critical early establishment period, depending on precipitation.
    - 3. For fall seeding the meadows are not expected germinate so they do not require irrigation.
- 3.13 MEADOW MANAGEMENT
- A. First Growing Season
    - 1. Mowing the meadow is an important management practice during the first growing year. Mowing favors perennial meadow species over annual weeds that may be present. The first mowing should start when the tallest growth approaches 12" (mid – late June). Mow at a height of 6" to cut the annual weed flower/seed heads. Continue mowing every 3-4 weeks, as needed until late October, with a mowing height of 6". Most native perennials will not grow taller than 4-6" inches in the first year. Some vegetation such as Black Eyed Susan will grow taller but will not be adversely affected by cutting.
    - 2. Refrain from mowing the meadow alone after late October until the next growing season. Mowing is extremely important for the first year to control weeds. It is strongly recommended not pull any weeds within the first year as such activity will disturb the native seedlings. These (typically annual) weeds will not present a problem and can be controlled by mowing. Once the meadow has become established the meadow species should out-compete the weeds, except for unusual situations which can be "spot" treated with herbicide, or hand-pulled. Inspection by a trained ecological restoration professional are recommended during the establishment period to advise on mowing regime and weed control.
  - B. Second Growing Season
    - 1. Around April 1 -15 (following the first growing season), the meadow should be mowed to a height of 3-4" and raked lightly to expose the small plants and some soil. Remove the mowing debris if possible. Mowing should only be performed twice throughout the second growing season to a height of 12 inches, which should be sufficient to control annual and

biennial weeds. Timing of mowing should correspond to the bloom and seed cycles of biennial weeds such as Sweet clover, Burdock, and Queen Anne's Lace. Rhizomatous weeds such as Canada thistle, Canada goldenrod, and Reed canary grass can be spot-treated or physically removed as needed.

### 3.14 LONG TERM MEADOW MANAGEMENT: MOWING

- A. It is recommended that the meadow be managed flail mowing every one to two years, mid-spring (Mid-late April) to a height of 3-4". Spring mowing will not adversely impact emerging native grasses and perennials and will help prevent establishment of woody species. Spring mowing also leaves native meadow plants intact over winter for added visual interest, wildlife habitat, and additionally provides a buffer from extreme weather and frost action on the soil. Mid-spring mowing also will cut some of the undesirable cool-season grasses that will likely invade the meadow. Always rake and remove the cuttings to expose the soil. If the new growth of the meadow gets over 12" before it is mowed, do not mow that year.

### 3.15 MEADOW PLUGGING

- A. Edges of the plugged areas shall be smooth, and all plugged areas shall conform to the design cross sections and grade. At edges adjacent to curbs, paved areas, etc., top surface of earth in plugs shall be 1/2 in. below adjacent hard surface.
- B. Plugs shall be placed and all planting operations completed within 72 hours following stripping from plug source bed.
- C. Surface of completed plugged area shall be smooth. Plugs shall be pressed firmly into contact with soil bed by tamping or rolling, to eliminate air pockets. Plugs shall not be smothered with excess fill soil.
- D. Completed plugs shall immediately be watered sufficiently to uniformly wet the soil to at least 1 in. below the bottom of plugs bed.
- E. Maintenance of plugged areas shall begin upon completion of planting and shall continue for 45 days thereafter, unless planting is not completed until after September 15, in which case maintenance shall continue until the June 15 following.
  - 1. Watering
    - a. Week No. 1: Provide all watering necessary for rooting of plugs. Soil on plugs pads shall be kept moist at all times. Perform watering daily or as necessary to maintain moist soil to a depth of 4 in. Watering shall be done during the heat of the day to prevent wilting.
    - b. Week No. 2 and Subsequent Weeks: Water as necessary to maintain adequate moisture in the upper 4 in. of soil to promote deep root growth.
- F. Plugged areas which fail to show a uniform stand of grass shall be replanted as often as necessary to establish an acceptable stand of grass.
  - 1. Scattered bare spots, shall not exceed 1 sq. ft. each.
- G. Weeds and growth other than varieties of grass named in grass seed formula shall be removed. Removal may be accomplished by use of suitable herbicides or by physical removal, in which case top growth and roots shall both be removed, and bare spots exceeding specified limits shall be replanted.

END OF SECTION

## SECTION 329300

## PLANTING

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section

## PART 1 GENERAL

## 1.1 GENERAL REQUIREMENTS

- A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

## 1.2 SECTION INCLUDES

- A. Provide all materials and equipment, and do all work required to complete the planting, as indicated on the Drawings and as specified.

## 1.3 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.
2. Section 329115, PLANTING SOIL.
3. Section 329119, LANDSCAPE GRADING.
4. Section 329200, LAWNS AND GRASSES.

310000, EARTHWORK

## 1.4 REFERENCES

- A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. All standards shall include the latest additions and amendments as of the date of advertisement for bids.

1. American National Standards Institute, Inc. (ANSI):

Z60.1 American Standard for Nursery Stock (Sponsor: American Nursery and Landscape Association)

A 300 American National Standards for Tree Care Operations

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

C 136 Sieve Analysis of Fine and Coarse Aggregates

D 422 Particle-Size Analysis of Soils

E 11 Wire-Cloth Sieves for Testing Purposes

F 405 Corrugated Polyethylene (Pe) Tubing and Fittings

4. "Hortus Third", A Concise Dictionary of Plants Cultivated in the United States and Canada, Cornell University, L.H. Bailey Hortorium, MacMillian Publishing Co., New York, NY.

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- A. Finish Grade: Elevation of finished surfaces.

~~Manufactured Loam Borrow: Soil produced off site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil, loam borrow or planting soil.~~

#### 1.6 SUBMITTALS

- A. Samples: The following samples shall be submitted:

<u>Material</u>	<u>Sample Size or Quantity</u>
Mulch	1 ft. <sup>3</sup>
Tree stake	24 in. length
Tree wrap	24 in. length

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

Aluminum sulfate  
Antidessicant  
Fertilizer  
Fungicide  
Herbicide  
Insecticide  
Tree wrap  
Water retention additive  
Mycorrhizal fungi inoculant

- C. Certificates: Labels from the manufacturer certifying that the product meets the specified requirements shall be submitted for the following materials:

Compost

Commercial fertilizer  
Limestone

#### 1.7 SOURCE QUALITY CONTROL

- A. Identification of plant materials shall be as named in "Hortus Third".

