

LEWIS COUNTY JEFFERSON COMMUNITY COLLEGE EDUCATIONAL CENTER PROJECT



Bid Package #1: Site, Utilities, and Structural Technical Specifications

Contract Documents

JUNE 22, 2018



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LEWIS COUNTY
LEWIS COUNTY – JEFFERSON COMMUNITY COLLEGE
EDUCATION CENTER PROJECT

REQUEST FOR PROPOSALS
BID PACKAGE #1: SITE, UTILITIES, AND STRUCTURE

TECHNICAL SPECIFICATIONS

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SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including the Standard General Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Project information.
 - 2. Work covered by Contract Documents.
 - 3. Work under separate contracts.
 - 4. Access to site.
 - 5. Coordination with occupants.
 - 6. Work restrictions.
 - 7. Specification and drawing conventions.
 - 8. Miscellaneous provisions.

- B. Related Requirements:

- 1. Section 015000 “Temporary Facilities and Controls”.

1.3 PROJECT INFORMATION

- A. Project Identification: JCC-Lewis County Education Center – Contract #1, Sitework, Site Utilities, and Structural

- 1. Project Location: West Elm Street, City of Oneida, Madison County, NY

- B. Owner: Lewis County

- 1. Owner's Representative: Frank Pace, Director of Planning
 - a. Email: frankpace@lewiscounty.ny.gov
 - b. Office: (315) 376-5422
 - c. Cell: (315) 755-8783

- C. Engineer: C&S Engineers, Inc., 499 Col. Eileen Collins Blvd., Syracuse, NY 13212

- 1. Project Manager: Chuck Brooks
 - a. Email: cbrooks@cscos.com
 - b. Office: 315-455-2000
 - c. Cell: 315-729-4383

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and consists of the following:

1. This Work generally includes structural building construction, placement of underground utilities including water, sewer (including all floor drains), and electric (conduit and pull string only), and sitework as shown in the Contract Documents. The demarcation point for all underground utilities under this contract shall be at the stub ups within the building or as described below. The Owner will be self-performing the following work outside of this contract:
 - a. Constructing stormwater pollution prevention measures including silt fence and construction entrance. The Contractor shall assume responsibility from the Owner immediately upon receiving the Notice to Proceed.
 - b. Stripping organics within building and pavement footprints as described in the geotechnical report.
 - c. Placement and compaction of pavement subbase to within 5' of the building perimeter or as shown on the Contract Documents (whichever results in a great distance from the building line).
 - d. Paving of all parking and driving surfaces.
 - e. Construction of the underground water supply line from the point of connection to the match line shown on C-102. This match line shall be the contract limit line for the water supply line installation.
 - f. Plantings (other than grasses) as shown on the landscape drawings. The Contractor shall be responsible for finish grading and seeding to achieve a stabilized site per the requirements of the SWPPP.

B. Type of Contract:

1. Project will be constructed under a single prime contract.

1.5 WORK UNDER SEPARATE CONTRACTS

- A. The Owner intends to complete the remainder of the site development and building project under separate contracts to be bid at a later date. It is anticipated that these contracts will be performed concurrently with this contract on the same Project Site.
- B. The Contractor shall cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under separate contracts.

1.6 ACCESS TO SITE

- A. General: Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work or to retain other contractors on portions of Project.

- B. Use of Site: Limit use of Project site to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
 - 1. Limits: Confine construction operations to project area.
 - 2. Driveways and Entrances: Keep driveways, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
 - a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
 - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

1.7 WORK RESTRICTIONS

- A. Work Restrictions, General: Comply with restrictions on construction operations.
 - 1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.
- B. On-Site Work Hours: Limit work on the project site to normal business working hours of 7 a.m. to 5 p.m., Monday through Friday, unless otherwise indicated.
- C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or adjacent properties unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:
 - 1. Notify Engineer not less than two days in advance of proposed utility interruptions.
 - 2. Obtain Engineer's written permission before proceeding with utility interruptions.
- D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to adjacent properties with Engineer.
 - 1. Notify Engineer not less than two days in advance of proposed disruptive operations.
 - 2. Obtain Engineer's written permission before proceeding with disruptive operations.

1.8 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 - 1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
 - 2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

- B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
- C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
 - 1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
 - 2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and scheduled on Drawings.
 - 3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 WORK SEQUENCING

- A. Contractor shall sequence/prioritize work to complete the foundation construction and masonry, steel, and wood framing as early as possible in the project duration to allow finish out contracts to be bid at a later time access to the building interior as early as possible.

END OF SECTION 011000

SECTION 012200 - UNIT PRICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including the Standard General Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for unit prices.
- B. Related Requirements:
 - 1. Section 012600 "Contract Modification Procedures".
 - 2. Section 013300 "Submittal Procedures".
 - 3. Section 310513 "Soils For Earthwork".
 - 4. Section 312000 "Earth Moving".

1.3 DEFINITIONS

- A. Unit price is an amount incorporated in the Agreement, applicable during the duration of the Work as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.
- B. A contingency unit price item shall only be incorporated when determined necessary, and as approved by the Owner and Engineer.

1.4 PROCEDURES

- A. Unit prices include all necessary material, plus cost for delivery, quality assurance testing, insurance, overhead, and profit.
- B. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.
- C. List of Unit Prices: A schedule of unit prices is included in Part 3. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES

A. Contingency Unit Price Item 312200.01: Imported Granular Material.

1. Description: Obtain and deliver imported granular material from an approved off site borrow source, according to Sections 310513 "Soils for Earthwork" and 312000 "Earth Moving." This item does not include placement or compaction of the soil material.
2. Unit of Measurement: Cubic yard of material delivered, based on transported weight and material unit density.
3. The cost of placement and compaction shall be included in the contract total lump sum price.

END OF SECTION 012200

SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including the Standard General Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

1.3 MINOR CHANGES IN THE WORK

- A. Engineer will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on form included in Project Manual.

1.4 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Engineer will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
 - 1. Work Change Proposal Requests issued by Engineer are not instructions either to stop work in progress or to execute the proposed change.
 - 2. Within time specified in Proposal Request after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
 - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Include costs of labor and supervision directly attributable to the change.
 - d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
 - e. Quotation Form: Use forms provided by Engineer. Sample copies are included in Project Manual.

- B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Engineer.
 - 1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
 - 2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - 3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - 4. Include costs of labor and supervision directly attributable to the change.
 - 5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
 - 6. Proposal Request Form: Use form provided by Owner. Sample copy is included in Project Manual.

1.5 ADMINISTRATIVE CHANGE ORDERS

- A. Unit-Price Adjustment: See Section 012200 (Unit Prices) for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect measured scope of unit-price work.

1.6 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Work Changes Proposal Request, Engineer will issue a Change Order for signatures of Owner and Contractor on form included in Project Manual.

1.7 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: Engineer may issue a Construction Change Directive on form included in Project Manual. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
 - 1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
 - 1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

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PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including the Standard General Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. Related Requirements:
 - 1. Section 012200 "Unit Prices".
 - 2. Section 012600 "Contract Modification Procedures".
 - 3. Section 013200 "Construction Progress Documentation".

1.3 DEFINITIONS

- A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.4 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.
 - 1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:
 - a. Application for Payment forms with continuation sheets.
 - b. Submittal schedule.
 - c. Items required to be indicated as separate activities in Contractor's construction schedule.
 - 2. Submit the schedule of values to Engineer at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
 - 3. Subschedules for Phased Work: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values coordinated with each phase of payment.

- B. Format and Content: Use Project Manual table of contents and the contract drawings as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.
1. Identification: Include the following Project identification on the schedule of values:
 - a. Project name and location.
 - b. Name of Engineer.
 - c. Engineer's project number.
 - d. Contractor's name and address.
 - e. Date of submittal.
 2. Arrange schedule of values consistent with format of AIA Document G703.
 3. Arrange the schedule of values in tabular form with separate columns to indicate the following for each item listed:
 - a. Related Specification Section or Drawing Number.
 - b. Description of the Work.
 - c. Name of subcontractor.
 - d. Name of manufacturer or fabricator.
 - e. Name of supplier.
 - f. Change Orders (numbers) that affect value.
 - g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
 - 1) Labor.
 - 2) Materials.
 - 3) Equipment.
 4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
 - a. Include separate line items under Contractor and principal subcontracts for Project closeout requirements in an amount totaling five percent of the Contract Sum and subcontract amount.
 5. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
 6. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
 - a. Differentiate between items stored on-site and items stored off-site. If required, include evidence of insurance.
 7. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.

8. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
 - a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.
9. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.5 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Engineer and paid for by Owner.
 1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.
- B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.
- C. Payment Application Times: Submit Application for Payment to Engineer by the last day of the month. The period covered by each Application for Payment is one month, ending on the last day of the month.
 1. Submit draft copy of Application for Payment seven days prior to due date for review by Engineer.
- D. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.
- E. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Engineer will return incomplete applications without action.
 1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
 2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
 3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
 4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.

- F. **Stored Materials:** Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.
1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
 2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
 3. Provide summary documentation for stored materials indicating the following:
 - a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
 - b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
 - c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.
- G. **Transmittal:** Submit three signed and notarized original copies of each Application for Payment to Engineer by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.
1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
- H. **Initial Application for Payment:** Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
1. List of subcontractors.
 2. Schedule of values.
 3. Contractor's construction schedule (preliminary if not final).
 4. Products list (preliminary if not final).
 5. Schedule of unit prices.
 6. Submittal schedule (preliminary if not final).
 7. List of Contractor's staff assignments.
 8. List of Contractor's principal consultants.
 9. Copies of building permits.
 10. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
 11. Initial progress report.
 12. Report of preconstruction conference.
- I. **Application for Payment at Substantial Completion:** After Engineer issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.

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2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- J. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements.
 2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
 3. Updated final statement, accounting for final changes to the Contract Sum.
 4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
 5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
 6. AIA Document G707, "Consent of Surety to Final Payment."
 7. Evidence that claims have been settled.
 8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
 9. Final liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including the Standard General Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. General coordination procedures.
 - 2. Requests for Information (RFIs).
 - 3. Project meetings.
- B. Related Requirements:
 - 1. Section 013200 "Construction Progress Documentation".
 - 2. Section 017300 "Execution".
 - 3. Section 017700 "Closeout Procedures".

1.3 DEFINITIONS

- A. RFI: Request For Information – a written request from Owner, Engineer, or Contractor seeking information required by or clarifications of the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
 - 1. Name, address, and telephone number of entity performing subcontract or supplying products.
 - 2. Number and title of related Specification Section(s) covered by subcontract.
 - 3. Drawing number and detail references, as appropriate, covered by subcontract.
- B. Key Personnel Names: Within 5 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.

1. Post copies of list in project meeting room, in temporary field office, on Project Web site, and by each temporary telephone. Keep list current at all times.

1.5 GENERAL COORDINATION PROCEDURES

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.
 1. Schedule construction operations in 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 performance and accessibility for required maintenance, service, and repair.
 3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
 1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
 1. Preparation of Contractor's construction schedule.
 2. Preparation of the schedule of values.
 3. Installation and removal of temporary facilities and controls.
 4. Delivery and processing of submittals.
 5. Progress meetings.
 6. Pre-installation conferences.
 7. Project closeout activities.
 8. Startup and adjustment of systems.

1.6 REQUESTS FOR INFORMATION (RFIs)

- 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. Engineer will return RFIs submitted to Engineer by other entities controlled by Contractor with no response.
 2. Coordinate and submit RFIs in a prompt manner 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:

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1. Project name.
 2. Project number.
 3. Date.
 4. Name of Contractor.
 5. Name of Engineer.
 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 RFI.
 12. Contractor's signature.
 13. 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: In a form suitable to Owner and Engineer.
1. Attachments to electronic RFI's shall be electronic files in Adobe Acrobat PDF format.
- D. Engineer's Action: Engineer will review each RFI, determine action required, and respond. Allow seven working days for Engineer's response for each RFI. RFIs received by Engineer 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 Engineer's actions on submittals.
 - g. Incomplete RFIs or inaccurately prepared RFIs.
 2. Engineer's action may include a request for additional information, in which case Engineer's time for response will date from time of receipt of additional information.
 3. Engineer'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 Section 012600 (Contract Modification Procedures).
 - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Engineer in writing within 10 days of receipt of the RFI response.
- E. On receipt of Engineer's action, immediately distribute the RFI response to affected parties. Review response and notify Engineer 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.

1.7 PROJECT MEETINGS

- A. General: Engineer will schedule and conduct meetings and conferences at Project site unless otherwise indicated.
 1. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Engineer will distribute the meeting minutes to everyone concerned, including Owner, within three days of the meeting.
- B. Preconstruction Conference: Engineer will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Engineer, but no later than 15 days after execution of the Agreement.
 1. Attendees: Authorized representatives of Owner, Engineer, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 2. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Tentative construction schedule.
 - b. Phasing.
 - c. Critical work sequencing and long-lead items.
 - d. Designation of key personnel and their duties.
 - e. Lines of communications.
 - f. Procedures for processing field decisions and Change Orders.
 - g. Procedures for RFIs.
 - h. Procedures for testing and inspecting.
 - i. Procedures for processing Applications for Payment.
 - j. Distribution of the Contract Documents.
 - k. Submittal procedures.
 - l. Preparation of record documents.
 - m. Use of the premises and existing buildings.
 - n. Work restrictions.
 - o. Working hours.
 - p. Owner's occupancy requirements.
 - q. Responsibility for temporary facilities and controls.
 - r. Procedures for disruptions and shutdowns.
 - s. Construction waste management and recycling.
 - t. Parking availability.
 - u. Office, work, and storage areas.
 - v. Equipment deliveries and priorities.
 - w. Safety.
 - x. Security.
 - y. Progress cleaning.

3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- C. Project Closeout Conference: Engineer will schedule and conduct a project closeout conference, at a time convenient to Owner and Engineer, but no later than 30 days prior to the scheduled date of Substantial Completion.
1. Attendees: Authorized representatives of Owner, Engineer, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 2. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
 - a. Preparation of record documents.
 - b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
 - c. Submittal of written warranties.
 - d. Requirements for preparing operations and maintenance data.
 - e. Requirements for delivery of material samples and spare parts.
 - f. Preparation of Contractor's punch list.
 - g. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
 - h. Submittal procedures.
 - i. Owner's partial occupancy requirements.
 - j. Responsibility for removing temporary facilities and controls.
 3. Minutes: Entity conducting meeting will record and distribute meeting minutes.
- D. Progress Meetings: Engineer will conduct progress meetings at weekly intervals.
1. Attendees: In addition to representatives of Owner and Engineer, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - 1) Review schedule for next period.

- b. Review present and future needs of each entity present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Status of submittals.
 - 4) Deliveries.
 - 5) Off-site fabrication.
 - 6) Access.
 - 7) Site utilization.
 - 8) Temporary facilities and controls.
 - 9) Progress cleaning.
 - 10) Quality and work standards.
 - 11) Status of correction of deficient items.
 - 12) Field observations.
 - 13) Status of RFIs.
 - 14) Status of proposal requests.
 - 15) Pending changes.
 - 16) Status of Change Orders.
 - 17) Pending claims and disputes.
 - 18) Documentation of information for payment requests.
- 3. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
- 4. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including the Standard General Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
 - 1. Contractor's construction schedule.
 - 2. Construction schedule updating reports.
 - 3. Daily construction reports.
 - 4. Site condition reports.
 - 5. Special reports.
- B. Related Requirements:
 - 1. Section 013300 "Submittal Procedures".
 - 2. Section 014000 "Quality Requirements".

1.3 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
 - 1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
 - 2. Predecessor Activity: An activity that precedes another activity in the network.
 - 3. Successor Activity: An activity that follows another activity in the network.
- B. Cost Loading: The allocation of the schedule of values for the completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum unless otherwise approved by Engineer.
- C. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.
- D. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- E. Event: The starting or ending point of an activity.

- F. Float: The measure of leeway in starting and completing an activity.
 - 1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
 - 2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
 - 3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.
- G. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.

1.4 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals in the following format:
 - 1. Working electronic copy of schedule file, where indicated.
 - 2. PDF electronic file.
- B. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
 - 1. Submit a working electronic copy of schedule, using software indicated, and labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label.
- C. Construction Schedule Updating Reports: Submit with Applications for Payment.
- D. Daily Construction Reports: Submit at weekly intervals.
- E. Site Condition Reports: Submit at time of discovery of differing conditions.
- F. Special Reports: Submit at time of unusual event.

1.5 QUALITY ASSURANCE

- A. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Section 013100 (Project Management and Coordination). Review methods and procedures related to the preliminary construction schedule and Contractor's construction schedule, including, but not limited to, the following:
 - 1. Discuss constraints, including phasing, work stages, area separations, and interim milestones.
 - 2. Review delivery dates for Owner-furnished products.
 - 3. Review schedule for work of Owner's separate contracts.
 - 4. Review submittal requirements and procedures.
 - 5. Review time required for review of submittals and resubmittals.
 - 6. Review requirements for tests and inspections by independent testing and inspecting agencies.

7. Review time required for Project closeout and Owner startup procedures.
8. Review and finalize list of construction activities to be included in schedule.
9. Review procedures for updating schedule.

1.6 COORDINATION

- A. Coordinate Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.
 1. Secure time commitments for performing critical elements of the Work from entities involved.
 2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Time Frame: Extend schedule from date established for the Notice of Award to date of final completion.
 1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
- B. Activities: Treat each separate area as a separate numbered activity for each main element of the Work. Comply with the following:
 1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Engineer.
 2. Procurement Activities: Include procurement process activities for long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
 3. Submittal Review Time: Include review and resubmittal times indicated in Section 013300 (Submittal Procedures) in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
 4. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Engineer's administrative procedures necessary for certification of Substantial Completion.
 5. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.
- C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
 1. Phasing: Arrange list of activities on schedule by phase.
 2. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.

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3. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Section 011000 (Summary). Delivery dates indicated stipulate the earliest possible delivery date.
4. Work Restrictions: Show the effect of the following items on the schedule:
 - a. Use of premises restrictions.
 - b. Provisions for future construction.
 - c. Seasonal variations.
 - d. Environmental control.
5. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
 - a. Subcontract awards.
 - b. Submittals.
 - c. Purchases.
 - d. Fabrication.
 - e. Deliveries.
 - f. Installation.
 - g. Tests and inspections.
6. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
 - a. Site grading by Phase location.
 - b. Completion of stormwater management facilities.
 - c. Completion of landscaping.
 - d. Substantial Completion.
- D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion.
- E. Cost Correlation: Superimpose a cost correlation timeline, indicating planned and actual costs. On the line, show planned and actual dollar volume of the Work performed as of planned and actual dates used for preparation of payment requests.
 1. See Section 012900 (Payment Procedures) for cost reporting and payment procedures.
- F. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
 1. Unresolved issues.
 2. Unanswered Requests for Information.
 3. Rejected or unreturned submittals.
 4. Notations on returned submittals.
 5. Pending modifications affecting the Work and Contract Time.
- G. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours,

working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.