- B. Selection of Plant Materials: Contractor shall submit to Architect a complete list of all proposed nurseries including location, contact #, plant list for each nursery, all proposed substitutions, credits and/or additional charges. No tagging will occur until this list is complete and submitted. Contractor shall be responsible for delays if list is not submitted complete and in advance of proposed tagging dates.

- Inspect all nursery materials to determine that the materials meet the requirements of this section. Proposed materials shall be flagged by the nurseries for review by the Contractor and the Architect.
- Schedule with the Architect a time for viewing plant material at the nursery. Trips to nurseries shall be efficiently arranged to allow Architect to maximize viewing time. A minimum of six weeks shall be allowed for this viewing prior to time that plants are to be dug.
- Architect may choose to attach seal to each plant, or representative samples.
- Viewing and/or sealing of plant materials by the Architect at the nursery does not preclude the Architect's right to reject material at the site of planting.
- Architect will provide a maximum of two (2) tagging trips. Additional tagging trips (time and expense) shall be paid for by the Contractor.

- C. Plant Photographs: Include color photographs in digital format of each required species and size of plant material as it will be furnished for the Project. Take photographs from an angle

depicting true size and condition of the plant to be provided. Include a scale rod or other measuring device in each photograph. Include a minimum of three photographs for each species to be furnished. Photographs shall show actual material available for selection. Clearly identify photographs with botanical name, size and source nursery.

#### 1.8 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful establishment of similar plantings with highly technical soil installations. Installer shall provide evidence of the following credentials:
1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
  2. Experience: Five years' experience in landscape installation in addition to requirements in Division 01 General Requirements."
  3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
  4. 3 projects similar scale and similar components within last 5 years
  5. 3 references with phone numbers
  6. 3 photos each for each reference project
  7. Positive responses from all references
  8. Reference project review by Architect and Owner within New Windsor, NY area.
- B. Pesticide Applicator: State licensed, commercial.

#### 1.9 PLANT MATERIAL QUANTITIES

- A. In the event of a discrepancy in plant material quantities between the Drawings and the Plant List(s), the larger quantity shall be required.

## 1.10 UNAVAILABILITY OF PLANT MATERIALS

- A. Before changes or substitutions can be made due to unavailability of plant material, submit satisfactory evidence that the Contractor has advertised for a one month period in a trade journal such as the "American Nurseryman", (Tel. 312-427-7339 and Fax: 312-427-7346), with no response, or has undertaken other methods of locating plant material acceptable to the Architect.

## 1.11 DELIVERY, STORAGE, AND HANDLING

- A. Transportation of Plant Material: Plants transported to the project in open vehicles shall be covered with tarpaulins or other suitable covers securely fastened to the body of the vehicle to prevent injury to the plants. Closed vehicles shall be adequately ventilated to prevent overheating of the plants. Trees shall not be transported when daytime air temperatures are below 20°.
  - 1. Plants shall be kept moist, fresh, and protected at all times. Such protection shall encompass the entire period during which the plants are in transit, being handled, or are in temporary storage.
  - 2. Unless otherwise authorized by the Architect, notify the Architect at least two working days in advance of the anticipated delivery date of any plant material. A legible copy of the bill of lading, showing the quantities, kinds, and sizes of materials included for each shipment shall be furnished to the Architect, if requested.
- B. Storage: Unless specific authorization is obtained from the Architect, unprotected plants shall not remain on the site of work longer than three days prior to being planted.
  - 1. Plants that are not planted immediately shall be protected as follows:
    - a. Earth balls shall be kept moist, not be allowed to freeze, and their solidity carefully preserved.
  - 2. Both the duration and method of storage of plant materials shall be subject to the approval of the Architect.
- C. Handling of Plant Materials: Exercise care in handling plant materials to avoid damage or stress.

## 1.12 REJECTION OF MATERIALS

- A. Evidence of inadequate protection following digging, carelessness while in transit, or improper handling or storage, shall be cause for rejection.
- B. Upon arrival at the temporary storage location or the site of the work, plants shall be inspected for proper shipping procedures. Plants with roots dried out, large branches broken, balls of earth broken or loosened, or areas of bark torn shall be subject to rejection by the Architect.
- C. Rejected plants shall be removed from the area of work and replaced with same species of the required size and quality.

## 1.13 DIGGING/PLANTING SEASONS

- A. Planting Restrictions and Seasons: Plant during one of the following the following periods, weather permitting. Coordinate planting periods with maintenance periods to provide required maintenance.
  - 1. Spring Planting
    - a. Deciduous trees and shrubs: March 15 to May 1.
    - b. Evergreen trees and shrubs: March 30 to May 15.

- c. Bareroot Trees: April 1 – May 7.
  - d. Groundcovers: April 15 to May 30.
  - e. Ornamental Grasses: April 15 to May 30.
  - f. Plants: After danger of frost between April 15 to June 1.
  - g. Bulbs: Do not plant in Spring.
  - 2. Fall Planting
    - a. Deciduous trees and shrubs: October 15 to November 30.
    - b. Evergreen trees and shrubs: September 1 to October 15.
    - c. Groundcovers: September 1 to October 15.
    - d. Ornamental Grasses: September 1 to October 15.
    - e. Plants: September 1 to October 15 or first frost.
    - f. Bulbs: September 1 to November 30.
  - 3. The following are fall planting hazards and shall be planted in the Spring only. Planting at times other Spring Season shall be done at Contractor's risk and shall not relieve Contractor of warranty obligations.
    - a. Trees.
  - 4. Execute the actual planting of plant material during periods within these seasons as determined by weather conditions, by acceptable practice in the locality of the project, or as may be approved by the Architect.
- B. Plant frost-tender trees only after danger of frost is past or sufficiently before frost season to allow for establishment before first frost. Do not plant in frozen ground.
  - C. Planting Seasons: Planting shall only be performed when weather and soil conditions are suitable for planting the material specified, in accordance with locally accepted practice, approval of the Architect, and to maintain the Contractor's guarantee.
- 1.14 ACCEPTANCE FOR SUBSTANTIAL COMPLETION
- A. The Architect shall inspect all work of this Section for Acceptance for Substantial Completion upon receipt of written notice of completion by the Contractor. The request shall be received at least ten calendar days before the anticipated date of inspection.
  - B. Acceptance of plant material by the Architect shall be for general conformance to specified size, character, and quality, and shall not diminish responsibility for full conformance to the Contract Documents.
  - C. Upon completion and reinspection of all repairs or renewals necessary in the judgement of the Architect, the Architect shall recommend that Acceptance for Substantial Completion of the work of this Section be given by the Owner.
  - D. Acceptance in Part
    - 1. The work may be Accepted in parts when it is deemed to be in the Owner's best interest to do so, and when permission is given to the Contractor in writing to complete the work in parts.
    - 2. Acceptance and use of such areas by the Owner shall not waive any other provisions of this Contract.
- 1.15 MAINTENANCE
- A. The Contractor shall maintain plant material until the completion of the one year Guarantee Period and Final Acceptance of work, as described in this Section.
- 1.16 GUARANTEE

- A. Plants shall be guaranteed for a period of one year after the date of Acceptance by the Owner. However, under no conditions shall the Guarantee Period include less than 2 full growing seasons.
  - 1. When the work is Accepted in parts, the guarantee periods shall extend from each of the partial Acceptances to the terminal date of the last guarantee period. Thus, all guarantee periods terminate at one time.
- B. Plants shall be healthy, free of pests and disease, and in flourishing condition at the end of the guarantee period. Plants shall be free of dead and dying branches and branch tips, and shall bear foliage of normal density, size, and color.
- C. Replace dead plants and all plants not in a vigorous, thriving condition, as determined by the Architect during and at the end of the guarantee period, without cost to the Owner, as soon as weather conditions permit and within the specified planting period.
  - 1. Replacements shall closely match adjacent specimens of the same species. Replacements shall be subject to all requirements stated in this Specification.
  - 2. Make all necessary repairs due to plant replacements. Such repairs shall be done at no extra cost to the Owner.
  - 3. The guarantee of all replacement plants shall extend for an additional one year period from the date of their Acceptance after replacement. In the event that a replacement plant is not acceptable during or at the end of the said extended guarantee period, the Owner may elect one more replacement or credit for each item.
- D. At the end of the guarantee period, and no less than five days prior to final inspection, staking and guying materials, and tree wrap and ties shall be removed from the site.

#### 1.17 FINAL INSPECTION AND FINAL ACCEPTANCE

- A. At the end of the guarantee period, the Architect shall, upon receipt of written notice of end of guarantee period, inspect the work for Final Acceptance. Request shall be received at least ten calendar days before the anticipated date for Final Inspection.
- B. Final Inspection shall not be conducted while plants are in a dormant state.
- C. Upon completion and reinspection of full repairs or replacements necessary in the judgment of the Architect at that time, the Architect shall recommend to the Owner that Final Acceptance of the work of this Section be given.

### PART 2 PRODUCTS

#### 2.1 PLANTS

- A. Except as otherwise specified, size and grade of plant materials and their root balls shall conform to ANSI Z60.1.
- B. Plants shall have outstanding form; symmetrical, heavily branched with an even branch distribution, densely foliated and/or budded, and a strong, straight, distinct leader where this is characteristic of species. Plants shall possess a normal balance for the species between height and spread. The Architect will be the final arbiter of acceptability of plant form.
  - 1. 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.
  - 2. Small Trees: Branched or pruned naturally according to species and type, with relationship of caliper, height, and branching according to ANSI Z60.1; stem form.

3. Multistem Trees: Branched or pruned naturally according to species and type, with relationship of caliper, height, and branching according to ANSI Z60.1; stem form.
  4. Deciduous Shrubs: Form and Size: Deciduous 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.
  5. Coniferous Evergreens: Form and Size: Normal-quality, well-balanced, coniferous evergreens, of type, height, spread, and shape required, complying with ANSI Z60.1.
  6. Coniferous Evergreens: Form and Size: Specimen-quality, exceptionally heavy, tightly knit, symmetrically shaped coniferous evergreens.
  7. Broadleaf Evergreens: Form and Size: Heavy, well-balanced, broadleaf evergreens, of type, height, spread, and shape required, complying with ANSI Z60.1.
- C. Plants shall be healthy and vigorous, free of disease, insect pests and their eggs, and larvae.
- D. Plants shall have a well-developed fibrous root system.
- E. Plants shall be free of physical damage such as scrapes, broken or split branches, scars, bark abrasions, sunscalds, fresh limb cuts, disfiguring knots, or other defects.
- F. Plants shall meet the sizes indicated on the Plant List. Plants larger or smaller than specified may be used only if accepted in writing by the Architect.
- G. Where a size or caliper range is stated, at least 50% of the material shall be closer in size to the top of the range stated.
- H. Plants shall not be pruned before delivery.
- I. All trees and shrubs shall be labeled. Labels shall be durable and legible, stating the correct plant name and size in weather-resistant ink or embossed process. Labels shall be securely attached to all plants prior to delivery to the site, being careful not to restrict growth.
- J. Plants indicated as "B&B" shall be balled and burlapped.
1. Unless otherwise permitted by the Architect, plants shall be nursery grown.
  2. Plants shall be grown for at least two years under climatic conditions similar to those in the locality of the Project.
  3. Nursery grown plants shall be dug in the current planting season. No heeled in plants or plants from cold storage that were dug in the previous season shall be accepted.
- K. Container grown plants shall be well rooted and established in the container in which they were grown. They shall have grown in the container for a sufficient length of time for the root system to hold the planting medium when taken from the container, but not long enough to become root bound. Container grown plants exceeding the sizes indicated in ANSI Z60.1 shall have containers which are not less than 75% of the ball sizes for comparable B&B plant material. Each container plant shall be inspected and circling roots loosened or pruned as needed.
1. Any trees grown in pots, including pot-in-pot culture, will be rejected.
- L. Canes or Trunk(s) and Branches:
1. Very well formed and sturdy with distinct leader and no crotches that may interfere with growth of leader. Trees with included bark in crotches shall be avoided.
  2. Branching well spaced and uniformly distributed both vertically and around the circumference to form a well balanced plant.
  3. Scars shall be free of rot and not exceed  $\frac{1}{4}$  the diameter of the wood beneath in greatest dimension unless completely healed (except pruning scars).
  4. Pruning scars clean cut leaving little or no protrusion from the trunk or branch.