- H. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE (GANTT CHART)

- A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's construction schedule within 10 days of date established for the Notice of Award.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.
 - 1. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

2.3 REPORTS

- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
 - 1. List of subcontractors at Project site.
 - 2. List of separate contractors at Project site.
 - 3. Approximate count of personnel at Project site.
 - 4. Equipment at Project site.
 - 5. Material deliveries.
 - 6. High and low temperatures and general weather conditions, including presence of rain or snow.
 - 7. Accidents.
 - 8. Meetings and significant decisions.
 - 9. Unusual events (see special reports).
 - 10. Stoppages, delays, shortages, and losses.
 - 11. Emergency procedures.
 - 12. Orders and requests of authorities having jurisdiction.
 - 13. Change Orders received and implemented.
 - 14. Construction Change Directives received and implemented.
 - 15. Services connected and disconnected.
 - 16. Independent tests and inspections.
 - 17. Partial completions and occupancies.
 - 18. Substantial Completions authorized.
- B. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

2.4 SPECIAL REPORTS

- A. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
 - 1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
 - 2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
 - 3. As the Work progresses, indicate final completion percentage for each activity.
- B. Distribution: Distribute copies of approved schedule to Engineer, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
 - 1. Post copies in Project meeting rooms and temporary field offices.
 - 2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 013200

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including the Standard General Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, and other submittals.
- B. Related Requirements:
 - 1. Section 012900 "Payment Procedures".
 - 2. Section 013200 "Construction Progress Documentation".
 - 3. Section 017839 "Project Record Documents".

1.3 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Engineer's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."
- B. Informational Submittals: Written and graphic information and physical samples that do not require Engineer's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."
- C. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.4 ACTION SUBMITTALS

- A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Engineer and additional time for handling and reviewing submittals required by those corrections.
 - 1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.

2. Initial Submittal: Submit within 5 days of date established for the Notice of Award. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.
 - a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.
4. Format: Arrange the following information in a tabular format:
 - a. Scheduled date for first submittal.
 - b. Specification Section number and title.
 - c. Submittal category: Action; informational.
 - d. Name of subcontractor.
 - e. Description of the Work covered.
 - f. Scheduled date for Engineer's final release or approval.
 - g. Scheduled date of fabrication.

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Engineer's Digital Data Files: Electronic digital data files of the Contract Drawings will not be provided by Engineer for Contractor's use in preparing submittals.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
 3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
 4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Engineer's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
 1. Initial Review: Allow 14 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Engineer will advise Contractor when a submittal being processed must be delayed for coordination.

2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
 3. Resubmittal Review: Allow 14 days for review of each resubmittal.
- D. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:
1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
 2. Name file with submittal number or other unique identifier, including revision identifier.
 - a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., 312000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 312000.01.A).
 3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Engineer.
 4. Transmittal Form for Electronic Submittals: Use electronic form provided by Engineer, containing the following information:
 - a. Project name.
 - b. Date.
 - c. Name and address of Engineer.
 - d. Name of Contractor.
 - e. Name of firm or entity that prepared submittal.
 - f. Names of subcontractor, manufacturer, and supplier.
 - g. Category and type of submittal.
 - h. Submittal purpose and description.
 - i. Specification Section number and title.
 - j. Specification paragraph number or drawing designation and generic name for each of multiple items.
 - k. Drawing number and detail references, as appropriate.
 - l. Location(s) where product is to be installed, as appropriate.
 - m. Related physical samples submitted directly.
 - n. Indication of full or partial submittal.
 - o. Transmittal number, numbered consecutively.
 - p. Submittal and transmittal distribution record.
 - q. Other necessary identification.
 - r. Remarks.
 5. Metadata: Include the following information as keywords in the electronic submittal file metadata:
 - a. Project name.
 - b. Number and title of appropriate Specification Section.
 - c. Manufacturer name.
 - d. Product name.
- E. Options: Identify options requiring selection by Engineer.

- F. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Engineer on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.
- G. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
 - 1. Note date and content of previous submittal.
 - 2. Note date and content of revision in label or title block and clearly indicate extent of revision.
 - 3. Resubmit submittals until they are marked with approval notation from Engineer's action stamp.
- H. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- I. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Engineer's action stamp.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

- A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
 - 1. Submit electronic submittals via email as PDF electronic files.
 - a. Engineer will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
 - 2. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
 - a. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
 - 1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
 - 2. Mark each copy of each submittal to show which products and options are applicable.
 - 3. Include the following information, as applicable:

- a. Manufacturer's catalog cuts.
 - b. Manufacturer's product specifications.
 - c. Standard color charts.
 - d. Statement of compliance with specified referenced standards.
 - e. Testing by recognized testing agency.
 - f. Application of testing agency labels and seals.
 - g. Notation of coordination requirements.
 - h. Availability and delivery time information.
4. For equipment, include the following in addition to the above, as applicable:
 - a. Wiring diagrams showing factory-installed wiring.
 - b. Printed performance curves.
 - c. Operational range diagrams.
 - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
5. Submit Product Data before or concurrent with Samples.
6. Submit Product Data in the following format:
 - a. PDF electronic file.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
 1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Identification of products.
 - b. Schedules.
 - c. Compliance with specified standards.
 - d. Notation of coordination requirements.
 - e. Notation of dimensions established by field measurement.
 - f. Relationship and attachment to adjoining construction clearly indicated.
 - g. Seal and signature of professional engineer if specified.
 2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than 30 by 42 inches.
 3. Submit Shop Drawings in the following format:
 - a. PDF electronic file.
- D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
 1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.

2. Identification: Attach label on unexposed side of Samples that includes the following:
 - a. Generic description of Sample.
 - b. Product name and name of manufacturer.
 - c. Sample source.
 - d. Number and title of applicable Specification Section.
 - e. Specification paragraph number and generic name of each item.
3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
 - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
 - a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Engineer will return submittal with options selected.
- E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
 1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
 2. Manufacturer and product name, and model number if applicable.
 3. Number and name of room or space.
 4. Location within room or space.
 5. Submit product schedule in the following format:
 - a. PDF electronic file.
- F. Contractor's Construction Schedule: Comply with requirements specified in Section 013200 (Construction Progress Documentation).
- G. Application for Payment and Schedule of Values: Comply with requirements specified in Section 012900 (Payment Procedures).
- H. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 014000 (Quality Requirements).
- I. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 017700 (Closeout Procedures).

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- J. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of Engineers and owners, and other information specified.
- K. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
- L. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
- M. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- N. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- O. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
- P. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- Q. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
 - 1. Name of evaluation organization.
 - 2. Date of evaluation.
 - 3. Time period when report is in effect.
 - 4. Product and manufacturers' names.
 - 5. Description of product.
 - 6. Test procedures and results.
 - 7. Limitations of use.
- R. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
- S. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
- T. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

- U. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.2 DELEGATED-DESIGN SERVICES

- 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 Engineer.
- B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file of certificate, 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.
 - 1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

- A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Engineer.
- B. Project Closeout and Maintenance Material Submittals: See requirements in Section 017700 (Closeout Procedures).
- C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ENGINEER'S ACTION

- A. Action Submittals: Engineer will review each submittal, make marks to indicate corrections or revisions required, and return it. Engineer will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.

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- B. Informational Submittals: Engineer will review each submittal and will not return it, or will return it if it does not comply with requirements. Engineer will forward each submittal to appropriate party.
- C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Engineer.
- D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- E. Submittals not required by the Contract Documents may be returned by the Engineer without action.

END OF SECTION 013300

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including the Standard General Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
 - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
 - 3. Requirements for Contractor to provide quality-assurance and -control services required by Engineer, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
 - 4. Specific test and inspection requirements are not specified in this Section.

1.3 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Engineer.
- C. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.
- D. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

- E. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.
- F. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- G. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- H. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
 - 1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).
- I. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4 CONFLICTING REQUIREMENTS

- A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Engineer for a decision before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Engineer for a decision before proceeding.

1.5 INFORMATIONAL SUBMITTALS

- A. Testing Agency Qualifications: 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. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
 - 1. Specification Section number and title.
 - 2. Entity responsible for performing tests and inspections.
 - 3. Description of test and inspection.
 - 4. Identification of applicable standards.
 - 5. Identification of test and inspection methods.

6. Number of tests and inspections required.
7. Time schedule or time span for tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

1.6 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. 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. Record of temperature and weather 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 re-inspecting.
- B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
 1. Name, address, and telephone number of technical representative making report.
 2. Statement on condition of substrates and their acceptability for installation of product.
 3. Statement that products at Project site comply with requirements.
 4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
 5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 6. Statement whether conditions, products, and installation will affect warranty.
 7. Other required items indicated in individual Specification Sections.
- C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
 1. Name, address, and telephone number of factory-authorized service representative making report.
 2. Statement that equipment complies with requirements.
 3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 4. Statement whether conditions, products, and installation will affect warranty.

5. Other required items indicated in individual Specification Sections.

- D. 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. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Quality-assurance tests and inspections are Contractor's responsibility. Perform quality-assurance activities required by individual Specification Sections to verify that the Work complies with Project requirements.
- C. 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, as well as sufficient production capacity to produce required units.
- D. 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.
- E. 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.
- F. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.
- G. Specialists: Certain Specification Sections 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. Requirements of authorities having jurisdiction shall supersede requirements for specialists.
- H. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

- I. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- J. 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.

1.8 QUALITY CONTROL

- A. Quality-control tests and inspections are Contractor's responsibility. Perform quality-control activities required by individual Specification Sections to verify that the Work complies with Project requirements.
 - 1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
 - 2. Engage a qualified testing agency to perform quality-control services.
 - 3. Perform additional quality-control activities as required to verify that the Work complies with requirements, whether specified or not.
 - 4. Submit a certified written report, in duplicate, of each quality-control service.
 - 5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- B. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 013300 "Submittal Procedures."
- C. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in pre-installation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.
- D. Retesting/Re-inspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and re-inspecting, for construction that replaced Work that failed to comply with the Contract Documents.

1.9 COORDINATION

- A. Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

- B. Prepare a schedule of tests, inspections, and similar quality-assurance and -control services required by the Contract Documents. Coordinate and submit concurrently with Contractor's construction schedule. Update as the Work progresses.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

- A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
 - 1. Date test or inspection was conducted.
 - 2. Description of the Work tested or inspected.
 - 3. Date test or inspection results were transmitted to Engineer.
 - 4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Engineer's reference during normal working hours.

3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
- 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 014000

SECTION 014200 - REFERENCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including the Standard General Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Approved": When used to convey Engineer's action on Contractor's submittals, applications, and requests, "approved" is limited to Engineer's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": A command or instruction by Engineer. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
- D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.
- H. "Provide": Furnish and install, complete and ready for the intended use.
- I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.3 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
 - 1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.4 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."
- B. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
 - 1. AABC - Associated Air Balance Council; www.aabc.com.
 - 2. AAMA - American Architectural Manufacturers Association; www.aamanet.org.
 - 3. AAPFCO - Association of American Plant Food Control Officials; www.aapfco.org.
 - 4. AASHTO - American Association of State Highway and Transportation Officials; www.transportation.org.
 - 5. AATCC - American Association of Textile Chemists and Colorists; www.aatcc.org.
 - 6. ABMA - American Bearing Manufacturers Association; www.americanbearings.org.
 - 7. ACI - American Concrete Institute; (Formerly: ACI International); www.concrete.org.
 - 8. ACPA - American Concrete Pipe Association; www.concrete-pipe.org.
 - 9. AEIC - Association of Edison Illuminating Companies, Inc. (The); www.aeic.org.
 - 10. AF&PA - American Forest & Paper Association; www.afandpa.org.
 - 11. AGA - American Gas Association; www.aga.org.
 - 12. AHAM - Association of Home Appliance Manufacturers; www.aham.org.
 - 13. AHRI - Air-Conditioning, Heating, and Refrigeration Institute (The); www.ahrinet.org.
 - 14. AI - Asphalt Institute; www.asphaltinstitute.org.
 - 15. AIA - American Institute of Engineers (The); www.aia.org.
 - 16. AISC - American Institute of Steel Construction; www.aisc.org.
 - 17. AISI - American Iron and Steel Institute; www.steel.org.
 - 18. AITC - American Institute of Timber Construction; www.aitc-glulam.org.
 - 19. AMCA - Air Movement and Control Association International, Inc.; www.amca.org.
 - 20. ANSI - American National Standards Institute; www.ansi.org.
 - 21. AOSA - Association of Official Seed Analysts, Inc.; www.aosaseed.com.
 - 22. APA - APA - The Engineered Wood Association; www.apawood.org.
 - 23. APA - Architectural Precast Association; www.archprecast.org.
 - 24. API - American Petroleum Institute; www.api.org.
 - 25. ARI - Air-Conditioning & Refrigeration Institute; (See AHRI).
 - 26. ARI - American Refrigeration Institute; (See AHRI).
 - 27. ARMA - Asphalt Roofing Manufacturers Association; www.asphaltroofing.org.

28. ASCE - American Society of Civil Engineers; www.asce.org.
29. ASCE/SEI - American Society of Civil Engineers/Structural Engineering Institute; (See ASCE).
30. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; www.ashrae.org.
31. ASME - ASME International; (American Society of Mechanical Engineers); www.asme.org.
32. ASSE - American Society of Safety Engineers (The); www.asse.org.
33. ASSE - American Society of Sanitary Engineering; www.asse-plumbing.org.
34. ASTM - ASTM International; (American Society for Testing and Materials International); www.astm.org.
35. ATIS - Alliance for Telecommunications Industry Solutions; www.atis.org.
36. AWEA - American Wind Energy Association; www.awea.org.
37. AWI - Architectural Woodwork Institute; www.awinet.org.
38. AWMAC - Architectural Woodwork Manufacturers Association of Canada; www.awmac.com.
39. AWPA - American Wood Protection Association; (Formerly: American Wood-Preservers' Association); www.awpa.com.
40. AWS - American Welding Society; www.aws.org.
41. AWWA - American Water Works Association; www.awwa.org.
42. BHMA - Builders Hardware Manufacturers Association; www.buildershardware.com.
43. BIA - Brick Industry Association (The); www.gobrick.com.
44. BICSI - BICSI, Inc.; www.bicsi.org.
45. BIFMA - BIFMA International; (Business and Institutional Furniture Manufacturer's Association); www.bifma.com.
46. BOCA - BOCA; (Building Officials and Code Administrators International Inc.); (See ICC).
47. CDA - Copper Development Association; www.copper.org.
48. CEA - Consumer Electronics Association; www.ce.org.
49. CFFA - Chemical Fabrics & Film Association, Inc.; www.chemicalfabricsandfilm.com.
50. CFSEI - Cold-Formed Steel Engineers Institute; www.cfsei.org.
51. CGA - Compressed Gas Association; www.cganet.com.
52. CIMA - Cellulose Insulation Manufacturers Association; www.cellulose.org.
53. CISCA - Ceilings & Interior Systems Construction Association; www.cisca.org.
54. CISPI - Cast Iron Soil Pipe Institute; www.cispi.org.
55. CLFMI - Chain Link Fence Manufacturers Institute; www.chainlinkinfo.org.
56. CPA - Composite Panel Association; www.pbmdf.com.
57. CRRC - Cool Roof Rating Council; www.coolroofs.org.
58. CRSI - Concrete Reinforcing Steel Institute; www.crsi.org.
59. CSA - Canadian Standards Association; www.csa.ca.
60. CSA - CSA International; (Formerly: IAS - International Approval Services); www.csa-international.org.
61. CSI - Construction Specifications Institute (The); www.csinet.org.
62. CSSB - Cedar Shake & Shingle Bureau; www.cedarbureau.org.
63. CTI - Cooling Technology Institute; (Formerly: Cooling Tower Institute); www.cti.org.
64. CWC - Composite Wood Council; (See CPA).
65. DASMA - Door and Access Systems Manufacturers Association; www.dasma.com.
66. DHI - Door and Hardware Institute; www.dhi.org.
67. ECA - Electronic Components Association; www.ec-central.org.
68. ECAMA - Electronic Components Assemblies & Materials Association; (See ECA).
69. EIA - Electronic Industries Alliance; (See TIA).

70. EIMA - EIFS Industry Members Association; www.eima.com.
71. EJMA - Expansion Joint Manufacturers Association, Inc.; www.ejma.org.
72. ESD - ESD Association; (Electrostatic Discharge Association); www.esda.org.
73. EVO - Efficiency Valuation Organization; www.evo-world.org.
74. FM Approvals - FM Approvals LLC; www.fmglobal.com.
75. FM Global - FM Global; (Formerly: FMG - FM Global); www.fmglobal.com.
76. FSA - Fluid Sealing Association; www.fluidsealing.com.
77. FSC - Forest Stewardship Council U.S.; www.fscus.org.
78. GA - Gypsum Association; www.gypsum.org.
79. GANA - Glass Association of North America; www.glasswebsite.com.
80. GS - Green Seal; www.greenseal.org.
81. HI - Hydraulic Institute; www.pumps.org.
82. HI/GAMA - Hydronics Institute/Gas Appliance Manufacturers Association; (See AHRI).
83. HMMA - Hollow Metal Manufacturers Association; (See NAAMM).
84. HPVA - Hardwood Plywood & Veneer Association; www.hpva.org.
85. HPW - H. P. White Laboratory, Inc.; www.hpwhite.com.
86. IAPSC - International Association of Professional Security Consultants; www.iapsc.org.
87. IAS - International Approval Services; (See CSA).
88. ICBO - International Conference of Building Officials; (See ICC).
89. ICC - International Code Council; www.iccsafe.org.
90. ICEA - Insulated Cable Engineers Association, Inc.; www.icea.net.
91. ICPA - International Cast Polymer Alliance; www.icpa-hq.org.
92. ICRI - International Concrete Repair Institute, Inc.; www.icri.org.
93. IEC - International Electrotechnical Commission; www.iec.ch.
94. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); www.ieee.org.
95. IES - Illuminating Engineering Society; (Formerly: Illuminating Engineering Society of North America); www.ies.org.
96. IESNA - Illuminating Engineering Society of North America; (See IES).
97. IEST - Institute of Environmental Sciences and Technology; www.iest.org.
98. IGMA - Insulating Glass Manufacturers Alliance; www.igmaonline.org.
99. IGSHPA - International Ground Source Heat Pump Association; www.igshpa.okstate.edu.
100. ILI - Indiana Limestone Institute of America, Inc.; www.iliai.com.
101. Intertek - Intertek Group; (Formerly: ETL SEMCO; Intertek Testing Service NA); www.intertek.com.
102. ISA - International Society of Automation (The); (Formerly: Instrumentation, Systems, and Automation Society); www.isa.org.
103. ISAS - Instrumentation, Systems, and Automation Society (The); (See ISA).
104. ISFA - International Surface Fabricators Association; (Formerly: International Solid Surface Fabricators Association); www.isfanow.org.
105. ISO - International Organization for Standardization; www.iso.org.
106. ISSFA - International Solid Surface Fabricators Association; (See ISFA).
107. ITU - International Telecommunication Union; www.itu.int/home.
108. KCMA - Kitchen Cabinet Manufacturers Association; www.kcma.org.
109. LMA - Laminating Materials Association; (See CPA).
110. LPI - Lightning Protection Institute; www.lightning.org.
111. MBMA - Metal Building Manufacturers Association; www.mbma.com.
112. MCA - Metal Construction Association; www.metalconstruction.org.
113. MFMA - Metal Framing Manufacturers Association, Inc.; www.metalframingmfg.org.
114. MHIA - Material Handling Industry of America; www.mhia.org.
115. MIA - Marble Institute of America; www.marble-institute.com.