5. Graft union completely healed.
6. No mechanical or pest damage.
7. No extreme succulence.
8. Evidence of adequate twig growth in the past 2-4 years, and well-formed buds.

M. Foliage:

1. Densely supplied with healthy, vigorous leaves of normal size, shape, color and texture (except shrubs moved bare-root or deciduous shrubs when dormant).
2. One half of the foliage should be growing on the lower 2/3 of the trunk.
3. No chlorosis.
4. No more than 5% of total foliage affected by pest or mechanical damage.

- N. Root System:
1. Sturdily established and evenly distributed.
  2. Container grown plants shall be well developed and hold the soil ball together when removed from the container.
  3. Container grown plants shall not be excessively rootbound (except if deliberately grown rootbound to produce a dwarf plant).
- 2.2 GROUND COVER PLANTS AND VINES
- A. Ground Cover: Provide ground cover of species indicated, established and well rooted in pots or similar containers, and complying with ANSI Z60.1.
- B. Fast-Growing 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.
- 2.3 PLANTING SOIL – PLANTS
- A. Refer to Section 329115, PLANTING SOIL.
- 2.4 LIMESTONE
- A. Limestone shall be an approved agricultural limestone containing no less than 50% of total carbonates, and 25% total magnesium with a neutralizing value of at least 100%. The material shall be ground to such a fineness that 40% will pass through a No. 100 U.S. Standard Sieve, and 98% will pass through a No. 20 U.S. Standard Sieve. The lime shall be uniform in composition, dry and free flowing, and shall be delivered to the site in the original unopened containers, each bearing the manufacturer's guaranteed analysis. Any lime which becomes caked or otherwise damaged making it unsuitable for use, will be rejected.
- 2.5 ALUMINUM SULFATE
- A. Aluminum sulfate shall be unadulterated and shall be delivered in containers with the name of the material and manufacturer and net weight of contents.
- 2.6 WATER
- A. Water shall be suitable for irrigation and shall be free from ingredients harmful to plant life.

## 2.7 MYCORRHIZAL FUNGI INNOCULANT

- A. Mycorrhizal Fungi Inoculant shall be three ounce (3 oz.) premeasured dry formulation packets, such as Mycor Tree Saver Transplant®, as manufactured by Plant Health Care, Inc., Pittsburgh, PA, or approved equal. Packets shall contain, as a minimum: one thousand (1000) live spores of Vesicular-Arbuscular fungi, including: *Entrophosphora columbiana*, *Glomus clarum*, *Glomus etunicatum*, and *Glomus sp.*; seventeen million five hundred thousand (17,500,000) live spores of Ectomycorrhizal fungi, including: *Pisolithus tinctorius*; biostimulants including *Yucca schidigera* extract; soluble sea kelp extract derived from *Ascophyllum nodosum*; humic acids; and acrylamide copolymer gel as a water absorbent medium.
1. Apply at each tree pit three (3) three-ounce (3 oz.) packets added to the top six to eight inches (6" to 8") of backfill soil added and thoroughly mixed to distribute the inoculant in accordance with manufacturer's printed instructions.

## 2.8 MULCH

- A. Mulch shall be a 100% fine-shredded pine bark or double shredded, aged hardwood mulch, typical to the Windsor area, of uniform size and free from rot, leaves, twigs, debris, stones, or any material harmful to plant growth. Bark shall have been shredded and stockpiled no less than six months and no more than two years before use. No chunks 3 in. or more in size, and thicker than 1/4 in. shall be left on site.

## 2.9 GUYING AND STAKING MATERIALS

- A. Wood Stakes: Straight, sound, rough sawn lumber 2"+ diameter, cedar stakes with bark on, tops chamfered 1/2", length 8-10 ft. Wire for staking shall be 12 gauge steel.
- B. Wire for Guying: Galvanized steel 1 x 19 preformed 3/16 in. diameter. Thimbles and nicopress clips shall be used for connections and splices.
- C. Turnbuckles: 1/4" x 7-3/4" Galvanized steel with a 2-1/2" in. lengthwise opening fitted with eyebolts, as manufactured by Crown Bolt Inc., or approved equal.
- D. Hose: High quality braided rubber hose, 3/4 in. diameter and suitable length, black in color.
- E. Strapping: Arbortie, manufactured by DeepRoot Green Infrastructure, LLC, 530 Washington Street, San Francisco, CA 94111 Tel: 800 458 7668 or 415 781 9700; Fax: 800 277 7668 or 415 781 0191, or approved equal.
- F. Below Grade Rootball Tiedown: Arborguy by GreenBlueUrban; <https://www.greenblue.com/na/products/arborguy/>, or approved equal.

## 2.10 WRAPPING MATERIAL

- A. Tree wrapping material shall be equal to the following:
1. Osnaburg Cloth, 4-7/8 in. wide, unbleached, pinked on both edges, manufactured by The Carnegie Textile Co., 1734 Ivanhoe Road, P.O. Box 10276, Cleveland, OH 44110.
  2. Tree wrap shall be secured to the trunk using bio-degradable tape suitable for nursery use and expected to degrade in sunlight in less than two years after installation.
  3. Option: Arbor Tape, supplied by American Arborist Supplies, 882 S Matlack Street, Unit A, West Chester, PA 19382: Phone: 800-441-8381/610-430-1214; Fax: 610-430-8560; E-mail Address: [info@arborist.com](mailto:info@arborist.com), or approved equal.

## 2.11 ANTIDESICCANT

- A. Antidessicant shall be an emulsion specifically manufactured for plant protection which provides a protective film over plant surfaces which is permeable enough to permit transpiration. Antidessicant shall be delivered in manufacturer's sealed containers and shall contain manufacturer's printed instructions for use.

- B. Antidessicant shall be equal to the following:

<u>Product</u>	<u>Manufacturer</u>
Wilt-Pruf	Wilt-Pruf Products, Inc. P.O. Box 469 Essex, CT 06426
Winter Shield	Rockland Corporation

#### 2.12 FUNGICIDE

- A. Fungicide shall be "Bordeaux Mix", manufactured by Hi-Yield, or approved equal.

#### 2.13 INSECTICIDE

- A. Insecticide shall be LESCO Sevin Brand SL, #019106, for broad spectrum control for most trees, shrubs and ornamentals, manufactured by LESCO, Rocky River, OH 44116, or approved equal.