116. MMPA - Moulding & Millwork Producers Association; (Formerly: Wood Moulding & Millwork Producers Association); www.wmmpa.com.
117. MPI - Master Painters Institute; www.paintinfo.com.
118. MSS - Manufacturers Standardization Society of The Valve and Fittings Industry Inc.; www.mss-hq.org.
119. NAAMM - National Association of Architectural Metal Manufacturers; www.naamm.org.
120. NACE - NACE International; (National Association of Corrosion Engineers International); www.nace.org.
121. NADCA - National Air Duct Cleaners Association; www.nadca.com.
122. NAIMA - North American Insulation Manufacturers Association; www.naima.org.
123. NBGQA - National Building Granite Quarries Association, Inc.; www.nbgqa.com.
124. NCMA - National Concrete Masonry Association; www.ncma.org.
125. NEBB - National Environmental Balancing Bureau; www.nebb.org.
126. NECA - National Electrical Contractors Association; www.necanet.org.
127. NeLMA - Northeastern Lumber Manufacturers Association; www.nelma.org.
128. NEMA - National Electrical Manufacturers Association; www.nema.org.
129. NETA - InterNational Electrical Testing Association; www.netaworld.org.
130. NFPA - NFPA; (National Fire Protection Association); www.nfpa.org.
131. NFPA - NFPA International; (See NFPA).
132. NFRC - National Fenestration Rating Council; www.nfrc.org.
133. NHLA - National Hardwood Lumber Association; www.nhla.com.
134. NLGA - National Lumber Grades Authority; www.nlga.org.
135. NOFMA - National Oak Flooring Manufacturers Association; (See NWFA).
136. NOMMA - National Ornamental & Miscellaneous Metals Association; www.nomma.org.
137. NRCA - National Roofing Contractors Association; www.nrca.net.
138. NRMCA - National Ready Mixed Concrete Association; www.nrmca.org.
139. NSF - NSF International; (National Sanitation Foundation International); www.nsf.org.
140. NSPE - National Society of Professional Engineers; www.nspe.org.
141. NSSGA - National Stone, Sand & Gravel Association; www.nssga.org.
142. NTMA - National Terrazzo & Mosaic Association, Inc. (The); www.ntma.com.
143. NWFA - National Wood Flooring Association; www.nwfa.org.
144. PCI - Precast/Prestressed Concrete Institute; www.pci.org.
145. PDI - Plumbing & Drainage Institute; www.pdionline.org.
146. RCSC - Research Council on Structural Connections; www.boltcouncil.org.
147. RFCI - Resilient Floor Covering Institute; www.rfci.com.
148. RIS - Redwood Inspection Service; www.redwoodinspection.com.
149. SAE - SAE International; (Society of Automotive Engineers); www.sae.org.
150. SCTE - Society of Cable Telecommunications Engineers; www.scte.org.
151. SDI - Steel Deck Institute; www.sdi.org.
152. SDI - Steel Door Institute; www.steeldoor.org.
153. SEFA - Scientific Equipment and Furniture Association; www.sefalabs.com.
154. SEI/ASCE - Structural Engineering Institute/American Society of Civil Engineers; (See ASCE).
155. SIA - Security Industry Association; www.siaonline.org.
156. SJI - Steel Joist Institute; www.steeljoist.org.
157. SMA - Screen Manufacturers Association; www.smainfo.org.
158. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association; www.smacna.org.
159. SPFA - Spray Polyurethane Foam Alliance; www.sprayfoam.org.
160. SPIB - Southern Pine Inspection Bureau; www.spib.org.
161. SPRI - Single Ply Roofing Industry; www.spri.org.

162. SRCC - Solar Rating and Certification Corporation; www.solar-rating.org.
 163. SSINA - Specialty Steel Industry of North America; www.ssina.com.
 164. SSPC - SSPC: The Society for Protective Coatings; www.sspc.org.
 165. STI - Steel Tank Institute; www.steeltank.com.
 166. SWI - Steel Window Institute; www.steelwindows.com.
 167. SWPA - Submersible Wastewater Pump Association; www.swpa.org.
 168. TCA - Tilt-Up Concrete Association; www.tilt-up.org.
 169. TCNA - Tile Council of North America, Inc.; (Formerly: Tile Council of America); www.tileusa.com.
 170. TEMA - Tubular Exchanger Manufacturers Association, Inc.; www.tema.org.
 171. TIA - Telecommunications Industry Association; (Formerly: TIA/EIA - Telecommunications Industry Association / Electronic Industries Alliance); www.tiaonline.org.
 172. TIA/EIA - See TIA.
 173. TMS - The Masonry Society; www.masonrysociety.org.
 174. TPI - Truss Plate Institute; www.tpinst.org.
 175. TPI - Turfgrass Producers International; www.turfgrasssod.org.
 176. TRI - Tile Roofing Institute; www.tilerroofing.org.
 177. UBC - Uniform Building Code; (See ICC).
 178. UL - Underwriters Laboratories Inc.; www.ul.com.
 179. UNI - Uni-Bell PVC Pipe Association; www.uni-bell.org.
 180. USGBC - U.S. Green Building Council; www.usgbc.org.
 181. WASTEC - Waste Equipment Technology Association; www.wastec.org.
 182. WCMA - Window Covering Manufacturers Association; www.wcmanet.org.
 183. WDMA - Window & Door Manufacturers Association; www.wdma.com.
 184. WI - Woodwork Institute; (Formerly: WIC - Woodwork Institute of California); www.wicnet.org.
 185. WMMPA - Wood Moulding & Millwork Producers Association; (See MMPA).
 186. WSRCA - Western States Roofing Contractors Association; www.wsrca.com.
 187. WPA - Western Wood Products Association; www.wwpa.org.
- C. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is believed to be accurate as of the date of the Contract Documents.
1. IAPMO - International Association of Plumbing and Mechanical Officials; www.iapmo.org.
 2. ICC - International Code Council; www.iccsafe.org.
 3. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.
- D. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Information is subject to change and is up-to-date as of the date of the Contract Documents.
1. COE - Army Corps of Engineers; www.usace.army.mil.
 2. CPSC - Consumer Product Safety Commission; www.cpsc.gov.
 3. DOC - Department of Commerce; National Institute of Standards and Technology; www.nist.gov.
 4. DOD - Department of Defense; <http://dodssp.daps.dla.mil>.
 5. DOE - Department of Energy; www.energy.gov.
 6. EPA - Environmental Protection Agency; www.epa.gov.
 7. FAA - Federal Aviation Administration; www.faa.gov.

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8. FG - Federal Government Publications; www.gpo.gov.
9. GSA - General Services Administration; www.gsa.gov.
10. HUD - Department of Housing and Urban Development; www.hud.gov.
11. LBL - Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; <http://eetd.lbl.gov>.
12. OSHA - Occupational Safety & Health Administration; www.osha.gov.
13. SD - Department of State; www.state.gov.
14. TRB - Transportation Research Board; National Cooperative Highway Research Program; www.trb.org.
15. USDA - Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; www.ars.usda.gov.
16. USDA - Department of Agriculture; Rural Utilities Service; www.usda.gov.
17. USDJ - Department of Justice; Office of Justice Programs; National Institute of Justice; www.ojp.usdoj.gov.
18. USP - U.S. Pharmacopeia; www.usp.org.
19. USPS - United States Postal Service; www.usps.com.

E. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. CFR - Code of Federal Regulations; Available from Government Printing Office; www.gpo.gov/fdsys.
2. DOD - Department of Defense; Military Specifications and Standards; Available from Department of Defense Single Stock Point; <http://dodssp.daps.dla.mil>.
3. DSCC - Defense Supply Center Columbus; (See FS).
4. FED-STD - Federal Standard; (See FS).
5. FS - Federal Specification; Available from Department of Defense Single Stock Point; <http://dodssp.daps.dla.mil>.
 - a. Available from Defense Standardization Program; www.dsp.dla.mil.
 - b. Available from General Services Administration; www.gsa.gov.
 - c. Available from National Institute of Building Sciences/Whole Building Design Guide; www.wbdg.org/ccb.
6. MILSPEC - Military Specification and Standards; (See DOD).
7. USAB - United States Access Board; www.access-board.gov.
8. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

SECTION 015000 – TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including the Standard General Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes requirements for temporary utilities, support facilities, and protection measures.
- B. Related Requirements:
 - 1. Section 011000 "Summary".

1.3 REQUIREMENTS INCLUDED

- A. General Requirements: Overall responsibility, code compliance, permits for temporary work, and responsibility for additional temporary work.
- B. Temporary Utilities: Electricity, lighting, heat, ventilation, telephone service, water and sanitary facilities.
- C. Temporary Controls: Barriers, enclosures, fencing, protection of installed work, water control, noise control, dust control, maintenance of traffic and security.
- D. Construction Facilities: Access roads and parking, temporary buildings, project signage and cleaning during construction.

1.4 GENERAL REQUIREMENTS

- A. Provide, maintain and remove all temporary utilities, temporary controls and construction facilities included in this Section unless specifically noted otherwise.
- B. All work of this Section shall be in compliance with the National Electrical Code, Federal, State and local codes and regulations, and any utility company requirements.
- C. Obtain all permits required for providing temporary utilities, temporary controls and construction facilities.
- D. Where installation requirements for particular materials or equipment (as identified in the individual technical specifications and/or manufacturer's installation recommendations) exceed

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the general requirements specified in this section, provide the additional temporary utilities, controls and/or facilities as required for those individual construction operations.

1.5 RESPONSIBILITY

- A. Temporary Utilities: Provide, maintain and remove all temporary utilities as required to perform the Work.
- B. Temporary Controls:
 - 1. Provide, maintain and remove all specific items of temporary control identified in this Section and as indicated on the Contract Drawings, unless noted otherwise.
 - 2. In addition to the specific items of temporary control identified in this Section, provide, maintain and remove additional temporary controls as required to perform the Work, and for protection of work installed.
- C. Construction Facilities:
 - 1. Provide, maintain and remove all specific construction facilities identified in this Section and as indicated on the Contract Drawings, unless noted otherwise.
 - 2. Provide field offices, storage facilities and any other construction facilities not herein identified, as required for Contractor's operations.

1.6 USAGE CHARGES

- A. Installation and removal of, and use charges for, temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Engineer, testing agencies, and authorities having jurisdiction.

1.7 INFORMATIONAL SUBMITTALS

- A. Site Plan: Provide a scaled site layout drawing showing the proposed use of the site during construction and the space available for the use of other contractors and employee parking. Submittal shall be made prior to the preconstruction conference so that site allocation can be discussed at that conference. Revised site plan showing site allocation, as agreed-upon in the preconstruction conference, shall be prepared and submitted within one week after the conference.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Materials for temporary utilities, controls and construction facilities may be new or used provided they are adequate in capacity for the required usage. Materials must not create unsafe conditions or violate the requirements of applicable codes and regulations.

PART 3 - EXECUTION

3.1 TEMPORARY UTILITIES

- A. Electric Power Service: Provide and maintain temporary electric power and lighting as necessary to perform the Work. Comply with requirements of authorities having jurisdiction.
- B. Heat, Ventilation: Provide as required to maintain specified conditions for construction operations, to protect materials from damage due to temperature, humidity or fumes.
- C. Telephone Service: Contractor shall determine level of service required for Contractor's use.
- D. Water Service: Provide all water required to perform the Work.
- E. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

3.2 USE OF PERMANENT SYSTEMS

- A. Permanent systems may not be used for construction operations except where specifically noted otherwise.

3.3 BARRIERS

- A. Provide as required to prevent public entry to construction areas, and to protect existing facilities and adjacent properties from damage from construction operations.
- B. Provide barriers around trees and plants designated to remain. Protect against vehicular traffic, stored materials, dumping, chemically injurious materials, and puddling or continuous running water.

3.4 PROTECTION OF INSTALLED WORK

- A. Protect all installed work from damage during construction activities. Provide special protection if specified in individual Specification Sections.

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- B. Provide temporary protection for installed products. Control activity in immediate area to minimize damage.

3.5 WATER CONTROL

- A. Grade site to drain. Provide and operate pumping equipment to maintain excavations free of water.
- B. Prevent the introduction of sediment into existing sewers or surface water by the use of sediment basins or filters. Existing sewers or surface waters are to be cleaned if they become contaminated.
- C. Mechanically retard and control the rate of runoff from the construction site. This includes the construction of diversion ditches, benches, berms and the use of silt fences and strawbales and other appropriate measures to retard and divert runoff to protected drainage courses.
- D. Trap sediment in sediment basins designed for that purpose. Remove accumulated sediment to maintain basins in functioning condition.

3.6 NOISE AND DUST CONTROL

- A. Dust Control:
 - 1. Keep dust down at all times, including during nonworking periods.
 - 2. Control dust from site soils, haul roads, and other areas disturbed by operations by sprinkling with water or treating with dust suppressants.
- B. Noise Control: Make maximum use of low-noise emission products, as certified by the EPA.

3.7 MAINTENANCE OF TRAFFIC

- A. Maintain traffic on streets and roadways at all times unless specified or written permission is obtained.
- B. Maintain driveways to all fire departments, industrial establishments, businesses and residential structures.
- C. Coordinate the work with all interested parties to produce minimum disruption of traffic, parking and access.

3.8 CLEANING DURING CONSTRUCTION

- A. Control accumulation of waste materials and rubbish; periodically dispose of off-site.

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3.9 PROJECT SIGNS

- A. Provide project signs as indicated. Unauthorized signs are not permitted.
- B. Temporary Signs: Provide other signs as required to identify entrance to Project.

3.10 FIELD OFFICES AND SHEDS

- A. Provide field offices and storage facilities on site as required to perform the Work.
- B. Coordinate the location of these facilities with the Engineer and other Contractors to preclude interference with construction operations.
- C. Relocate facilities as required by construction operations.

3.11 REMOVAL

- A. Remove temporary materials, equipment, services and construction prior to Substantial Completion inspection.
- B. Clean and repair damage caused by installation or use of temporary facilities. Remove underground installations to full depth; grade site as indicated. Restore existing facilities used during construction to a specified or to original condition.

END OF SECTION 015000

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including the Standard General Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.
- B. Related Requirements:
 - 1. Section 014200 "References".

1.3 DEFINITIONS

- A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
 - 2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
 - 3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.4 ACTION SUBMITTALS

- A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
 - 2. Engineer's Action: If necessary, Engineer will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Engineer will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
 - a. Form of Approval: As specified in Section 013300 (Submittal Procedures).
 - b. Use product specified if Engineer does not issue a decision on use of a comparable product request within time allocated.
- B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 013300 (Submittal Procedures). Show compliance with requirements.

1.5 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

1.6 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. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
3. Protect stored products from damage and liquids from freezing.

1.7 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
 1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
 2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
 1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
 2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
 3. See other Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Section 017700)Closeout Procedures).

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
 1. Provide products complete with accessories and other items needed for a complete installation and indicated use and effect.
 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 3. Where products are accompanied by the term "as selected," Engineer will make selection.
 4. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures:

1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
3. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

C. Visual Matching Specification: Where Specifications require "match Engineer's sample", provide a product that complies with requirements and matches Engineer's sample. Engineer's decision will be final on whether a proposed product matches.

D. Visual Selection Specification: Where Specifications include the phrase "as selected by Engineer from manufacturer's full range" or similar phrase, select a product that complies with requirements. Engineer will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration: Engineer will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Engineer may return requests without action, except to record noncompliance with these requirements:

1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of Engineers and owners, if requested.
5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 017300 - EXECUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including the Standard General Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
 - 1. Construction layout.
 - 2. Field engineering and surveying.
 - 3. Installation of the Work.
 - 4. Progress cleaning.
 - 5. Protection of installed construction.
- B. Related Requirements:
 - 1. Section 011000 "Summary".
 - 2. Section 013300 "Submittal Procedures".
 - 3. Section 017700 "Closeout Procedures".

1.3 QUALITY ASSURANCE

- A. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning site work, investigate and

verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- B. Examination and Acceptance of Conditions: Before proceeding with the Work, examine substrates, areas, and conditions, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
- C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
1. Description of the Work.
 2. List of detrimental conditions, including substrates.
 3. List of unacceptable installation tolerances.
 4. Recommended corrections.
- D. 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 caused by differing field conditions outside the control of Contractor, submit a request for information to Engineer according to requirements in Section 013100 (Project Management and Coordination).

3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Engineer promptly.
- B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.

1. Establish benchmarks and control points to set lines and levels as needed to locate each element of Project.
 2. Establish limits on use of Project site.
 3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
 4. Check the location, level and plumb, of every major element as the Work progresses.
 5. Notify Engineer when deviations from required lines and levels exceed allowable tolerances.
 6. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
- C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.
- D. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Engineer.

3.4 FIELD ENGINEERING

- A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
1. Do not change or relocate existing benchmarks or control points without prior written approval of Engineer. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Engineer before proceeding.
 2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

3.5 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.
- 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.

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- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.
- F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- G. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 PROGRESS CLEANING

- A. General: Maintain Project site free of waste materials and debris. Dispose of materials lawfully.
- B. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways.
- C. 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.

3.7 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 maintenance and protection.

END OF SECTION 017300

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including the Standard General Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 - 1. Substantial Completion procedures.
 - 2. Final completion procedures.
 - 3. Warranties.
 - 4. Final cleaning.
 - 5. Repair of the Work.
- B. Related Requirements:
 - 1. Section 017300 "Execution".
 - 2. Section 017839 "Project Record Documents".