#### 2.14 POST-EMERGENT HERBICIDE

- A. Herbicide shall be QuikPRO™ herbicide, formulated as a water-soluble granule and packaged in easy-measure bottles, complete weed control, manufactured by Monsanto, or approved equal.

#### 2.15 PRE-EMERGENT HERBICIDE

- A. Herbicide shall be LESCO Ornamental Herbicide 5G, pre-emergent grassy and selected broadleaf weed control for ornamental plants, nursery stock and ground covers, #019515, manufactured by LESCO, Rocky River, OH 44116, or approved equal.

## 2.16 EDGING

- A. Steel edging shall be Border Concepts Edging, "Border King", manufactured by Border Concepts, Inc., P.O. Box 471185, Charlotte, NC 28247 or approved equal. Steel edging shall be shop fabricated, 1/4 in. thick x 5 in. deep, primed and painted Black. Edging shall be furnished in 16 ft. lengths.
1. Steel edging shall have slotted holes for staking steel edging every 30 in. o.c.
  2. Steel stakes shall be 15 in. long, tapered.
  3. Provide manufacturer's end stake and splicer unit.
  4. Provide manufacturer's standard touch-up paint for in field touch-up of scratched or marred areas..

## 2.17 TREE WATERING SYSTEM

- A. Tree watering system shall be 20 gallon Treegator® , a slow release watering system for new trees., capable of delivering a high volume of water directly to the root system of a newly planted tree with no run-off or evaporation, manufactured by Spectrum Products, Inc., Youngsville, North Carolina, 27596; supplied by PlanetGreenSpot.com PO Box 674 Pasadena, MD 21123, Tel. 888.574.6348.

## 2.18 WATER RETENTION ADDITIVE

- A. Water Retention Additive for application at time of planting shall be a granular polyacrylamide polymer of a potassium base and not a sodium base that slowly releases moisture into the root zone such as Terra Sorb, as manufactured by Plant Health Care, Inc., 440 William Pitt Way, Pittsburgh, PA, or approved equal.
1. Apply at each tree in non-irrigated areas Water Retention Additive in three (3) ounces or the amount specified by Water Retention Additive manufacturer's printed instructions.

## PART 3 EXECUTION

## 3.1 PREPARATION OF PLANT MATERIALS

- A. Immediately before digging and following consultation with the Architect, spray all evergreen or deciduous trees in full leaf with Transplant Biostimulant, applying an adequate film over trunks, branches, twigs and foliage and apply Transplant Biostimulant to the root ball area
- B. Dig, and ball and burlap (B&B) plants with firm, natural balls of earth, of depth and diameter not less than that recommended by the American Standard for Nursery stock. Plants moved with a ball will not be accepted if the ball is cracked or broken before or during planting operation. Remove all grass, weeds and accumulated soil resulting from nursery cultivation from the top of the root ball prior to digging so that the original trunk flare shows on top of the root ball.
- C. Use only natural burlap and jute twine. Do not use synthetic fibers or wire to ball and burlap root balls. Wire baskets will be acceptable if removed in accordance with these specifications.
- D. All plant material in transit or temporary stored shall be covered with burlap or similar covering to keep plants from drying out.
- E. Ship and store bare root material in refrigerated trucks and storage areas. Keep roots moist and cool until time of planting.

- F. If the construction schedule requires trees over 3 ½" in caliper to be planted in the fall, that are of a species considered to be difficult to transplant in the fall, these trees shall be root pruned the previous spring in the nursery.
1. The Architect will determine tree species to be root pruned.
  2. A trench shall be dug around the tree at the limit of the proposed root ball to a minimum depth of 24" and back-filled.
  3. A 3" high saucer shall be built around the tree outside the edge of the trench.
  4. The tree shall be guyed or braced.
  5. The tree shall be watered as necessary through the summer.
  6. When the tree is dug in the fall, the digging shall be done using methods that preserve the new root growth growing in the soft soil of the trench.
  7. Root pruning, when required, shall be done at no additional cost to the Owner, except for owner pre-purchased trees.

### 3.2 EXAMINATION OF SUBGRADE

- A. Examine subgrade and rough grading before planting. Alert Architect to unacceptable rough grading or subgrade conditions.

### 3.3 DECOMPACTION OF PLANTING AREAS

- A. After subgrade levels have been reached and immediately prior to placing planting soils, the entire subgrade area shall be loosened to a minimum depth of 12 inches utilizing the bucket of a backhoe or equivalent equipment.
- B. Any subgrade areas which have become heavily compacted (defined as exceeding 86% - 88% compaction ASTM D698 Standard Proctor) including, but not limited to, temporary parking areas, material stockpile areas, temporary roadways, construction areas, areas shown on the plans, or areas identified by Architect shall be deep-scarified. Immediately prior to placing soils, heavily compacted areas shall be loosened to a minimum depth of 36 inches using the teeth of a backhoe or other suitable equipment. Frequency of compaction tests shall be one per 200 square feet.
- C. Using a wide-track bulldozer size D-5 or smaller, compact the scarified subgrade to 86% - 88% compaction ASTM D698 Standard Proctor. Contractor shall provide shovel dug test pits to the full depth of the mitigation, where located per the direction of the Architect, in order for the Architect to review whether the work has been done as required. Backfill the pits after the review(s).
- D. Confirm that the subgrade is at the proper elevation and that no further earthwork is required to bring the subgrade to proper elevations. Provide a written report to Architect indicating that subgrade has been placed to the required elevations, has been decompacted according to the Contract Documents and is ready for inspection at least 3 days prior to placing planting soil. Perform no work of placing and spreading planting mixes until elevations have been confirmed and written report has been accepted by the Architect.
- E. After the soils have been loosened and inspected, planting soil may be spread by using a wide track bulldozer size D-5 or smaller or may be dumped and spread with bucket of a backhoe from the edge of the loosened area. No rubber-tired equipment or heavy equipment except for small bulldozer shall pass over the subsoils (subgrade) after they have been loosened. If Contractor plans to utilize such areas for any use of heavy equipment, this should be carried out prior to beginning the process of loosening soils or filling in that area, or it shall be rescarified to meet this specification requirement.