1.3 ACTION SUBMITTALS

- A. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- B. Certified List of Incomplete Items: Final submittal at Final Completion.

1.4 CLOSEOUT SUBMITTALS

- A. Certificates of Release: From authorities having jurisdiction.
- B. Certificate of Insurance: For continuing coverage.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.6 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, damage or settlement surveys, property surveys, and similar final record information.
 - 3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 - 4. Submit maintenance material submittals specified in individual Sections, including spare parts and similar items, and deliver to location designated by Engineer. Label with manufacturer's name and model number where applicable.
 - 5. Submit test records.
 - 6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
- C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Advise Owner of pending insurance changeover requirements.
 - 2. Complete startup and testing of systems and equipment.
 - 3. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
 - 4. Terminate and remove temporary facilities from Project site, along with construction tools, equipment and similar elements.
 - 5. Complete final cleaning requirements.
- D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the work will be completed and ready for final inspection. On receipt of request, Engineer will either proceed with inspection or notify Contractor of unfulfilled requirements. Engineer 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 Engineer, that must be completed or corrected before certificate will be issued.
 - 1. Re-inspection: Request re-inspection 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.

1.7 FINAL COMPLETION PROCEDURES

- A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:
 - 1. Submit a final Application for Payment according to Section 012900 (Payment Procedures).
 - 2. Certified List of Incomplete Items: Submit certified copy of Engineer's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Engineer. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 - 3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
- B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Engineer will either proceed with inspection or notify Contractor of unfulfilled requirements. Engineer will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
 - 1. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.8 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. List all incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
 - 1. Include the following information at the top of each page of the list:
 - a. Project name.
 - b. Date.
 - c. Name of Engineer.
 - d. Name of Contractor.
 - e. Page number.
 - 2. Submit list of incomplete items in the following format:
 - a. PDF electronic file. Engineer will return annotated file.

1.9 SUBMITTAL OF PROJECT WARRANTIES

- A. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
 - 1. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project.
 - 1. Clean Project site, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - 2. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - 3. Leave Project clean and ready for occupancy

3.2 REPAIR OF THE WORK

- A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.
- B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Restore damaged construction and permanent facilities used during construction to specified condition.

END OF SECTION 017700

SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including the Standard General Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for project record documents, including the following:
 - 1. Record Drawings.
 - 2. Record Product Data.
 - 3. Miscellaneous record submittals.
- B. Related Requirements:
 - 1. Section 017300 "Execution".
 - 2. Section 017700 "Closeout Procedures".

1.3 CLOSEOUT SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Maintain and submit record documents in accordance with General Condition 6.12.
 - 2. The Contractor shall obtain, at his own expense, two sets of full-size Contract Drawings for this purpose prior to the commencement of Work.
 - 3. Maintain accurate records of all authorized changes to the Contract Documents and deviations in the Work as it is actually installed.
 - 4. Submit one current copy of record documents prior to Substantial Completion and a separate final copy upon final completion, as required by General Condition 6.12. If Owner partially utilizes any portion of the project, Contractor shall submit a current copy of record documents for that portion being utilized, in accordance with General Condition 6.12.B, prior to Owner's acceptance of that portion as substantially complete.
- B. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.
- C. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit annotated PDF electronic files and directories of each submittal.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

- A. Record Prints: Maintain marked-up paper copies of the Contract Drawings, incorporating new and revised drawings as modifications are issued.
 - 1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally.
 - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b. Accurately record information in an acceptable drawing technique.
 - c. Record data as soon as possible after obtaining it.
 - 2. Content: Types of items requiring marking include, but are not limited to, the following:
 - a. Dimensional changes to Drawings.
 - b. Revisions to details shown on Drawings.
 - c. Locations and depths of underground utilities.
 - d. Revisions to routing of piping.
 - e. Actual equipment or structure locations.
 - f. Changes made by Change Order or Construction Change Directive.
 - g. Changes made following Engineer's written orders.
 - h. Details not on the original Contract Drawings.
 - i. Field records for variable and concealed conditions.
 - j. Record information on the Work that is shown only schematically.
 - 3. Mark the Contract Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
 - 4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
 - 5. Mark important additional information that was either shown schematically or omitted from original Drawings.
 - 6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
 - 1. Record Prints: Organize record prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
 - 2. Electronic File: Annotated PDF electronic file with comment function enabled.
 - 3. Identification: As follows:
 - a. Project name.
 - b. Date.
 - c. Designation "PROJECT RECORD DRAWINGS."
 - d. Name of Engineer.
 - e. Name of Contractor.

2.2 RECORD PRODUCT DATA

- A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
 - 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 Specifications, and record Drawings where applicable.
- B. Format: Submit record Product Data as annotated PDF electronic file.
 - 1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

2.3 MISCELLANEOUS RECORD SUBMITTALS

- A. 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.
- B. Format: Submit miscellaneous record submittals as PDF electronic file.
 - 1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.
- B. Maintenance of Record Documents: Store record documents apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Engineer's reference during normal working hours.

END OF SECTION 017839

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, and placement procedures for the following types of concrete mixes:
 - 1. Foundations (Bases at Fences, Light Poles, Bollards).
 - 2. Sidewalks and exterior slabs on grade (including dumpster and generator pad)
 - 3. Grade adjustment of drainage and utility structures (if required).
 - 4. Thrust blocks for underground watermain.
 - 5. Concrete curb (integral with sidewalk).
- B. Related Sections:
 - 1. Division 31 Section "Aggregates for Earthwork" for aggregate subbase course.
 - 2. Division 31 Section "Earth Moving" for subgrade preparation

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete mixture.
- C. Shop Drawings: For steel reinforcement and formwork.

1.3 QUALITY ASSURANCE

- A. Obtain cementitious materials from same source throughout project.
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products, that complies with ASTM C 94/C 94M requirements for production facilities and equipment, and has a minimum three years experience.
 - 1. Concrete batching plants shall be currently approved as concrete suppliers by the New York State Department of Transportation (NYSDOT).
 - 2. Truck mixers for concrete shall be currently approved by the New York State Department of Transportation (NYSDOT).
 - 4. Fly Ash supplier shall be on the New York State Department of Transportation's current "Approved List of Suppliers of Fly Ash".

5. Source Quality Control: The Owner's Representative reserves the right to inspect and approve the following items, at his own discretion, either with his own forces or with a designated inspection agency.
 6. Notify the Owner's Representative and the testing agency at least 24 hours prior to placing any concrete.
- C. Installer Qualifications: Company specializing in performing work of this section with minimum three years documented experience.
- D. Perform work in accordance with:
1. New York State Department of Transportation (NYSDOT) 2008 Standard Specifications:
 - a. Section 501: Portland Cement Concrete – General.
 - b. Section 608: Sidewalks, Driveways, and Bicycle Paths.
 2. ACI Publications:
 - a. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
 - b. ACI 301, "Specification for Structural Concrete."
 - c. ACI 304 - Guide for Measuring, Mixing, Transporting, and Placing Concrete.
 3. ASTM International:
 - a. ASTM A185 - Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.
 - b. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.
 - c. ASTM C150 - Standard Specification for Portland Cement.
 - d. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
 - e. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - f. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete.
 - g. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
 - h. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
- E. Preinstallation Conference: Conduct conference at Project site.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

2.2 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
- B. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.
- C. Deformed-Steel Welded Wire Reinforcement: ASTM A 497, flat sheet.
- D. Galvanized-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from galvanized steel wire into flat sheets.
- E. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice."

2.3 SYNTHETIC FIBER REINFORCEMENT

- A. Synthetic Fibers for Secondary Reinforcement: Synthetic, polypropylene fibrillated fibers, specifically engineered and manufactured for use as a secondary concrete reinforcement, complying with ASTM C 1116, Type III. Use Forta® Super-Net fibers, (or approved equal, as appearing on the NYS DOT Approved List for Concrete Fiber Reinforcement). Fiber lengths are ¾ inch long, collated fibrillated fiber, dosed into the concrete mix at 1.5 lb/CY.

2.4 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
 - 1. ASTM C 150, Type I or II Portland Cement.
 - 2. Use approved brands without change for the entire project.
 - 3. Cement used throughout the project shall be uniform in color so as not to prejudice the appearance of exposed concrete.
 - a. Fly Ash: ASTM C 618, Class F, as per NYSDOT 2008 Standard Specifications Section 711-10 (Fly Ash).
- B. Normal-Weight Aggregates: As per NYSDOT 2008 Standard Specifications Section 703-01 (Fine Aggregates) and 703-02 (Course Aggregate). Provide Aggregates from an approved NYSDOT source.
 - 1. Fine Aggregate:
 - a. Free of materials with deleterious reactivity to alkali in cement.
 - b. Clean, sharp, natural sand free from loam, clay, organic impurities or foreign materials meeting the requirements of ASTM C33.
 - 2. Coarse Aggregate: Crushed gravel or crushed stone meeting the requirements of ASTM C33. Aggregate size is dependent on mix type.

- C. Water: As per NYSDOT 2008 Standard Specifications Section 712-01 (Water) and ASTM C 94/C 94M, Potable. Approval of Owner's Representative is required for any water source other than a public potable water supply.
- D. Air-Entraining Admixture: As per NYSDOT 2008 Standard Specifications Section 711-08 (Admixtures) and ASTM C 260.
- E. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
 - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 - 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 - 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 - 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 - 6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.5 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Clear, Waterborne, Anti-Spalling, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B. Approved products and Manufacturers include, but are not limited to, the following:
 - 1. Kure-N-Seal by Sonneborn, A Division of BASF.
 - 2. SealCure Emulsion by Conspec, A Dayton Superior Company.
 - 3. Cure & Seal by Symons Corp.
 - 4. Or Approved Equal.
- F. Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type I, Class B, manufactured for colored concrete.
 - 1. For integrally colored concrete, curing compound shall be pigmented type approved by coloring admixture manufacturer.
 - 2. For concrete indicated to be sealed, curing compound shall be compatible with sealer.

- G. Clear Acrylic Sealer: Manufacturer's standard, waterborne, non-yellowing and UV-resistant, membrane-forming, medium-gloss, acrylic copolymer emulsion solution, manufactured for colored concrete, containing not less than 15 percent solids by volume

2.6 RELATED MATERIALS

- A. Expansion Joint Strips: As per NYSDOT 2008 Standard Specifications Section 705-07 (Premoulded Resilient Joint Filler) and ASTM D 1751, asphalt-saturated cellulosic fiber.
1. Use a material/manufacturer from the NYSDOT Approved List.

2.7 CONCRETE MIXTURES

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
- B. Cementitious Materials: Use fly ash, pozzolan, ground granulated blast-furnace slag, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.
- C. All concrete exposed to the weather or water, or subject to freezing shall be air-entrained.
- D. Cast-in-place concrete shall be normal weight concrete and shall have a minimum compressive strength of 4000 psi except as otherwise specified on the drawing notes. See table for location and concrete specifications.

Location	F'c (Min. 28-Day Comp. Strength) (psi)	Cement Unit Weight (lbs/cy) min.	ASTM C33 Aggregate (Size No.)	Range ** Slump (Inches)	Water Cement Ratio (by Weight)	Air Entr. (percent) ***
General Foundation (includes structure adjustments, foundations for Bollards, Hand-rail & Fence Posts, & Light Poles	4,000	611	67 or 57	2"- 4"	0.46	4-8
Watermain Thrust Blocks	4,000	611	67 or 57	2"- 4"	0.46	4-8
Slabs* on Grade other than inside building line, exterior concrete curb	4,000*	615	67 or 57	3"	0.45	4-8

Building Slab, Footings, Base- ment Walls	4500	611	67 or 57	2"-4"	0.45	4-8
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*This mix to have synthetic fiber. Concrete Mix for sidewalk installations shall have synthetic fiber that meets the requirements of Section 2.3A Secondary Fiber Reinforcement.

**Slump, as noted in table, is before the addition of any water-reducing admixtures. When a water-reducing admixture is used, maximum slump shall be 6 inches.

***Use air-entraining admixture, not air-entrained cement.

- E. Optional Material: Fly ash may be substituted for (Portland) cement in normal weight and lightweight concrete up to a maximum of 15 percent by weight of the required minimum (Portland) cement. If fly ash is incorporated in a concrete design mix, make necessary adjustments to the design mix to compensate for the use of fly ash as a partial replacement for (Portland) cement.
- F. Application rate for Corrosion-Inhibiting Admixture: The application rate for the corrosion-inhibiting admixture shall be the number of gallons per cubic yard of concrete, per the selected manufacturer's recommendation for all concrete placements where indicated on the drawings.
- G. Admixtures: Do not use admixtures in concrete unless specified or approved in writing by the Owner's Representative.
- H. Weather Conditions: Protect concrete from physical damage or reduced strength due to weather extremes during mixing, placement and curing.
 - 1. Hot Weather:
 - a. Provide adequate controls to insure that the temperature of the concrete when placed does not exceed 90 degrees F., and make every effort to place it at a lower temperature. The temperature of the concrete as placed shall not be so high as to cause difficulty from loss of slump, flash set or cold joints. Ingredients may be cooled before mixing by shading the aggregates, fog spraying the coarse aggregate, chilling the mixing water or other approved means. Mixing water may be chilled with flake ice or well-crushed ice of a size that will melt completely during mixing, providing the water equivalent of the ice is calculated into the total amount of mixing water.
 - b. When air temperature is between 85 degrees F and 90 degrees F, reduce mixing and delivery time from 1 1/2 hours to 75 minutes, and when air temperature is above 90°F, reduce mixing and delivery time to 60 minutes. (ACI 305)
 - 2. Cold Weather:
 - a. When air temperature is below 40 degrees F heat the mixing water and, if necessary, the aggregates to obtain a concrete mixture temperature of not less than 50 degrees F and not more than 80 degrees F at point of placement. If the mixing water is heated, do not exceed a temperature of 140 degrees F at the time it is added to the cement and aggregates. (ACI 306)
- I. Adjustment to Concrete Mixes: Mix design adjustments may be requested by the Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, at no additional cost to the Owner, and as accepted by the Owner's Representative.

Laboratory test data for revised mix design and strength results must be submitted to and accepted by the Owner's Representative before using in the work.

- J. Synthetic Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than 1.5 lb/cu. yd.
- K. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions.

2.8 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."
- B. Place as per the project Plans.

2.9 CONCRETE MIXING

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

PART 3 - EXECUTION

3.1 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork according to ACI 301 to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Chamfer exterior corners and edges of permanently exposed concrete.

3.2 EMBEDDED ITEMS

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

3.3 STEEL REINFORCEMENT

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

3.4 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Owner's Representative.
- C. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

3.5 CONCRETE PLACEMENT

- A. Before placing concrete, verify that
 1. Compacted subgrade soil is acceptable and ready to support paving and imposed loads.
 2. Compacted subbase is acceptable and ready to support paving and imposed loads.
 3. Gradients and elevations of base are correct.
 4. Installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed
 5. Moisten base to minimize absorption of water from fresh concrete.
 6. Coat surfaces of manhole and catch basin frames with oil to prevent bond with concrete pavement.
 7. Notify Owner's Representative minimum 24 hours prior to commencement of concreting operations.
- B. Do not place concrete when base surface temperature is less than 40 degrees F, or surface is wet or frozen.
- C. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
 1. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
- D. Cold-Weather Placement: Comply with ACI 306.1.
- E. Hot-Weather Placement: Comply with ACI 301.
- F. Interruption of Concreting: Should placing of concrete be suspended or unavoidably interrupted, keyways and bulkheads shall be provided and steps taken to prevent feather-edging when work is resumed. Horizontal surfaces shall be roughened for bond.
- G. Concrete shall be deposited within thirty (30) minutes of completion of mixing. If set retarding admixtures are used, concrete shall be deposited as recommended by the admixture manufacturer. In either case, concrete shall be discharged within 150 minutes of addition of cement to mixer.
- H. Retempering concrete, at the project site, by adding water or other means shall not be permitted after the initial specified slump has been obtained and site added admixtures are discharged.

3.6 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - 1. Apply to concrete surfaces not exposed to public view.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

3.7 FINISHING FLOORS AND SLABS

- A. For Exterior Slabs on Grade, perform work in accordance with Division 32 Section 321623 “Concrete Sidewalks”.
- B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.
- C. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 - 1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
 - 2. Finish surfaces to the following tolerances, according to [ASTM E 1155](#), for a randomly trafficked floor surface:
 - a. Specified overall values of flatness, F(F) 45; and of levelness, F(L) 35; with minimum local values of flatness, F(F) 30; and of levelness, F(L) 24.

3.8 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
- B. Evaporation Retarder: Contractor may apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause rapid moisture loss. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

- D. Curing Compound: Apply curing compound immediately after final finishing. Apply according to manufacturer's written instructions.
- E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.9 CONCRETE SURFACE REPAIRS

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

3.10 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner's Representative will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

Testing Services: Tests shall be performed according to ACI 301.

- B. The following Inspections will be performed:

- 1. Steel reinforcement placement.
- 2. Verification of use of required design mixture.
- 3. Concrete placement, including conveying and depositing.
- 4. Curing procedures and maintenance of curing temperature.
- 5. Verification of concrete strength.

- C. Concrete Tests (to be performed by the independent testing agency): Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

- 1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 4 cu. yd., but less than 20 cu. yd., plus one set for each additional 40 cu. yd. or fraction thereof.
 - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C 31/C 31M.
 - a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
 - a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
 - b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
7. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi .
8. Test results shall be reported in writing to the Owner's Representative, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
9. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Owners Representative but will not be used as sole basis for approval or rejection of concrete.
10. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by the Owner's Representative. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Owner's Representative.
11. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
12. Contractor shall correct deficiencies in the Work that test reports and inspections indicate does not comply with the Contract Documents. Contractor's method of correcting any deficiencies in the work shall be approved by the Owner's Representative.

END OF SECTION 033000

SECTION 042200 – CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Concrete masonry units.
 - 2. Mortar and grout.
 - 3. Masonry joint reinforcement.
 - 4. Miscellaneous masonry accessories.

1.3 DEFINITIONS

- A. CMU(s): Concrete masonry unit(s).
- B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For the following:
 - 1. Masonry Units: Show sizes, profiles, coursing, locations of special shapes and finishes.
 - 2. Fabricated Flashing: Detail corner units, and other special applications.

1.5 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For each type and size of the following:
 - 1. Masonry units.
 - a. Include data on material properties material test reports substantiating compliance with requirements.
 - b. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.