### 3.4 SOIL DRAINAGE/DETRIMENTAL SOILS

- A. Test drainage of five planting pits in each area where trees are being planted in locations as directed by the Architect. Pits shall be filled with water twice in succession. The time at which water is put into the pit for a second filling shall be noted. Architect shall then be notified of the time it takes for pit to drain completely. Planting operations shall not proceed until Architect has reviewed test drainage results.
  - 1. To test drainage, dig a hole about 1 foot deep. Fill with water and allow it to drain completely. Immediately refill the pit and measure the depth of the water with a ruler. 15 minutes later, measure the drop in water in inches, and multiply by 4 to calculate how much water drains in an hour.
    - a. Less than 1 inch per hour is poor drainage, indicating the site may stay wet for periods during the year. Plants that don't tolerate poor drainage will suffer. 1 to 6 inches of drainage per hour is desirable. Soils that drain faster than 6 inches per hour have excessive drainage, and Architect may consider choosing plants that tolerate dry or drought conditions. Any tree pits not meeting these criteria shall be excavated to a depth of 4 ft. and backfilled with enriched subsoil.
- B. The Contractor shall notify the Architect in writing if the need for underdrainage can be eliminated. Submit proposal and cost estimate for correction of the conditions for Architect's approval before starting work.
- C. In areas without underdrainage, soil percolation test shall be completed on every 1 of 3 plant pits, report and location map to be reviewed by Architect. Contractor shall remediate soils and retest until meeting specified infiltration rates.

### 3.5 LAYOUT OF PLANTING AREAS

- A. Individual trees shall be located in the field as indicated on the Drawings for Architect's approval prior to planting. Contractor shall provide one foreman, one loader with operator and two laborers to work with Architect in the field to determine the final location and orientation of each tree prior to planting. It is anticipated that this process may take several days to complete. Contractor shall plan to have this layout crew available to work with Architect at a slow and deliberate pace in order to achieve the desired results.
- B. Individual shrubs and perennials to be planted shall be laid out in plant beds by the Contractor in ample time to allow inspection by the Architect.

### 3.6 PREPARATION OF SUBGRADE

- A. Refer to Section 329119, LANDSCAPE GRADING and Section 329115, PLANTING SOIL.

### 3.7 PLANT PIT EXCAVATION

- A. Planting pits for trees and shrubs shall be excavated to the depth and dimensions indicated on the Drawings.
- B. Excavation shall not begin until locations are approved by the Architect.

### 3.8 EDGING

- A. Steel edging shall be installed at locations indicated on the Drawings. Where required, edging shall be cut square and accurately to required length.
  - 1. Steel edging shall be securely staked in required position. Stakes shall be driven every 30 in. o.c. along length of edging, .
  - 2. Adjacent lengths of edging shall overlap 8 in.

3.9 PLACING PLANTING SOIL

- A. Refer to Section 329115, PLANTING SOIL.
- B. Finish Grading: Refer to Section 329119, LANDSCAPE GRADING.

3.11 PLANTING

- A. Tree, shrub, and groundcover beds shall be excavated to the depth and widths indicated on the Drawings. Most plants are located within continuous soil volumes; See Soil Plans. Immediately following tree planting, the area surrounding each tree shall be amended with additional compost in the upper soil layer. Apply 4" compost on top of the planting soil within 10' of the rootball on all sides. Incorporate into the top 6-9" of soil by rototilling or discing. Where trees will be located within decked areas, complete compost amendment following soil placement and before installation of rodent deterrent fabric and deck framing. If the planting pit for any tree is dug too deep, soil shall be added to bring it to correct level, and the soil shall be thoroughly tamped. Walls of plant pits shall be dug so that they are sloped as shown on the Drawings, and scarified. Do not excavate compacted subgrades of adjacent pavement or structures.

- B. Plants shall be set as indicated on Drawings. Plants shall be set so that the root flare is at, or slightly above, finished grade as indicated on the Drawings. Plants located in poorly drained soils shall be set 2 to 4 inches above finished grade, gradually sloping between the top of the root ball and the surrounding finished grade.
  - 1. In play areas, and at Tree Planter Benches, trees shall be tied down with Below-Grade Rootball Tie Downs. In planting beds, trees shall be staked with wood stakes. Verify locations in field with Architect.
- C. Plants shall be turned to the desired orientation when required by Architect.
- D. Containerized plants shall be removed from container taking care not to damage roots. The side of the root ball shall be scarified to prevent root-bound condition before positioning in planting pit.
- E. Prior to Placing in Pit: Cut away bottom of wire basket and bottom of wrap material.
- F. Pits shall be backfilled with planting soil. Soil shall be worked carefully into voids and pockets, tamping lightly every 6 in.
  - 1. When pit is two-thirds full, plants shall be watered thoroughly, and water left to soak in before proceeding.
  - 2. At this time, ropes or strings on top of balls shall be cut and removed. Burlap or cloth wrapping shall be cut away from the top of the ball and slit down the sides. Non-biodegradable ball wrapping and support wire shall be totally removed from ball and planting pit.
  - 3. Wire baskets shall be completely cut away from sides of root ball, and removed from pit. Bottom of basket may remain.
  - 4. Remove nursery plant identification tags.
- G. Backfilling and tamping shall then be finished and a saucer formed around plant pits as indicated on the Drawings.
- H. Saucer shall be filled with water and water left to soak in. Saucer shall then be filled with water again.

### 3.12 PERENNIALS AND GROUNDCOVERS

- A. Set out and space plants **as indicated on the Drawings**. Amend top layer of soil as indicated on the Drawings.
- B. Perennials: Check root ball after removing plant from its container. Encircling roots need to be gently loosened from the tight mat of root-bound plants. If roots are very dense at bottom of pot, slice off the bottom 1". If roots are seriously disturbed when planting, cut back some foliage to reduce the water stress that will occur. Plant at the same soil level as the plant was in its container.
- C. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.
- D. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.
- E. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

### 3.13 TREE WATERING SYSTEM

- A. Street trees shall be irrigated with Gator Bags, placed in quantity and location as recommended by manufacturer.

#### 3.14 LIQUID BIOLOGICAL AMENDMENTS

- A. In all new planting areas, create injection sites made every 2 feet in a grid pattern. If the viable root zone varies from this area, adjust the pattern accordingly. Each injection site shall have a 2-inch wide diameter by 8-inch deep column that will act as leaching fields during the planting process. After the liquid and aeration injection is completed, the injection columns shall be backfilled with a custom blend of long-term granular food sources that include 25% feathermeal, 75% humate plus corresponding mycorrhizal spores.
- B. Early spring injection for both Ecto and Endo Mycorrhizal plants shall consist of 50% concentrated liquid Biological Amendment with 1/2 gallon per a 100 gallons of soluble kelp, humic acid and molasses (or fish hydrolysate).