- B. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1.6 QUALITY ASSURANCE

- A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.
- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.
- C. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.
- D. Mockups: Build in place mockup to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Build mockup of typical wall area as shown on Drawings.
 - 2. Build mockups for typical exterior wall in sizes approximately 48 inches long by 48 inches high by full thickness, including face and backup wythes and accessories.
 - a. Include a sealant-filled joint at least 16 inches long in exterior wall mockup.
 - 3. Protect accepted mockups from the elements with weather-resistant membrane.
 - 4. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.
 - a. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
 - b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.
 - 5. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Contractor shall be responsible to protect against all construction generated mortar dust. The contractor shall be responsible for all costs associated with cleanup of mortar dust.
- B. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

- C. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in covered weatherproof dispensing silos.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.8 PROJECT CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 - 1. Extend cover a minimum of 24 inches down both sides of walls and hold cover securely in place.
- B. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
 - 1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 - 2. Protect sills, ledges, and projections from mortar droppings.
 - 3. Protect surfaces of door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 - 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- C. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
 - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than 7 days after completing cleaning.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

- A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.

2.2 CONCRETE MASONRY UNITS

- A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
 - 1. Provide special shapes for movement joints, bonding, and other special conditions.
 - 2. Provide square-edged units for outside corners unless otherwise indicated.
- B. Decorative CMUs: ASTM C 90.
 - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2150 psi.
 - 2. Density Classification: Normal weight.
 - 3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
 - 4. Size (Width): Manufactured to the following dimensions: 8"x8"x16" Nominal
 - 5. Pattern and texture: Standard pattern, ground-face finish.
 - 6. Colors: As selected by Architect from manufacturer's full range.
 - 7. All units shall be square, true, and have sharp edges.
- C. Integral Water Repellant: Provide units made with liquid polymeric, integral water repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent admixture, when tested as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive according to ASTM E514, with test period extended to 24 hours, show no visible water or leaks on the back of the test specimen.

2.3 MORTAR AND GROUT MATERIAL

- A. Mortar Cement: ASTM C 1329.
- B. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979. Use only pigments with a record of satisfactory performance in masonry mortar.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Davis Colors; True Tone Mortar Colors.
 - b. Lanxess Corporation; Bayferrox Iron Oxide Pigments.
 - c. Solomon Colors, Inc.; SGS Mortar Colors.
- C. Aggregate for Mortar: ASTM C 144.
- D. Aggregate for Grout: ASTM C 404.
- E. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
- F. Water: Potable.

2.4 REINFORCEMENT

- A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.
- B. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.

2.5 TIES AND ANCHORS

- A. General: Ties and anchors shall extend at least 1-1/2 inches into veneer but with at least a 5/8-inch cover on outside face.
- B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:
 - 1. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304.
- C. Adjustable Anchors for Connecting to Structural Wood Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
 - 1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch-diameter, stainless-steel wire.
 - 2. Tie Section: Triangular-shaped wire tie made from 0.187-inch- diameter, stainless-steel wire.
- D. Adjustable Masonry-Veneer Anchors:
 - 1. General: Provide anchors that allow vertical adjustment but resist a 100-lbf load in both tension and compression perpendicular to plane of wall without deforming or developing play in excess of 1/16 inch.

2.6 MISCELLANEOUS ANCHORS

- A. Anchor Bolts: Headed steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153/A 153M, Class C; of dimensions indicated.
- B. Post installed Anchors: Chemical anchors as indicated.

2.7 MORTAR AND GROUT MIXES

- A. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- B. Mortar for Unit Masonry: Comply with ASTM C 270 Specifications. Provide the following types of mortar for applications stated unless another type is indicated.
 - 1. For reinforced masonry, use Type S.

2. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type S.
- C. Grout for Unit Masonry: Comply with ASTM C 476.
1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
 2. Proportion grout in accordance with ASTM C 476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 3000 psi.
 3. Provide grout with a slump of 9 inches as measured according to ASTM C 143/C 143M.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
 2. Verify that foundations are within tolerances specified.
 3. Verify that reinforcing dowels are properly placed.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

3.3 TOLERANCES

- A. Dimensions and Locations of Elements:
1. For dimensions in cross section or elevation do not vary by more than plus 1/2 inch or minus 1/4 inch.
 2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 inch.
 3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
3. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch.

3.4 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
- C. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar before laying fresh masonry.
- D. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- E. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.
- F. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.
- G. Fill cores in hollow CMUs with grout full height under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

3.5 MORTAR BEDDING AND JOINTING

- A. Lay hollow CMUs as follows:
 - 1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
 - 2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
 - 3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
 - 4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.
- B. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise specified.

3.6 ANCHORED MASONRY VENEERS

- A. Anchor masonry veneers to wall framing with masonry-veneer anchors to comply with the following requirements:
 - 1. Fasten screw-attached anchors through sheathing to wall framing with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
 - 2. Embed tie sections in masonry joints.
 - 3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
 - 4. Space anchors as indicated, but not more than 18 inches o.c. vertically and 24 inches o.c. horizontally, with not less than one anchor for each 2 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 8 inches, around perimeter.
- B. Provide not less than 2 inches of airspace between back of masonry veneer and face of sheathing.
 - 1. Keep airspace clean of mortar droppings and other materials during construction. Bevel beds away from airspace, to minimize mortar protrusions into airspace. Do not attempt to trowel or remove mortar fins protruding into airspace.

3.7 MASONRY JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
 - 1. Space reinforcement not more than 16 inches o.c.
 - 2. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings in addition to continuous reinforcement.
- B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.
- C. Provide continuity at wall intersections by using prefabricated T-shaped units.

- D. Provide continuity at corners by using prefabricated L-shaped units.
- E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.8 CONTROL AND EXPANSION JOINTS

- A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

3.9 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owners representative will engage special inspectors to perform tests and inspections and prepare reports. Contractor shall allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to meet specified requirements shall be done at Contractor's expense.
- B. Inspections: Level 1 special inspections according to the "International Building Code."
 - 1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
 - 2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
 - 3. Place grout only after inspectors have verified proportions of site-prepared grout.
- C. Testing Prior to Construction: One set of tests.
- D. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.
- E. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.
- F. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.
- G. Mortar Test (Property Specification): For each mix provided, according to ASTM C 780. Test mortar for mortar air content and compressive strength.
- H. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.
- I. Prism Test: For each type of construction provided, according to ASTM C 1314 at 7 days and at 28 days.

3.10 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
 - 3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
 - 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
 - 5. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.11 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
- B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
 - 1. Crush masonry waste to less than 4 inches in each dimension.
 - 2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Section 312000 "Earth Moving."
 - 3. Do not dispose of masonry waste as fill within 18 inches of finished grade.
- C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

3.11 SCAFFOLDING

- A. No putlog holes will be permitted for the exterior work.

END OF SECTION 042200

SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Structural steel.
 - 2. Field-installed shear connectors.
 - 3. Grout.

- B. Related Requirements:

- 1. Section 051213 "Architecturally Exposed Structural Steel Framing" for additional requirements for architecturally exposed structural steel.
 - 2. Section 053100 "Steel Decking" for field installation of shear connectors through deck.
 - 3. Section 055000 "Metal Fabrications" for steel lintels and shelf angles not attached to structural-steel frame miscellaneous steel fabrications and other steel items not defined as structural steel.
 - 4. Section 099113 "Exterior Painting" and Section 099123 "Interior Painting" and Section 099600 "High-Performance Coatings" for surface-preparation and priming requirements.

1.3 DEFINITIONS

- A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."
- B. Seismic-Load-Resisting System: Elements of structural-steel frame designated as "SLRS" or along grid lines designated as "SLRS" on Drawings, including columns, beams, and braces and their connections.
- C. Heavy Sections: Rolled and built-up sections as follows:
 - 1. Shapes included in ASTM A 6/A 6M with flanges thicker than 1-1/2 inches.
 - 2. Welded built-up members with plates thicker than 2 inches.
 - 3. Column base plates thicker than 2 inches.
- D. Protected Zone: Structural members or portions of structural members indicated as "Protected Zone" on Drawings. Connections of structural and nonstructural elements to protected zones are limited.

- E. Demand Critical Welds: Those welds, the failure of which would result in significant degradation of the strength and stiffness of the Seismic-Load-Resisting System and which are indicated as "Demand Critical" or "Seismic Critical" on Drawings.

1.4 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
 - 1. **Product Data:** For recycled content, indicating postconsumer and preconsumer recycled content and cost.
- C. Shop Drawings: Show fabrication of structural-steel components.
 - 1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
 - 2. Include embedment Drawings.
 - 3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
 - 4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.
- D. Delegated-Design Submittal: For structural-steel connections indicated to comply with design loads, include analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and fabricator.
- B. Welding certificates.

- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- D. Mill test reports for structural steel, including chemical and physical properties.
- E. Product Test Reports: For the following:
 - 1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
 - 2. Direct-tension indicators.
 - 3. Tension-control, high-strength, bolt-nut-washer assemblies.
 - 4. Shear stud connectors.
 - 5. Shop primers.
 - 6. Nonshrink grout.
- F. Source quality-control reports.
- G. Field quality-control and special inspection reports.

1.8 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.
- B. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category ACSE.
- C. Shop-Painting Applicators: Qualified according to AISC's Sophisticated Paint Endorsement P1 or to SSPC-QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators."
- D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- E. Comply with applicable provisions of the following specifications and documents:
 - 1. AISC 303.
 - 2. AISC 341 and AISC 341s1.
 - 3. AISC 360.
 - 4. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
 - 1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

- B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
 - 1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
 - 2. Clean and relubricate bolts and nuts that become dry or rusty before use.
 - 3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator, including comprehensive engineering analysis by a qualified professional engineer, to withstand loads indicated and comply with other information and restrictions indicated.
 - 1. Select and complete connections using schematic details indicated and AISC 360.
 - 2. Use Allowable Stress Design; data are given at service-load level.
- B. Moment Connections: Type FR, fully restrained.
- C. Construction: Combined system of moment frame and braced frame.

2.2 STRUCTURAL-STEEL MATERIALS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than the following:
 - 1. W-Shapes: 60 percent.
 - 2. Channels, Angles, M , S-Shapes: 60 percent.
 - 3. Plate and Bar: 25 percent.
 - 4. Cold-Formed Hollow Structural Sections: 25 percent.
 - 5. Steel Pipe: 25 percent.
 - 6. All Other Steel Materials: 25 percent.
- C. W-Shapes: ASTM A 992/A 992M.
- D. Channels, Angles, M , S-Shapes: ASTM A 36/A 36M.
- E. Plate and Bar: ASTM A 36/A 36M.
- F. Corrosion-Resisting Structural-Steel Shapes, Plates, and Bars: ASTM A 588/A 588M, Grade 50.

- G. Cold-Formed Hollow Structural Sections: ASTM A 500/A 500M, Grade B, structural tubing.
- H. Corrosion-Resisting, Cold-Formed Hollow Structural Sections: ASTM A 847/A 847M, structural tubing.
- I. Steel Pipe: ASTM A 53/A 53M, Type E or Type S, Grade B.
 - 1. Weight Class: As indicated.
 - 2. Finish: Black except where indicated to be galvanized.
- J. Steel Castings: ASTM A 216/A 216M, Grade WCB with supplementary requirement S11.
- K. Steel Forgings: ASTM A 668/A 668M.
- L. Welding Electrodes: Comply with AWS requirements.

2.3 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers; all with plain finish.
 - 1. Direct-Tension Indicators: ASTM F 959, Type 325, compressible-washer type with plain finish.
- B. High-Strength Bolts, Nuts, and Washers: ASTM A 490, Type 1, heavy-hex steel structural bolts or tension-control, bolt-nut-washer assemblies with splined ends; ASTM A 563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers with plain finish.
 - 1. Direct-Tension Indicators: ASTM F 959, Type 490, compressible-washer type with plain finish.
- C. Zinc-Coated High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade DH heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers.
 - 1. Finish: Hot-dip or mechanically deposited zinc coating.
 - 2. Direct-Tension Indicators: ASTM F 959, Type 325, compressible-washer type with mechanically deposited zinc coating finish.
- D. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, heavy-hex head assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.
 - 1. Finish: Mechanically deposited zinc coating.
- E. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.

F. Unheaded Anchor Rods: ASTM F 1554, Grade 36.

1. Configuration: Hooked.
2. Nuts: ASTM A 563 heavy-hex carbon steel.
3. Plate Washers: ASTM A 36/A 36M carbon steel.
4. Washers: ASTM F 436, Type 1, hardened carbon steel.
5. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C.

G. Headed Anchor Rods: ASTM F 1554, Grade 36, straight.

1. Nuts: ASTM A 563 heavy-hex carbon steel.
2. Plate Washers: ASTM A 36/A 36M carbon steel.
3. Washers: ASTM F 436, Type 1, hardened carbon steel.
4. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C.

H. Threaded Rods: ASTM A 36/A 36M.

1. Nuts: ASTM A 563 heavy-hex carbon steel.
2. Washers: ASTM A 36/A 36M carbon steel.
3. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C.

I. Clevises and Turnbuckles: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1035.

J. Eye Bolts and Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1030.

K. Sleeve Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1018.

2.4 PRIMER

- A. Primer: Comply with Section 099113 "Exterior Painting," Section 099123 "Interior Painting," and Section 099600 "High-Performance Coatings."
- B. Primer: SSPC-Paint 25, Type II, zinc oxide, alkyd, linseed oil primer.
- C. Primer: SSPC-Paint 25 BCS, Type II, zinc oxide, alkyd, linseed oil primer.
- D. Primer: SSPC-Paint 23, latex primer.
- E. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.
- F. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20.

2.5 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107/C 1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.6 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," and to AISC 360.
 - 1. Camber structural-steel members where indicated.
 - 2. Fabricate beams with rolling camber up.
 - 3. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
 - 4. Mark and match-mark materials for field assembly.
 - 5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
 - 1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.
- C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.
- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.
- F. Steel Wall-Opening Framing: Select true and straight members for fabricating steel wall-opening framing to be attached to structural-steel frame. Straighten as required to provide uniform, square, and true members in completed wall framing. Build up welded framing, weld exposed joints continuously, and grind smooth.
- G. Welded Door Frames: Build up welded door frames attached to structural-steel frame. Weld exposed joints continuously and grind smooth. Plug-weld fixed steel bar stops to frames. Secure removable stops to frames with countersunk machine screws, uniformly spaced not more than 10 inches o.c. unless otherwise indicated.
- H. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.
 - 1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
 - 2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
 - 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.7 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened.
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

2.8 SHOP PRIMING

- A. Shop prime steel surfaces except the following:
 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
 2. Surfaces to be field welded.
 3. Surfaces of high-strength bolted, slip-critical connections.
 4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
 5. Galvanized surfaces.
 6. Surfaces enclosed in interior construction.
- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
 1. SSPC-SP 11, "Power Tool Cleaning to Bare Metal."
- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

2.9 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.
 1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.
 2. Galvanize lintels shelf angles and welded door frames attached to structural-steel frame and located in exterior walls.

2.10 SOURCE QUALITY CONTROL

- A. Bolted Connections: Inspect shop-bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- B. Welded Connections: Visually inspect shop-welded connections according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 1. Liquid Penetrant Inspection: ASTM E 165.

2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
 3. Ultrasonic Inspection: ASTM E 164.
 4. Radiographic Inspection: ASTM E 94.
- C. In addition to visual inspection, test and inspect shop-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
 2. Conduct tests according to requirements in AWS D1.1/D1.1M on additional shear connectors if weld fracture occurs on shear connectors already tested.
- D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
1. Prepare a certified survey of existing conditions. Include bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.
1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
- B. Baseplates Bearing Plates and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.
 2. Weld plate washers to top of baseplate.
 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- C. Maintain erection tolerances of structural steel within AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."
- D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
1. Level and plumb individual members of structure.
 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- E. Splice members only where indicated.
- F. Do not use thermal cutting during erection.
- G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.
- H. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
1. Joint Type: Snug tightened.
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
 2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
 3. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," for mill material.

3.5 PREFABRICATED BUILDING COLUMNS

- A. Install prefabricated building columns to comply with AISC 360, manufacturer's written recommendations, and requirements of testing and inspecting agency that apply to the fire-resistance rating indicated.

3.6 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
 - 1. Verify structural-steel materials and inspect steel frame joint details.
 - 2. Verify weld materials and inspect welds.
 - 3. Verify connection materials and inspect high-strength bolted connections.
- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- C. Bolted Connections: Inspect bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- D. Welded Connections: Visually inspect field welds according to AWS D1.1/D1.1M.
 - 1. In addition to visual inspection, test and inspect field welds according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 - a. Liquid Penetrant Inspection: ASTM E 165.
 - b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
 - c. Ultrasonic Inspection: ASTM E 164.
 - d. Radiographic Inspection: ASTM E 94.
- E. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
 - 1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
 - 2. Conduct tests according to requirements in AWS D1.1/D1.1M on additional shear connectors if weld fracture occurs on shear connectors already tested.

3.7 REPAIRS AND PROTECTION

- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780/A 780M.
- B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

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1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

END OF SECTION 051200

SECTION 052100 - STEEL JOIST FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. K-series steel joists.
- 2. KCS-type K-series steel joists.
- 3. K-series steel joist substitutes.
- 4. LH- and DLH-series long-span steel joists.
- 5. CJ-series composite steel joists.
- 6. Joist girders.
- 7. Joist accessories.

- B. Related Requirements:

- 1. Section 033000 "Cast-in-Place Concrete" for installing bearing plates in concrete.
- 2. Section 042000 "Unit Masonry" for installing bearing plates in unit masonry.
- 3. Section 051200 "Structural Steel Framing" for field-welded shear connectors.

1.3 DEFINITIONS

- A. SJI's "Specifications": Steel Joist Institute's "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders."
- B. Special Joists: Steel joists or joist girders requiring modification by manufacturer to support nonuniform, unequal, or special loading conditions that invalidate load tables in SJI's "Specifications."