#### 3.15 FUNGICIDE

- A. Immediately after planting, all trunks of deciduous trees shall be sprayed with fungicide, applied as directed by chemical manufacturer.

#### 3.16 PRE-EMERGENT-HERBICIDE

- A. Immediately after planting, pre-emergent herbicide shall be applied to ornamental shrub beds and around base of trees, in strict accordance with chemical manufacturer's printed instructions.

#### 3.17 POST EMERGENT-HERBICIDE

- A. Upon the appearance of weeds within planted areas, pre-emergent herbicide shall be applied to ornamental shrub beds and around base of trees, in strict accordance with chemical manufacturer's printed instructions.

#### 3.18 INSECTICIDE

- A. Upon the appearance of insect problems, all trunks of deciduous trees shall be sprayed with insecticide, applied as directed by chemical manufacturer.

## 3.19 WRAPPING

- A. Trunks of deciduous trees shall be spiral wrapped to a minimum height of the first major branch. Wrap shall be applied from base up so that layers overlap and shed water. Secure at the top with flexible weatherproof tape, as specified.

## 3.20 STAKING AND GUYING

- A. All trees shall be staked or guyed immediately following planting. Plants shall stand verticle and plumb after staking or guying.
1. Staking and Guying: Set vertical stakes and space to avoid penetrating root balls or root masses. Allow enough slack to avoid rigid restraint of tree. Stakes and guys shall be installed as indicated on the Drawings.
- B. Below Grade Rootball Tiedown: install in accordance with manufacturer's printed instructions.

## 3.21 AERATION SYSTEM

- A. Pipe shall be installed in position and at locations indicated on the Drawings.
- B. Perforated pipe shall be fitted with pipe manufacturer's filter fabric "sock" prior to installation.

## 3.22 MULCHING

- A. Mulch shall be applied as follows (entire area listed shall be mulched):

<u>Plant Type</u>	<u>Mulch Area</u>	<u>Mulch Depth, in.</u>
Tree	Saucer	3
Shrub	Saucer or Bed	3
Ground Cover	Bed	3

Mulch shall not be allowed to cover the base of trunks.

## 3.23 PRUNING

- A. Each tree and shrub shall be pruned to preserve the natural character of the plant. Pruning shall be done after delivery of plants and after plants have been inspected and approved by the Architect. Pruning procedures shall be reviewed with Architect before proceeding.
- B. Pruning shall be done with clean, sharp tools. Cuts shall be made flush, leaving no stubs. No tree paint shall be used.
- C. Dead wood, suckers, and broken, weak, interfering and badly bruised branches shall be removed.

## 3.24 MAINTENANCE OF PLANTING

- A. Maintenance shall begin immediately after each plant is planted and shall continue until expiration of the one year Guarantee Period.
- B. Maintenance shall consist of pruning, watering, cultivating, weeding, mulching, fertilizing, removal of dead material, repairing and replacing of tree stakes, tightening and repairing of guys, adjusting and replacing of damaged tree wrap material, resetting plants to proper grades and upright position, and furnishing and applying such sprays as are necessary to keep plantings free of insects and disease, and in a healthy growing condition.

- C. Daily watering of 1 gal./caliper inch should be delivered to the root ball of each tree during the first summer after planting. Continue through fall, reducing frequency. For trees larger than 3 inch caliper, fill saucer with 6 – 8 gallons twice per week during hot, dry weather, and once per week during cooler, wetter periods. Refer to Irrigation Plans for plantings outside of automated irrigation zone.
- D. Planting areas shall be kept free of weeds, grass, and other undesired vegetative growth.
- E. Upon completion of the Guarantee Period, the Owner shall assume all maintenance activities.

END OF SECTION

SECTION 329643

This section should be titled "Tree Transplanting"

~~TREE PROTECTION AND~~ TRANSPLANTING

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

- A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

- A. Work of this Section includes all labor, materials, equipment and services necessary to complete the tree protection and transplanting as shown on the drawings and/or specified herein, including, but not necessarily limited to, the following:

- 1. Balling and burlapping existing trees to be transplanted.
- 2. Transport, unloading, and replanting of existing trees to be transplanted.
- ~~3. Protection of existing trees.~~

1.3 RELATED SECTIONS

- A. Division 1 Section "Temporary Facilities and Controls" for temporary construction, protection facilities, and environmental protection measures for site demolition operations.
- B. Division 1 Section "Execution Requirements."
- C. Division 2 Section "~~Site Preparation, Demolition and Clearing~~" for existing soil removal, clearing & grubbing, removal and disposal of debris and/or obstructions interfering with new work and removal of existing above grade structures and/or site structures.
- D. Earthwork - Section ~~312000~~, for fill and backfill materials, excavating, backfilling, site grading and existing site utility coordination.

Clearing and Grubbing

310000

1.4 SUBMITTALS

Planting - Section 329300, for planting requirements.

- A. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and address of architects and owners, and other information specified.
- B. Schedule indicating anticipated dates the work is to take place, confirmation of suitability of final locations for each location associated with tree transplanting.
- C. Provide a report from the arborist illustrating the protection of existing trees that will be impacted by Construction for review by Owner and Landscape Architect.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer who has completed landscaping work similar in material, design, and extent to that indicated for this Project and with a 20-year record of successful landscape establishment.