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of joist, accessory, and product.
- B. Sustainable Design Submittals:
 - 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
- C. Shop Drawings:

1. Include layout, designation, number, type, location, and spacing of joists.
2. Include joining and anchorage details, bracing, bridging, and joist accessories; splice and connection locations and details; and attachments to other construction.
3. Indicate locations and details of bearing plates to be embedded in other construction.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer.
- B. Welding certificates.
- C. Manufacturer certificates.
- D. Mill Certificates: For each type of bolt.
- E. Comprehensive engineering analysis of special joists signed and sealed by the qualified professional engineer responsible for its preparation.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A manufacturer certified by SJI to manufacture joists complying with applicable standard specifications and load tables in SJI's "Specifications" and "Standard Specifications for Composite Steel Joists, CJ-Series" in "Standard Specifications for Composite Steel Joists, Weight Tables and Bridging Tables, Code of Standard Practice."
 1. Manufacturer's responsibilities include providing professional engineering services for designing special joists to comply with performance requirements.
- B. Welding Qualifications: Qualify field-welding procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle joists as recommended in SJI's "Specifications" and "Standard Specifications for Composite Steel Joists, CJ-Series" in "Standard Specifications for Composite Steel Joists, Weight Tables and Bridging Tables, Code of Standard Practice."
- B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

1.8 SEQUENCING

- A. Deliver steel bearing plates to be built into cast-in-place concrete and masonry construction.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide special joists and connections capable of withstanding design loads indicated.
 - 1. Use ASD; data are given at service-load level.
 - 2. Design special joists to withstand design loads with live-load deflections no greater than the following:
 - a. Floor Joists: Vertical deflection of 1/360 of the span.
 - b. Roof Joists: Vertical deflection of 1/240 of the span except for the covered seating canopy. For
- B. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

2.2 K-SERIES STEEL JOISTS

- A. Manufacture steel joists of type indicated according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members, underslung ends, and parallel top chord.
 - 1. Joist Type: K-series steel joists.
- B. Steel Joist Substitutes: Manufacture according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle or -channel members.
- C. Provide holes in chord members for connecting and securing other construction to joists.
- D. Top-Chord Extensions: Extend top chords of joists with SJI's Type S top-chord extensions where indicated, complying with SJI's "Specifications."
- E. Extended Ends: Extend bearing ends of joists with SJI's Type R extended ends where indicated, complying with SJI's "Specifications."
- F. Do not camber joists.
- G. Camber joists as indicated.
- H. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches.

2.3 LONG-SPAN STEEL JOISTS

- A. Manufacture steel joists according to "Standard Specifications for Longspan Steel Joists, LH-Series and Deep Longspan Steel Joists, DLH-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members; of joist type and end and top-chord arrangements as indicated.

- B. Provide holes in chord members for connecting and securing other construction to joists.
- C. Camber long-span steel joists as indicated.
- D. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches.

2.4 COMPOSITE STEEL JOISTS

- A. Manufacture steel joists according to "Standard Specifications for Composite Steel Joists, CJ-Series" in SJI's "Standard Specifications for Composite Steel Joists, Weight Tables and Bridging Tables, Code of Standard Practice," with steel-angle top- and bottom-chord members and parallel top chord, and with underslung or square ends as indicated.
- B. Camber composite steel joists as indicated.

2.5 JOIST GIRDERS

- A. Manufacture joist girders according to "Standard Specifications for Joist Girders" in SJI's "Specifications," with steel-angle top- and bottom-chord members; with end and top-chord arrangements as indicated.
- B. Provide holes in chord members for connecting and securing other construction to joist girders.
- C. Camber joist girders as indicated.
- D. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches.

2.6 PRIMERS

- A. Primer: SSPC-Paint 15, or manufacturer's standard shop primer complying with performance requirements in SSPC-Paint 15.
- B. Primer: Provide shop primer that complies with Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

2.7 JOIST ACCESSORIES

- A. Bridging: Provide bridging anchors and number of rows of horizontal or diagonal bridging of material, size, and type required by SJI's "Specifications" and "Standard Specifications for Composite Steel Joists, CJ-Series" in "Standard Specifications for Composite Steel Joists, Weight Tables and Bridging Tables, Code of Standard Practice" for type of joist, chord size, spacing, and span. Furnish additional erection bridging if required for stability.
- B. Fabricate steel bearing plates from ASTM A 36/A 36M steel with integral anchorages of sizes and thicknesses indicated. Shop prime paint.

- C. Carbon-Steel Bolts and Threaded Fasteners: ASTM A 307, Grade A, carbon-steel, hex-head bolts and threaded fasteners; carbon-steel nuts; and flat, unhardened steel washers.
 - 1. Finish: Mechanically deposited zinc coating, ASTM B 695, Class 50.
- D. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.
 - 1. Finish: Mechanically deposited zinc coating, ASTM B 695, Class 50.
- E. Welding Electrodes: Comply with AWS standards.
- F. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20.
- G. Furnish miscellaneous accessories including splice plates and bolts required by joist manufacturer to complete joist assembly.

2.8 CLEANING AND SHOP PAINTING

- A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories by hand-tool cleaning, SSPC-SP 2 or power-tool cleaning, SSPC-SP 3.
- B. Do not prime paint joists and accessories to receive sprayed fire-resistive materials.
- C. Shop priming of joists and joist accessories is specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting substrates, embedded bearing plates, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Do not install joists until supporting construction is in place and secured.
- B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications" and "Standard Specifications for Composite Steel Joists, CJ-Series" in "Standard Specifications for Composite Steel Joists, Weight Tables and Bridging Tables, Code of Standard Practice," joist manufacturer's written recommendations, and requirements in this Section.
 - 1. Before installation, splice joists delivered to Project site in more than one piece.

2. Space, adjust, and align joists accurately in location before permanently fastening.
 3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.
 4. Delay rigidly connecting bottom-chord extensions to columns or supports until dead loads are applied.
- C. Field weld joists to supporting steel bearing plates and framework. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
- D. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and bolted connections and to perform field tests and inspections and prepare test and inspection reports.
- B. Visually inspect field welds according to AWS D1.1/D1.1M.
- C. Visually inspect bolted connections.
- D. Correct deficiencies in Work that test and inspection reports have indicated are not in compliance with specified requirements.
- E. Perform additional testing to determine compliance of corrected Work with specified requirements.

3.4 PROTECTION

- A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Touchup Painting: Cleaning and touchup painting are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
- C. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that joists and accessories are without damage or deterioration at time of Substantial Completion.

END OF SECTION 052100

SECTION 053100 - STEEL DECKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Roof deck.
- 2. Acoustical roof deck.
- 3. Cellular roof deck.
- 4. Acoustical cellular roof deck.
- 5. Composite floor deck.
- 6. Electrified cellular floor deck.
- 7. Noncomposite form deck.
- 8. Noncomposite vented form deck.

- B. Related Requirements:

- 1. Section 033000 "Cast-in-Place Concrete" for normal-weight and lightweight structural concrete fill over steel deck.
- 2. Section 051200 "Structural Steel Framing" for shop- and field-welded shear connectors.
- 3. Section 099113 "Exterior Painting" for repair painting of primed deck and finish painting of deck.
- 4. Section 099123 "Interior Painting" for repair painting of primed deck and finish painting of deck.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of deck, accessory, and product indicated.

- B. Sustainable Design Submittals:

- 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.

- C. Shop Drawings:

- 1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Product Certificates: For each type of steel deck.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:
 - 1. Power-actuated mechanical fasteners.
 - 2. Acoustical roof deck.
- D. Evaluation Reports: For steel deck.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."
- C. FM Global Listing: Provide steel roof deck evaluated by FM Global and listed in its "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."
- B. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

2.2 ROOF DECK

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. [Canam Steel Corporation; Canam Group, Inc.](#)
 2. [CMC Joist & Deck.](#)
 3. [Nucor Corp.](#)
- B. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:
1. Prime-Painted Steel Sheet: ASTM A 1008/A 1008M, Structural Steel (SS), Grade 33 minimum, shop primed with manufacturer's standard baked-on, rust-inhibitive primer.
 - a. Color: Manufacturer's standard.
 2. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33, zinc coating.
 3. Galvanized and Shop-Primed Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33, G60 zinc coating; cleaned, pretreated, and primed with manufacturer's standard baked-on, rust-inhibitive primer.
 - a. Color: Manufacturer's standard.
 4. Deck Profile: As indicated.
 5. Cellular Deck Profile: As indicated, with bottom plate.
 6. Profile Depth: As indicated.
 7. Design Uncoated-Steel Thickness: As indicated.
 8. Span Condition: Simple span.
 9. Side Laps: Interlocking seam.

2.3 COMPOSITE FLOOR DECK

- A. [Manufacturers:](#) Subject to compliance with requirements, provide products by one of the following:
1. [Canam Steel Corporation; Canam Group, Inc.](#)
 2. [CMC Joist & Deck.](#)
 3. [Nucor Corp.](#)
- B. Composite Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 31, with the minimum section properties indicated, and with the following:
1. Prime-Painted Steel Sheet: ASTM A 1008/A 1008M, Structural Steel (SS), Grade 33 minimum, with top surface phosphatized and unpainted and underside surface shop primed with manufacturers' standard gray or white baked-on, rust-inhibitive primer.
 2. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33, G30 zinc coating.
 3. Galvanized and Shop-Primed Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33, G30 zinc coating; with unpainted top surface and cleaned and pretreated bottom surface primed with manufacturer's standard gray or white baked-on, rust-inhibitive primer.

4. Profile Depth: As indicated.
5. Design Uncoated-Steel Thickness: As indicated.
6. Span Condition: Simple span.

2.4 NONCOMPOSITE FORM DECK

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Canam Steel Corporation; Canam Group, Inc.
2. CMC Joist & Deck.
3. Nucor Corp.

- B. Noncomposite Form Deck: Fabricate ribbed-steel sheet noncomposite form-deck panels to comply with "SDI Specifications and Commentary for Noncomposite Steel Form Deck," in SDI Publication No. 31, with the minimum section properties indicated, and with the following:

1. Uncoated Steel Sheet: ASTM A 1008/A 1008M, Structural Steel (SS), Grade 33 minimum.
2. Prime-Painted Steel Sheet: ASTM A 1008/A 1008M, Structural Steel (SS), Grade 33 minimum, with underside surface shop primed with manufacturer's standard baked-on, rust-inhibitive primer.
 - a. Color: Manufacturer's standard.
3. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33, G30 zinc coating.
4. Galvanized and Shop-Primed Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33, G60 zinc coating; cleaned, pretreated, and primed with manufacturer's standard baked-on, rust-inhibitive primer.
 - a. Color: Manufacturer's standard.
5. Profile Depth: As indicated.
6. Design Uncoated-Steel Thickness: As indicated.
7. Span Condition: Simple span.
8. Side Laps: Interlocking seam.

2.5 NONCOMPOSITE VENTED FORM DECK

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Canam Steel Corporation; Canam Group, Inc.
2. CMC Joist & Deck.
3. Nucor Corp.

- B. Noncomposite Vented Form Deck: Fabricate ribbed- and vented-steel sheet noncomposite form-deck panels to comply with "SDI Specifications and Commentary for Noncomposite Steel Form Deck," in SDI Publication No. 31, and with the following:
1. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33, G30 zinc coating.
 2. Galvanized and Shop-Primed Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33, G30 zinc coating; cleaned, pretreated, and primed with manufacturer's standard baked-on, rust-inhibitive primer.
 - a. Color: Manufacturer's standard.
 3. Profile Depth: As indicated.
 4. Design Uncoated-Steel Thickness: As indicated.
 5. Span Condition: Simple span.
 6. Side Laps: Interlocking seam.
 7. Vent Slot Area: Manufacturer's standard vent slots providing 1-1/2 percent open area.

2.6 ACCESSORIES

- A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.
- C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.
- D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.
- E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
- F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi, of same material and finish as deck, and of thickness and profile indicated.
- G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.
- H. Piercing Hanger Tabs: Piercing steel sheet hanger attachment devices for use with floor deck.
- I. Flat Sump Plates: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck. For drains, cut holes in the field.
- J. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck, with 3-inch-wide flanges and sloped recessed pans of 1-1/2-inch minimum depth. For drains, cut holes in the field.

- K. Galvanizing Repair Paint: SSPC-Paint 20 or MIL-P-21035B, with dry film containing a minimum of 94 percent zinc dust by weight.
- L. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.
- B. Install temporary shoring before placing deck panels if required to meet deflection limitations.
- C. Locate deck bundles to prevent overloading of supporting members.
- D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
- E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
- H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

3.3 ROOF-DECK INSTALLATION

- A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches long, and as follows:
 - 1. Weld Diameter: 5/8 inch, nominal.
 - 2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds as indicated.

- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of 1/2 of the span or 12 inches, and as follows:
 - 1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
 - 1. End Joints: Lapped 2 inches minimum.
- D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and weld flanges to top of deck. Space welds not more than 12 inches apart with at least one weld at each corner.
 - 1. Install reinforcing channels or zees in ribs to span between supports and weld or mechanically fasten.
- E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld or mechanically fasten to substrate to provide a complete deck installation.
 - 1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.
- F. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

3.4 FLOOR-DECK INSTALLATION

- A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:
 - 1. Weld Diameter: 5/8 inch, nominal.
 - 2. Weld Spacing: Space and locate welds as indicated.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of half of the span or 12 inches, and as follows:
 - 1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
 - 1. End Joints: Lapped.
- D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations unless otherwise indicated.
- E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Field welds will be subject to inspection.
- C. Testing agency will report inspection results promptly and in writing to Contractor and Architect.
- D. Remove and replace work that does not comply with specified requirements.
- E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.6 PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Repair Painting: Wire brushing, cleaning, and repair painting of rust spots, welds, and abraded areas of both deck surfaces are included in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
- C. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 053100

SECTION 061000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Framing with dimension lumber.
2. Wood blocking and nailers.
3. Wood furring.
4. Plywood backing panels.

1.2 ACTION SUBMITTALS

- ##### A. Product Data:
- For each type of process and factory-fabricated product.

1.3 INFORMATIONAL SUBMITTALS

- ##### A. Material Certificates:
- For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.
- ##### B. Evaluation Reports:
- For the following, from ICC-ES:
1. Wood-preservative-treated wood.
 2. Fire-retardant-treated wood.
 3. Engineered wood products.
 4. Shear panels.
 5. Power-driven fasteners.
 6. Post-installed anchors.
 7. Metal framing anchors.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- ##### A. Lumber:
- DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
1. Factory mark each piece of lumber with grade stamp of grading agency.
 2. Dress lumber, S4S, unless otherwise indicated.

- B. Maximum Moisture Content of Lumber: 19 percent unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWP A U1; Use Category UC2.
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- D. Application: Treat all rough carpentry unless otherwise indicated.
 - 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 - 2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
 - 3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
 - 4. Wood framing members that are less than 18 inches (460 mm) above the ground in crawlspaces or unexcavated areas.
 - 5. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 DIMENSION LUMBER FRAMING

- A. Non-Load-Bearing Interior Partitions: Construction or No. 2 grade.
 - 1. Application: All interior partitions.
 - 2. Species:
 - a. Southern pine or mixed southern pine; SPIB.
 - b. Northern species; NLGA.
- B. Framing Other Than Non-Load-Bearing Partitions: No. 2 grade.
 - 1. Application: Framing other than interior partitions.
 - 2. Species:
 - a. Hem-fir (north); NLGA.
 - b. Southern pine; SPIB.
 - c. Douglas fir-larch; WCLIB or WWPA.
 - d. Spruce-pine-fir; NLGA.
 - e. Douglas fir-south; WWPA.
 - f. Hem-fir; WCLIB or WWPA.
 - g. Douglas fir-larch (north); NLGA.

- h. Spruce-pine-fir (south); NeLMA, WCLIB, or WWP.

2.4 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
 - 1. Blocking.
 - 2. Nailers.
 - 3. Rooftop equipment bases and support curbs.
 - 4. Cants.
 - 5. Furring.
 - 6. Grounds.
- B. Dimension Lumber Items: Construction or No. 2 grade lumber of any species.
- C. Concealed Boards: 19 percent maximum moisture content and any of the following species and grades:
 - 1. Mixed southern pine or southern pine; No. 2 grade; SPIB.
 - 2. Eastern softwoods; No. 2 Common grade; NeLMA.
 - 3. Northern species; No. 2 Common grade; NLGA.
 - 4. Western woods; Construction or No. 2 Common grade; WCLIB or WWP.

2.5 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: Plywood, DOC PS 1, Exterior, A-C, in thickness indicated or, if not indicated, not less than 3/4-inch (19-mm) nominal thickness.

2.6 FASTENERS

- A. General: Fasteners shall be of size and type indicated and shall comply with requirements specified in this article for material and manufacture.
 - 1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- C. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 ICC-ES AC58 ICC-ES AC193 or ICC-ES AC308 as appropriate for the substrate.

2.7 MISCELLANEOUS MATERIALS

- A. Sill-Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6.4 mm) thick, selected from manufacturer's standard widths to suit width of sill members indicated.
- B. Adhesives for Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- B. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
- C. Do not splice structural members between supports unless otherwise indicated.
- D. Comply with AWP A M4 for applying field treatment to cut surfaces of preservative-treated lumber.
- E. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- F. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code (IBC).
 - 2. ICC-ES evaluation report for fastener.

3.2 PROTECTION

- A. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061000

SECTION 061753 - SHOP-FABRICATED WOOD TRUSSES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wood roof trusses.

1.2 ACTION SUBMITTALS

A. Product Data: For metal-plate connectors, metal truss accessories, and fasteners.

B. Shop Drawings: Show fabrication and installation details for trusses.

1. Show location, pitch, span, camber, configuration, and spacing for each type of truss required.
2. Indicate sizes, stress grades, and species of lumber.
3. Indicate locations of permanent bracing required to prevent buckling of individual truss members due to design loads.
4. Indicate locations, sizes, and materials for permanent bracing required to prevent buckling of individual truss members due to design loads.
5. Indicate type, size, material, finish, design values, orientation, and location of metal connector plates.
6. Show splice details and bearing details.

C. Delegated-Design Submittal: For metal-plate-connected wood trusses indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

A. Product Certificates: For metal-plate-connected wood trusses, signed by officer of truss-fabricating firm.

B. Evaluation Reports: For the following, from ICC-ES:

1. Metal-plate connectors.
2. Metal truss accessories.

1.4 QUALITY ASSURANCE

A. Metal Connector-Plate Manufacturer Qualifications: A manufacturer that is a member of TPI and that complies with quality-control procedures in TPI 1 for manufacture of connector plates.

1. Manufacturer's responsibilities include providing professional engineering services needed to assume engineering responsibility.
 2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
- B. Fabricator Qualifications: Shop that participates in a recognized quality-assurance program, complies with quality-control procedures in TPI 1, and involves third-party inspection by an independent testing and inspecting agency acceptable to Architect and authorities having jurisdiction.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Handle and store trusses to comply with recommendations in SBCA BCSI, "Building Component Safety Information: Guide to Good Practice for Handling, Installing, Restraining, & Bracing Metal Plate Connected Wood Trusses."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design metal-plate-connected wood trusses.
- B. Structural Performance: Metal-plate-connected wood trusses shall be capable of withstanding design loads within limits and under conditions indicated. Comply with requirements in TPI 1.
- C. Comply with applicable requirements and recommendations of TPI 1, TPI DSB, and SBCA BCSI.
- D. Wood Structural Design Standard: Comply with applicable requirements in AF&PA's "National Design Specifications for Wood Construction" and its "Supplement."

2.2 DIMENSION LUMBER

- A. Lumber: DOC PS 20 and applicable rules of any rules-writing agency certified by the American Lumber Standard Committee (ALSC) Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
1. Provide dry lumber with 19 percent maximum moisture content at time of dressing.
- B. Permanent Bracing: Provide wood bracing that complies with requirements for miscellaneous lumber in Section 061000 "Rough Carpentry."

2.3 METAL CONNECTOR PLATES

- A. General: Fabricate connector plates to comply with TPI 1.

- B. Hot-Dip Galvanized-Steel Sheet: ASTM A 653/A 653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G60 (Z180) coating designation; and not less than 0.036 inch (0.9 mm) thick.

2.4 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 - 1. Provide fasteners for use with metal framing anchors that comply with written recommendations of metal framing manufacturer.
 - 2. Where trusses are exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Nails, Brads, and Staples: ASTM F 1667.

2.5 METAL FRAMING ANCHORS AND ACCESSORIES

- A. Allowable design loads, as published by manufacturer, shall comply with or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency. Framing anchors shall be punched for fasteners adequate to withstand same loads as framing anchors.
- B. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 (Z180) coating designation.

2.6 FABRICATION

- A. Assemble truss members in design configuration indicated; use jigs or other means to ensure uniformity and accuracy of assembly, with joints closely fitted to comply with tolerances in TPI 1. Position members to produce design camber indicated.
 - 1. Fabricate wood trusses within manufacturing tolerances in TPI 1.
- B. Connect truss members by metal connector plates located and securely embedded simultaneously in both sides of wood members by air or hydraulic press.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install wood trusses only after supporting construction is in place and is braced and secured.
- B. If trusses are delivered to Project site in more than one piece, assemble trusses before installing.

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- C. Hoist trusses in place by lifting equipment suited to sizes and types of trusses required, exercising care not to damage truss members or joints by out-of-plane bending or other causes.
- D. Install and brace trusses according to TPI recommendations and as indicated.
- E. Anchor trusses securely at bearing points; use metal truss tie-downs or floor truss hangers as applicable. Install fasteners through each fastener hole in metal framing anchors according to manufacturer's fastening schedules and written instructions.
- F. Install and fasten permanent bracing during truss erection and before construction loads are applied. Anchor ends of permanent bracing where terminating at walls or beams.
 - 1. Install bracing to comply with Section 061000 "Rough Carpentry."
- G. Install wood trusses within installation tolerances in TPI 1.
- H. Do not alter trusses in field. Do not cut, drill, notch, or remove truss members.
- I. Replace wood trusses that are damaged or do not comply with requirements.

END OF SECTION 061753

SECTION 129300 - SITE FURNISHINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Bollards.
 - 2. Hitching Rail for Horses
- B. Related Sections include the following:
 - 1. Division 03 Section "Cast-in-Place Concrete" for installation of pipe tubings in concrete.
 - 2. Division 31 Section "Earth Moving" for excavation for installation of concrete footings.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Initial Selection: For units with factory-applied color finishes, or type of paint to be used if field applied.

1.3 QUALITY ASSURANCE

- A. Source Limitations: Obtain Bollards through one source from a single manufacturer.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Steel: Hot-formed welded and seamless carbon steel structural tubing or cold-formed welded and seamless structural tubing, free of surface blemishes and complying with the following:
 - 1. 6 inch OD Schedule 40 steel pipe.
 - 2. Tubing:
 - a. Hot-formed steel tubing complying with ASTM A 501 M.
 - b. Cold-formed steel tubing complying with ASTM A 500
 - 3. Mechanical Tubing: Cold-rolled, electric-resistance-welded carbon or alloy steel tubing complying with ASTM A 513, or steel tubing fabricated from steel complying with ASTM A 1011 and complying with dimensional tolerances in ASTM A 500; zinc coated internally and externally.
- B. Concrete Foundation: As per Division 03 Section "Cast-in-Place Concrete" (Section 033000).

2.2 BOLLARDS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Canterbury International.
 - 2. Columbia Cascade Company.
 - 3. FairWeather Site Furnishings.
 - 4. Maglin Furniture Systems Ltd.
 - 5. Urban Accessories, Inc.
- B. Bollard Construction:
 - 1. Tubing OD: Not less than 6 inches fluted.
 - a. Steel: Schedule 40 pipe.
 - 2. Style: Welded Flat or Dome top as indicated on the Project Plans.
 - 3. Overall Height, Width, and Depth: As indicated on the Drawings.
- C. Steel Finish: Color coated.
 - 1. Color: Safety Yellow. Color to be approved by the Owner's Representative.
 - 2. Painted: The Contractor shall paint all outside surfaces of the post, top and fittings of the bollard. All surfaces shall be painted with one coat dull orange primer (NYSDOT 2018 Standard Specifications, Section 708-04) on outside faces, and shall be field painted two coats with the color indicated above, following the method prescribed in NYSDOT 2018 Standard Specifications, Section 708-02-01, Structural Steel Paints.

2.3 HITCHING RAIL

- 1. Refer to Detail provided in the Project Plans. Provide Shop Drawing for proposed method of materials and fabrication.
- B. Hitching Rail Construction:
 - 1. Schedule 40 Steel Pipe, mild steel.
 - 2. Finish: Painted: The Contractor shall paint all outside surfaces of the post, top and fittings of the Hitching Rail. All surfaces shall be painted with one coat dull orange primer (NYSDOT 2018 Standard Specifications, Section 708-04) on outside faces, and shall be field painted two coats with the color indicated above, following the method prescribed in NYSDOT 2018 Standard Specifications, Section 708-02-01, Structural Steel Paints.
 - 3. Color: Forest Green or Green selected by Architect from manufacturer's full range. Final color to be confirmed with the Owner's Representative.

2.4 FABRICATION

- A. Metal Components: Form to required shapes and sizes with true, consistent curves, lines, and angles. Separate metals from dissimilar materials to prevent electrolytic action.
- B. Welded Connections: No mill transverse welds will be permitted on the post sections except in top fabrication. Longitudinal welds shall be made by the resistance, gas shield arc, submerged arc or plasma arc welded process; shall be sound, free from defects, and shall not be repaired. Weld connections continuously. Weld hollow members with full-circumference welds. At exposed connections, finish surfaces smooth and blended so no roughness or unevenness shows after finishing and welded surface matches contours of adjoining surfaces.

2.5 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Baked-Enamel, Powder-Coat Finish: Manufacturer's standard, baked, polyester, powder-coat finish complying with finish manufacturer's written instructions for surface preparation, including pretreatment, application, baking, and minimum dry film thickness.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finished grade, mounting surfaces, installation tolerances, and other conditions affecting performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. All surfaces of the bollard shall be painted as shown in the Contract Documents.
- B. Reflectorized object markers shall be placed on the bollard as indicated in the Contract Documents.
- C. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated.

- D. Unless otherwise indicated, install bollards after landscaping and paving have been completed.
- E. Bollards shall be set cast-in support posts in concrete footing with smooth top, shaped to shed water, at locations indicated on Drawings. Protect portion of posts above footing from concrete splatter. Verify that posts are set plumb or at correct angle and are aligned and at correct height and spacing. Hold bollards in position during placement and finishing operations until concrete is sufficiently cured.

3.3 CLEANING

- A. After completing site furnishing installation, inspect components. Remove spots, dirt, and debris. Repair damaged finishes to match original finish or replace component.

3.4 FIELD QUALITY CONTROL

- A. The Contractor shall be responsible for their maintenance until the final acceptance of the contract, keeping them in their proper location and condition at all times.

END OF SECTION 129300

SECTION 223000 – PLUMBING – GENERAL

PART 1 GENERAL

1.1 SCOPE

- A. Sanitary Sewer System
- B. Pipe and Pipe Fittings
- C. Floor Drains
- D. Cleanouts
- E. Oil Interceptor

1.2 RELATED WORK

- A. Division 31 - Excavation, Trenching & Backfill

1.3 REFERENCES

- A. ANSI Standards
- B. ASME Standards
- C. ASSE Standards
- D. Local and State Building Codes

1.4 SUBMITTALS

- A. Include data on pipe material, drains, cleanouts, oil interceptor and accessories.

1.5 QUALITY ASSURANCE

- A. Sanitary and vent system plastic pipe, fittings and pipe related components shall be Third-Party Certified. All other pipe materials shall be Third-Party Tested.
- B. All cast iron pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute and be listed by NSF International.

PART 2 PRODUCTS

2.1 SANITARY SEWER PIPING – BURIED

- | | | |
|----|-----------------|--|
| A. | Cast Iron Pipe: | ASTM A74 service weight |
| | Fittings: | Cast iron |
| | Joints: | Hub & Spigot, ASTM C564, neoprene gasketing system |
| B. | PVC Pipe: | ASTM D 2665 |
| | Fittings: | PVC |
| | Joints: | ASTM D2665, solvent weld |

2.2 FLOOR DRAINS

- A. Floor Drain, FD, (Toilet Rooms): Coated cast iron body with 6-inch square nickel bronze adjustable strainer with square holes, Model ZN-415-S manufactured by Zurn or equal. In line floor drain trap sealer manufactured by Sure-Seal or equal.
- B. Floor Drain, FD "A", (Mechanical Rooms): Coated cast iron body with 9-inch round top, removable sediment bucket, seepage pan, medium duty cast iron anti-tilt slotted grate and combination membrane flashing clamp and frame; Model Z-550-Y manufactured by Zurn or equal. In line floor drain trap sealer manufactured by Sure-Seal or equal.
- C. Floor Drain, FD "B", (Mechatronics Classroom, Instructional Lab, Fabrication Lab): Coated cast iron body with 12-inch diameter wide flange floor drain, heavy duty nickel bronze slotted grate and combination membrane flashing clamp and frame, with suspended sediment bucket; Model ZN-532 manufactured by Zurn or equal. In line floor drain trap sealer manufactured by Sure-Seal or equal.

2.3 CLEANOUTS

- A. Interior Finished Floor Areas (DPCO): Coated cast iron, two piece body with double drainage flange, weep holes, [reversible clamping collar,] and adjustable nickel-bronze strainer, round with scoriated cover in service areas and round or square with depressed cover to accept floor finish in finished floor areas; manufactured by Zurn or equal.

2.4 OIL INTERCEPTOR

- A. Construction: Epoxy coated fabricated steel for flush with installation, 4 inch inlet and outlet, 4 inch internal vent, outside trap seal, easily removable filter screen, heavy traffic reinforced cover, integral extension (approximately 15 inches high but needs to be field verified per invert elevations); Model OS-5633 manufactured by Rockford or equal.
- B. Unit Rating: 65gal/min flow and 100 gallon static capacity.

PART 3 EXECUTION

3.1 PREPARATION

- A. Remove scale and dirt, inside and outside of pipe, before assembly.
- C. Remove welding slag or foreign material from pipe and fitting materials.
- D. Coordinate cutting and forming of floor construction to receive drains to required invert elevations.

3.2 INSTALLATION AND APPLICATION

- A. Route piping in orderly manner and maintain gradient.
- B. Install piping to allow for expansion and contraction without stressing piping, joints or connected equipment.
- C. Establish invert elevations, slopes for drainage to 1/4 inch per foot for piping 3 inches & smaller and 1/8 inch per foot for piping 4 inches and larger.
- D. Excavate in accordance with Division 31.
- E. Backfill in accordance with Division 31.
- F. Install bell and spigot pipe with bell end upstream.
- G. Locate cleanouts at changes in direction of more than 45 degrees on all horizontal runs, where required by Code and elsewhere as shown.
- H. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.

3.3 TESTS

- A. Tests and inspections shall comply with the Plumbing Code of New York State.
- B. Interior Buried Sanitary and Vent Piping: Seal openings; fill with water at minimum 10 feet of head and hold water level constant for two hours. Section test system so that maximum test pressure at any point in system does not exceed 40 psi. Locate test tees as required.

END OF SECTION 223000

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes grounding and bonding systems and equipment, plus the following special applications:
 - 1. Underground distribution grounding.
 - 2. Foundation steel electrodes.
 - 3. Grounding light poles

1.2 ACTION SUBMITTALS

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

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article.
- B. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.
 - 1. Plans showing as-built, dimensioned locations of grounding features specified in "Field Quality Control" Article, including the following:
 - a. Ground rods.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Certified by NETA.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

- B. Comply with UL 467 for grounding and bonding materials and equipment.

2.2 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Burndy; Part of Hubbell Electrical Systems.
 - 2. ERICO International Corporation.
 - 3. ILSCO.
 - 4. O-Z/Gedney; a brand of Emerson Industrial Automation.
 - 5. Thomas & Betts Corporation; A Member of the ABB Group.

2.3 CONDUCTORS

- A. Insulated Conductors: tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Stranded Conductors: ASTM B 8.
 - 3. Tinned Conductors: ASTM B 33.
 - 4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
 - 5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.

2.4 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- C. Cable-to-Cable Connectors: Compression type, copper or copper alloy.
- D. Conduit Hubs: Mechanical type, terminal with threaded hub.
- E. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.

2.5 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 2/0 AWG minimum.
 - 1. Bury at least 24 inches below grade.
- C. Conductor Terminations and Connections:
 - 1. Underground Connections: Welded connectors.

3.2 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

- A. Comply with IEEE C2 grounding requirements.
- B. Pad-Mounted Transformers: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches from the foundation.

3.3 EQUIPMENT GROUNDING

- A. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.4 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.
 - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
- C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

D. Grounding Concrete Encased Electrodes:

1. Provide grounding conductor to location of the main distribution panel with enough extra cable to bolt to the service ground bus bar.

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal and at individual ground rods. Make tests at ground rods before any conductors are connected.
 - a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
 - b. Perform tests by fall-of-potential method according to IEEE 81.
4. Prepare dimensioned Drawings locating each ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

C. Grounding system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

E. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10ohms.
2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.

- F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

SECTION 260543 - UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL AND COMMUNICATION SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal conduits and fittings, including GRC steel conduit.
2. Rigid nonmetallic duct.
3. Duct accessories.
4. Polymer concrete handholes and boxes with polymer concrete cover.

1.2 DEFINITIONS

- A. Direct Buried: Duct or a duct bank that is buried in the ground, without any additional casing materials such as sand or concrete.
- B. Duct: A single duct or multiple ducts. Duct may be either installed singly or as component of a duct bank.
- C. Duct Bank:
1. Two or more ducts installed in parallel, with or without additional casing materials.
 2. Multiple duct banks.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings:
1. Factory-Fabricated Handholes and Boxes Other Than Precast Concrete:
 - a. Include dimensioned plans, sections, and elevations, and fabrication and installation details.
 - b. Include duct entry provisions, including locations and duct sizes.
 - c. Include cover design.
 - d. Include grounding details.

1.4 INFORMATIONAL SUBMITTALS

- A. Source quality-control reports.
- B. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND FITTINGS

- A. GRC: Comply with ANSI C80.1 and UL 6.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Allied Tube & Conduit; a part of Atkore International.
 - 2. O-Z/Gedney; a brand of Emerson Industrial Automation.
 - 3. Republic Conduit.
 - 4. Thomas & Betts Corporation; A Member of the ABB Group.
- C. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.

2.2 RIGID NONMETALLIC DUCT

- A. Underground Plastic Utilities Duct: Type EPC-80-PVC and Type EPC-40-PVC RNC, complying with NEMA TC 2 and UL 651, with matching fittings complying with NEMA TC 3 by same manufacturer as duct.
- B. <Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. CANTEX INC.
 - 2. CertainTeed Corporation.
 - 3. Manhattan/CDT.
- C. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.

2.3 DUCT ACCESSORIES

- A. Duct Spacers: Factory-fabricated, rigid, PVC interlocking spacers; sized for type and size of duct with which used, and selected to provide minimum duct spacing indicated while supporting duct during concreting or backfilling.
 - 1. <Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Allied Tube & Conduit; a part of Atkore International.
- b. CANTEX INC.
- c. Carlson; a brand of Thomas & Betts Corporation.
- d. IPEX USA LLC.
- e. PenCell Plastics.

B. Underground-Line Warning Tape:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. Ideal Industries, Inc.
 - c. LEM Products Inc.
2. Tape:
 - a. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
 - b. Printing on tape shall be permanent and shall not be damaged by burial operations.
 - c. Tape material and ink shall be chemically inert and not subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.
3. Color and Printing:
 - a. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, ANSI Z535.4, and ANSI Z535.5.
 - b. Inscriptions for Red-Colored Tapes: "ELECTRIC LINE, HIGH VOLTAGE".
 - c. Inscriptions for Orange-Colored Tapes: "TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE".
4. Type:
 - a. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core; bright colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
 - b. Width: 3 inches.
 - c. Overall Thickness: 5 mils.
 - d. Foil Core Thickness: 0.35 mil.
 - e. Weight: 28 lb/1000 sq. ft..
 - f. Tensile according to ASTM D 882: 70 lbf and 4600 psi.

2.4 POLYMER CONCRETE HANDHOLES AND BOXES WITH POLYMER CONCRETE COVER

- A. Description: Molded of sand and aggregate, bound together with a polymer resin, and reinforced with steel or fiberglass or a combination of the two.
- B. <Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Armorcast Products Company.
 - 2. NewBasis.
 - 3. Oldcastle Enclosure Solutions.
 - 4. Quazite: Hubbell Power Systems, Inc.
- C. Standard: Comply with SCTE 77. Comply with tier requirements in "Underground Enclosure Application" Article.
- D. Color: Gray.
- E. Configuration: Units shall be designed for flush burial and have open bottom.
- F. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
- G. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
- H. Cover Legend: Molded lettering, as indicated for each service.
- I. Duct Entrance Provisions: Duct-terminating fittings shall mate with entering duct for secure, fixed installation in enclosure wall.

2.5 SOURCE QUALITY CONTROL

- A. Nonconcrete Pull-Box Prototype Test: Test prototypes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
 - 1. Tests of materials shall be performed by an independent testing agency.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Coordinate layout and installation of duct, duct bank, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field. Notify the Construction Manager if there is a conflict between areas of excavation and existing structures or archaeological sites to remain.

- B. Coordinate elevations of duct and duct-bank entrances into handholes, and boxes with final locations and profiles of duct and duct banks, as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations as required to suit field conditions and to ensure that duct and duct bank will drain to handholes and away from buildings and as approved by Construction Manager.