1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on the Project site during times that tree transplanting operations are in progress.
  - B. Tree Service Qualifications: An experienced tree service firm that has successfully completed tree transplanting work similar to that required for this Project and that will assign an experienced, qualified arborist to project site on a full-time basis during execution of the Work.
    1. Arborist Qualifications: A New York State certified arborist with a minimum of twenty years experience.
    2. Tree Pruning Standards: Comply with ANSI A300, "Trees, Shrubs and Other Woody Plant Maintenance – Standard Practices," and the "Standards of Shade Trees," current edition, as published by National Arborist Association, The Meeting Place Mall, Route 101, P.O. Box 1494, Amherst, NH 03031-1094.
- 1.6 DELIVERY, STORAGE, AND HANDLING
- A. Packaged Materials: Deliver packaged materials in waterproof containers showing weight, analysis, and name of manufacturer. Protect materials from deterioration during delivery and while stored at site.
- 1.7 PROJECT CONDITIONS
- A. Existing Utilities: See Division 1 Section "Execution Requirements" and Section 312000, Earthwork.
- 1.8 COORDINATION AND SCHEDULING
- A. Coordinate transplanting of materials with the Landscape Architect. Deciduous trees shall be dug and transplanted in the early Spring while they are still dormant, or at other times as determined by or acceptable to the Landscape Architect.
- 1.9 PROTECTION OF EXISTING TREES AND VEGETATION
- A. Protect existing trees and other vegetation indicated to remain in place against unnecessary cutting, breaking, or skinning of roots, skinning and bruising of bark, smothering of trees by stockpiling construction materials or excavated materials within drip line, excess foot or vehicular traffic, or **See Section 015639, TEMPORARY TREE AND PLANT PROTECTION** temporary guards to protect trees and other vegetation.
  - B. Water trees and other vegetation to remain within the limits of the contract work as required to maintain their health during the course of construction operations.
  - C. Provide protection for roots over 1-1/2" diameter cut during construction operations. Coat the cut faces with emulsified asphalt, or other acceptable coating, formulated for use on damaged plant tissues. Temporarily cover exposed roots with wet burlap to prevent roots from drying out; cover with earth as soon as possible.
  - D. Repair trees damaged by construction operations, in a manner acceptable to the Landscape Architect. Repair tree damage by a qualified tree surgeon.
- 1.10 WARRANTY
- A. General Warranty: For operations associated with tree transplanting, warrant all transplanted materials for a period of one year from the date of transplant, against defects including death and unsatisfactory growth, except for defects resulting from abnormal

weather conditions unusual for warranty period, or incidents that are beyond Contractor's control.

#### 1.11 MAINTENANCE

- A. Maintenance shall include pruning, including removal of dead or broken branches and treatment of pruned areas or other wounds.

### PART 2 PRODUCTS

#### 2.1 MATERIALS

- A. Organic Mulch: Organic mulch, free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following:
  - 1. Type: Dark brown in color, uniform in size, double shredded hardwood bark mulch.
- B. Pruning Alcohol: Commercial ethyl alcohol or ethanol, 70-95%.
- C. Anti-Desiccant: "Wilt-Pruf NCF" anti-desiccant by Wilt-Pruf Products, Inc., "Cloud Cover" by Easy Gardener, or approved equal conforming to the following:
  - 1. 100% organic and biodegradable, and not damaged by freezing.
- D. Trunk-Wrap Tape: Two layers of crinkled paper cemented together with bituminous material, 4 inches wide minimum, with stretch factor of 33 percent.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Examine areas of transplanting for conditions affecting performance of work of this Section. Do not proceed with installation until unsatisfactory conditions have been corrected.
- B. Verify locations of all underground utilities in the proposed planting areas.

#### 3.2 PREPARATION

- A. Root prune all trees to be transplanted in accordance with accepted horticultural practices.
- B. Thoroughly water trees within 24-48 hours prior to transplanting.
- C. Trees to be Transplanted: Immediately prior to transplanting trees shown as indicated, thin out each tree by one-third in accordance with acceptable horticultural practices, and as follows:
  - 1. Perform pruning with sharp tools. Disinfect tools by dipping in alcohol at the commencement of the day's operation and again after finishing each tree known to be diseased. Use fresh alcohol each day for this operation.
  - 2. Prune to remove dead, weak, interfering, suckered, damaged, or unsightly twigs or branches in accordance with acceptable horticultural practice.

#### 3.3 DIGGING

- A. Prior to digging existing trees to be transplanted, spray with an approved anti-desiccant and prewater.

- B. Prior to digging operations, obtain the Landscape Architect's approval of the proposed rootball perimeter of each tree to be transplanted.
- C. Securely tie in tree branches starting at treetop and work down using 3-ply and 5-ply sisal twine. Tie each branch individually in such a way as not to bruise or break the branches.
- D. Tag the north side of each tree trunk and transplant in new locations with the same orientation.

#### 3.4 BALLING AND BURLAPPING OPERATIONS

- A. Dig immediately before moving.
- B. Dig to retain as many fibrous roots as possible.
- C. Hand shape final rootball, prior to burlapping, to a diameter and depth suitable for the species and approved by the Landscape Architect.
- D. Prune, with a clean cut, all projecting roots or root tips shredded by digging operations.
- E. Cover the entire rootball, top and bottom inclusive, with burlap. Securely pin burlap to the rootball with eight-penny nails, or an approved equal.
- F. Prior to lacing, fold the slack burlap neatly into pleats on the lower tapered part of the rootball and pin smoothly with eight-penny nails.
- G. Drum-lace the rootball using 42 inches diameter manila rope for top and bottom and 1/4 inch diameter manila rope for vertical lacing.

#### 3.5 TRANSPORTING TREE TO NEW LOCATION

- A. Take all necessary precautions so as not to damage the tree trunk, break branches or loosen the rootball mass during transport of the tree.
- B. Employ a crane and approved tree lifting equipment as in accordance with acceptable horticultural practices
- C. Prevent the rootball from rolling.
- D. Place burlap on trunk at points of contact where rope, straps, and cable touch trunk.
- E. Transport the trees to a new location as approved by the Landscape Architect.

#### 3.6 TRANSPLANTING TREE TO A TEMPORARY LOCATION

- A. Transport the trees to the location previously agreed upon by the Landscape Architect and Contractor and after preparations for temporary storage have been completed.
- B. Prepare temporary location: Excavate shallow trench and examine existing subgrade for conditions detrimental to plant growth such as debris and/or obstructions and adverse drainage conditions.
  - 1. Contractor shall perform a percolation test as necessary or as directed by the Landscape Architect to determine whether the existing soil permeability is adequate.
- C. Set trees side-by-side within trench and backfill with approved soil, compact lightly, covering all roots and burlap.

- D. Water thoroughly while in temporary location as required. Mulch all trees with 2" depth of mulch and wrap as approved by the Landscape Architect.

3.7 CLEANUP AND PROTECTION

- A. During transplanting, keep pavements clean and work area in an orderly condition.
- B. Protect existing site features to remain from damage due to landscape operations, operations by other contractors and trades, and trespassers. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged landscape work as directed.

3.8 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of it off the Owner's property.

END OF SECTION