3.2 UNDERGROUND DUCT APPLICATION

- A. Duct for Electrical Primary Service Feeder: RNC Schedule-40-PVC, concrete-encased unless otherwise indicated.
- B. Duct for Electrical Secondary Service Feeder and Branch Circuits: RNC Schedule-80-PVC, direct-buried in sand bed unless otherwise indicated.
- C. Stub-ups: Concrete-encased GRC.

3.3 UNDERGROUND ENCLOSURE APPLICATION

- A. Handholes and Boxes for 600 V and Less:
 - 1. Polymer concrete, SCTE 77, Tier 22 structural load rating.
 - 2. Cover design load shall not exceed the design load of the handhole or box.

3.4 EARTHWORK

- A. Excavation and Backfill: Comply with Section 312000 "Earth Moving," but do not use heavy-duty, hydraulic-operated, compaction equipment.
- B. Restore areas disturbed by trenching, storing of dirt, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching. Comply with Section 329200 "Turf and Grasses" and Section 329300 "Plants."

3.5 DUCT AND DUCT-BANK INSTALLATION

- A. Provide duct, spacers, and accessories into the duct-bank configuration shown. Duct installation requirements in this Section also apply to duct bank.
- B. Install duct according to NEMA TCB 2.
- C. Slope: Pitch duct a minimum slope of 1:300 down toward handholes and away from buildings and equipment. Slope duct from a high point to drain in both directions.
- D. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 25 feet, both horizontally and vertically, at other locations unless otherwise indicated.
 - 1. Duct shall have maximum of two 90 degree bends or the total of all bends shall be no more 180 degrees between pull points.

- E. Joints: Use solvent-cemented joints in duct and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent duct do not lie in same plane.
- F. End Bell Entrances to Concrete and Polymer Concrete Handholes: Use end bells, spaced approximately 10 inches o.c. for 5-inch duct, and vary proportionately for other duct sizes.
- G. Building Wall Penetrations: Make a transition from underground duct to GRC at least 10 feet outside the building wall, without reducing duct line slope away from the building and without forming a trap in the line. Use fittings manufactured for RNC-to-GRC transition. Sealing: Provide temporary closure at terminations of duct with pulled cables. Seal spare duct at terminations. Use sealing compound and plugs to withstand at least 15-psig hydrostatic pressure.
- H. Pulling Cord: Install 200-lbf-test nylon cord in empty ducts.
- I. Concrete-Encased Ducts and Duct Bank:
 - 1. Excavate trench bottom to provide firm and uniform support for duct. Prepare trench bottoms as specified in **Section 312000 "Earth Moving"** for pipes less than 6 inches in nominal diameter.
 - 2. Width: Excavate trench 3 inches wider than duct on each side.
 - 3. Depth: Install so top of duct envelope is at least 24 inches below finished grade in areas not subject to deliberate traffic, and at least 30 inches below finished grade in deliberate traffic paths for vehicles unless otherwise indicated.
 - 4. Support duct on duct spacers coordinated with duct size, duct spacing, and outdoor temperature.
 - 5. Spacer Installation: Place spacers close enough to prevent sagging and deforming of duct, with not less than four spacers per 20 feet of duct. Place spacers within 24 inches of duct ends. Stagger spacers approximately 6 inches between tiers. Secure spacers to earth and to duct to prevent floating during concreting. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
 - 6. Elbows: Use manufactured duct elbows for stub-ups, at building entrances, and at changes of direction in duct unless otherwise indicated. Extend encasement throughout length of elbow.
 - 7. Elbows: Use manufactured GRC elbows for stub-ups, at building entrances, and at changes of direction in duct run.
 - 8. Reinforcement: Reinforce concrete-encased duct where crossing disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.
 - 9. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
 - 10. Concrete Cover: Install a minimum of 3 inches of concrete cover between edge of duct to exterior envelope wall, 2 inches between duct of like services, and 4 inches between power and communications ducts.
 - 11. Concreting Sequence: Pour each run of envelope between manholes or other terminations in one continuous operation.
 - 12. Pouring Concrete: Comply with requirements in "Concrete Placement" Article in **Section 033000 "Cast-in-Place Concrete."** Place concrete carefully during pours to prevent voids under and between duct and at exterior surface of envelope. Do not allow a

heavy mass of concrete to fall directly onto ducts. Allow concrete to flow around duct and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-installation application.

J. Duct Bank in Sand Bed:

1. Excavate trench bottom to provide firm and uniform support for duct. Comply with requirements in **Section 312000 "Earth Moving"** for preparation of trench bottoms for pipes less than 6 inches in nominal diameter.
2. Width: Excavate trench 3 inches wider than duct on each side.
3. Depth: Install top of duct at least 36 inches below finished grade unless otherwise indicated.
4. Set elevation of bottom of duct bank below frost line (5 feet below grade).
5. Support ducts on duct spacers coordinated with duct size, duct spacing, and outdoor temperature.
6. Spacer Installation: Place spacers close enough to prevent sagging and deforming of duct, with not less than four spacers per 20 feet of duct. Place spacers within 24 inches of duct ends. Stagger spacers approximately 6 inches between tiers. Secure spacers to earth and to ducts to prevent floating during concreting. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
7. Install duct with a minimum of 3 inches between ducts for like services and 6 inches between power and communications duct.
8. Elbows: Install manufactured duct elbows for stub-ups, at building entrances, and at changes of direction in duct direction unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
9. Install manufactured GRC elbows for stub-ups, at building entrances, and at changes of direction in duct.
10. After installing first tier of duct, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand place backfill to 4 inches over duct and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, make final duct connections at end of run and complete backfilling with normal compaction. Comply with requirements in **Section 312000 "Earth Moving"** for installation of backfill materials.
 - a. Place minimum 3 inches of sand as a bed for duct. Place sand to a minimum of 6 inches above top level of duct.

K. Underground-Line Warning Tape:

1. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.
2. Provide underground-line warning tape for all ductbanks shown on the electrical site plan.

L.

3.6 INSTALLATION OF HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

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

3.7 GROUNDING

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

3.8 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Demonstrate capability and compliance with requirements on completion of installation of underground duct, duct bank, and utility structures.
 - 2. Pull solid aluminum or wood test mandrel through duct to prove joint integrity and adequate bend radii, and test for out-of-round duct. Provide a minimum 12-inch-long mandrel equal to duct size minus 1/4 inch. If obstructions are indicated, remove obstructions and retest.
- B. Correct deficiencies and retest as specified above to demonstrate compliance.
- C. Prepare test and inspection reports.

3.9 CLEANING

- A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of duct until duct cleaner indicates that duct is clear of dirt and debris. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.
- B. Clean internal surfaces of manholes, including sump.
 - 1. Sweep floor, removing dirt and debris.
 - 2. Remove foreign material.

END OF SECTION 260543

SECTION 265613 - LIGHTING POLES AND STANDARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Poles and accessories for support of luminaires.

1.2 DEFINITIONS

- A. EPA: Equivalent projected area.
- B. Luminaire: Complete luminaire.
- C. Pole: Luminaire-supporting structure.
- D. Standard: See "Pole."

1.3 ACTION SUBMITTALS

- A. Product Data: For each pole and accessory.
- B. Shop Drawings:
1. Include plans, elevations, sections, and mounting and attachment details.
 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 3. Foundation construction details, including material descriptions, dimensions, anchor bolts, support devices, and calculations, signed and sealed by a professional engineer licensed in the state of installation.
 4. Anchor bolt templates keyed to specific poles and certified by manufacturer.
 5. Method and procedure of pole installation. Include manufacturer's written installations.

1.4 INFORMATIONAL SUBMITTALS

- A. Pole and Support Component Certificates: Signed by manufacturers of poles, certifying that products are designed for indicated load requirements according to AASHTO LTS-6-M and that load imposed by luminaire and attachments has been included in design. The certification shall be based on design calculations signed and sealed by a professional engineer.
- B. Field quality-control reports.
- C. Sample warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data for pole-mounted accessories.

1.6 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of pole(s) that fail in materials or workmanship; that corrode; or that fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within a specified warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs from special warranty period.

- 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Characteristics: Comply with AASHTO LTS-6-M.
- B. Dead Load: Weight of luminaire and its horizontal and vertical supports, and supporting structure, applied according to AASHTO LTS-6-M.
- C. Ice Load: Load of 3 lbf/sq. ft., applied according to AASHTO LTS-6-M for applicable areas on the Ice Load Map.
- D. Wind Load: Pressure of wind on pole and luminaire, calculated and applied according to AASHTO LTS-6-M.
 - 1. Basic wind speed for calculating wind load for poles 50 feet high or less is 100 mph.
- E. Strength Analysis: For each pole, multiply the actual EPA of luminaires and brackets by a factor of 1.1 to obtain the EPA to be used in pole selection strength analysis.
- F. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts unless otherwise indicated.

2.2 ALUMINUM POLES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper Lighting, an Eaton business.
 - 2. H.E. Williams.
 - 3. Hubbell Incorporated.
 - 4. Lithonia Lighting; Acuity Brands Lighting, Inc.
 - 5. LSI Industries.

- B. Poles: Seamless, extruded structural tube complying with ASTM B 221, Alloy 6063-T6, with access handhole in pole wall.
 - 1. Shape: Square, straight.
 - 2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.
- C. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.
- D. Grounding and Bonding Lugs: Bolted 1/2-inch threaded lug, complying with requirements in Section 260526 "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.
- E. Fasteners: Stainless steel, size and type as determined by manufacturer. Corrosion-resistant items compatible with support components.
 - 1. Materials: Compatible with poles and standards as well as to substrates to which poles and standards are fastened and shall not cause galvanic action at contact points.
 - 2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication unless otherwise indicated.
- F. Handhole: Oval shaped, with minimum clear opening of 2-1/2 by 5 inches, with cover secured by stainless-steel captive screws.
- G. Powder-Coat Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" recommendations for applying and designating finishes.
 - 1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1 to remove dirt, oil, grease, and other contaminants that could impair powder coat bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, according to SSPC-SP 5/NACE No. 1 or SSPC-SP 8.
 - 2. Powder coat shall comply with AAMA 2604.
 - a. Electrostatic applied powder coating; single application with a minimum 2.5- to 3.5-mils dry film thickness; cured according to manufacturer's instructions. Coat interior and exterior of pole for equal corrosion protection.
 - b. Color: As selected by Architect from manufacturer's full range.

2.3 POLE ACCESSORIES

- A. Base Covers: Manufacturers' standard metal units, finished same as pole, and arranged to cover pole's mounting bolts and nuts.

2.4 MOUNTING HARDWARE

- A. Anchor Bolts: Manufactured to ASTM F 1554, Grade 55, with a minimum yield strength of 55,000 psi.

1. Galvanizing: Hot dip galvanized according to ASTM A 153, Class C.
- B. Nuts: ASTM A 563, Grade A, Heavy-Hex
 1. Galvanizing: Hot dip galvanized according to ASTM A 153, Class C.
 2. Four nuts provided per anchor bolt, shipped with nuts pre-assembled to the anchor bolts.
- C. Washers: ASTM F 436, Type 1.
 1. Galvanizing: Hot dip galvanized according to ASTM A 153, Class C.
 2. Two washers provided per anchor bolt.

2.5 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 POLE FOUNDATION

- A. Pre-Cast Foundations: Factory fabricated, with structural steel complying with ASTM A 36/A 36M and hot-dip galvanized according to ASTM A 123/A 123M; and with top-plate and mounting bolts to match pole-base flange and strength required to support pole, luminaire, and accessories. Concrete, reinforcement, and formwork are specified in Section 033000 "Cast-in-Place Concrete."
- B. Anchor Bolts: Install plumb using manufacturer-supplied template, uniformly spaced.

3.2 POLE INSTALLATION

- A. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Section 033000 "Cast-in-Place Concrete."
- B. Foundation-Mounted Poles: Store poles and fixtures per the manufacturer's recommendations. Furnish poles and fixtures to the Electrical Contractor that is selected for the project Phase 2 Building Construction.
- C. Raise and set pole using web fabric slings (not chain or cable) at locations indicated by manufacturer.

3.3 CORROSION PREVENTION

- A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum using insulating fittings or treatment.

3.4 GROUNDING

- A. Ground Metal Poles and Support Structures: Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."
 - 1. Install grounding electrode for each pole unless otherwise indicated.
 - 2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.

END OF SECTION 265613

SECTION 265619 - LED EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior solid-state luminaires that are designed for and exclusively use LED lamp technology.
2. Luminaire supports.

1.2 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color rendering index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating
- E. Lumen: Measured output of lamp and luminaire, or both.
- F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of luminaire.

1.4 INFORMATIONAL SUBMITTALS

Coordination Drawings: Plans, drawn to scale and coordinated.

- A. Sample warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.
1. Provide a list of luminaire characteristics for each fixture type.

1.6 FIELD CONDITIONS

- A. Mark locations of exterior luminaires for approval by construction manager prior to the start of light pole foundation installation.

1.7 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

- 1. Warranty Period: two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 LUMINAIRE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. UL Compliance: Comply with UL 1598 and listed for wet location.
- C. CRI of minimum 80. CCT of 3000 K.
- D. L70 lamp life of 50,000 hours.
- E. Nominal Operating Voltage: Refer to Luminaire Schedule on drawings.
- F. Source Limitations: Obtain luminaires for each fixture type from single source from a single manufacturer.

2.2 LUMINAIRE TYPES

- A. Refer to Luminaire Schedule on drawings.

2.3 MATERIALS

- A. Metal Parts: Free of burrs and sharp corners and edges.
- B. Sheet Metal Components: Corrosion-resistant. Form and support to prevent warping and sagging.
- C. Doors, Frames, and Other Internal Access: Smooth operating and free of light leakage under operating conditions. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during servicing and when secured in operating position. Doors shall be removable for cleaning.

- D. Lens and Refractor Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.
- E. Housings:
 - 1. Rigidly formed, weather- and light-tight enclosure that will not warp, sag, or deform in use.

2.4 FINISHES

- A. Variations in Finishes: Noticeable variations in finishes are unacceptable.
- B. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Comply with NECA 1.
- B. Fasten luminaire to structural support.
- C. Supports:
 - 1. Sized and rated for luminaire weight.
 - 2. Able to maintain luminaire position after cleaning.
 - 3. Support luminaires without causing deflection of finished surface.
 - 4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.
- D. Wall-Mounted Luminaire Support:
 - 1. Attached to structural members in walls.
- E. Wiring Method: Install wiring in raceways.
- F. Install luminaires level, plumb, and square.
- G. Coordinate layout and installation of luminaires with other construction.

END OF SECTION 265619

SECTION 310100 – MAINTENANCE OF EARTHWORK

PART 1 - GENERAL

1.1 WORK INCLUDED.

- A. Project Survey and Layout. Includes construction stake-out, and maintenance of all layout points during the Project.
- B. Utility Locating Service
- C. Utility Test Pits
- D. Off-site Disposal of Excess Soil Materials
- D. Moisture and Dust Control
- E. Temporary Resurfacing of Roadways
- F. Restoration of existing facilities damaged as a result of this project. Items included but are not limited to: curbs, concrete walks, and gutters, underground utilities, signs, ditches and swales.

1.2 PRE-CONSTRUCTION REQUIREMENT. The Contractor shall video the entire project site and all areas that will require restoration and supply the Owner's Representative with a copy of the video on a compact disk, or similar data electronic storage device.

1.3 RELATED DOCUMENTS - Refer to Section 321000 (Earthmoving).

PART 2 - PRODUCTS

2.1 RESTORATION OF SURFACES. The quality of materials and the performance of work used in the restoration shall be equal to or better than the condition of each before the work began. In the event a surface or material requires restoration and the material is not specified under this Contract, the Contractor shall notify the Owner's Representative and submit to the Owner's Representative his proposed restoration plan. Such restoration shall be reviewed by the Owner's Representative.

2.2 TEMPORARY RESURFACING

- A. Temporary resurfacing shall consist of crushed stone at such depth as is necessary to withstand the traffic to which it is subjected. Where concrete pavements are removed, the broken stone shall be surfaced with "cold patch." In areas where temporary asphalt walkways are specified, the Contractor shall provide a minimum of 2 ½" of Hot Mix Asphalt Binder over 6" of crushed stone (A1) subbase material.

- B. For dust protection, the Contractor shall treat all surfaces not covered with cold patch with calcium chloride (liquid or granular) as approved by the Owner's Representative.
- 2.3 OTHER TYPES OF PAVEMENTS AND SURFACES. All pavement other than brick and concrete, and all gravel, crushed stone and other types of roadway surfaces, shall be replaced with new materials except where, in the opinion of the Owner's Representative, materials salvaged from stone or gravel roadways have been removed, handled, and stored in such a manner that their original quality has been maintained, in which case such salvaged materials may be used to the extent available in the lower portion of the roadway surfaces after proper screening to remove dust and other excess material.
- 2.4 ROADSIDE DITCHES. All disturbed ditches and swales shall be regraded to their original grades. Ditches shall be topsoiled and seeded with new materials; topsoil (free from weeds, sticks, and stones) and a seed mix consistent with the remaining lawns.
- 2.5 MATERIALS FOR CONSTRUCTION STAKEOUT. The Contractor shall supply all stakeout materials.

PART 3 - EXECUTION

3.1 TEMPORARY RESURFACING AND REPAVING

- A. Immediately upon completion of refilling of the trench or excavation, the Contractor shall place a temporary pavement over all disturbed areas of the road, driveways, and other travelled places where the original surface has been disturbed as a result of this project. The temporary pavement shall be of a character satisfactory in all respects and safe for public travel. The surface of the temporary pavement shall conform to the street grades. Mounding up of any material over a trench and covering the same with loose broken stone will not be considered in compliance with the above requirements.
- B. The temporary pavement shall be placed and maintained by the Contractor in a safe and satisfactory condition until such time as the permanent pavement is completed. The Contractor shall immediately remove and restore to a satisfactory condition any and all such pavements as they become unsatisfactory and not in accordance with the terms and intent of the Specifications.

3.2 CONCRETE WALKS

- A. Concrete walks removed in connection with or damaged as a result of construction operations under the Contract shall be replaced with new construction. Refer to Section 321313 (Portland Cement Concrete Paving).

3.3 CURBS, GUTTERS, AND CULVERTS. The Contractor shall, at his own expense, permanently repair and relay all curbs, gutters, roadway and driveway culverts where the same have been broken, damaged, or disturbed by the Contractor in executing any of the work covered by the Contract or by or on account of said work. The Contractor shall restore the same in a manner, to a condition and with material, either new or old as required, similar and equal to what existed before the start of this project.

3.4 WORK ADJACENT TO EXISTING BUILDINGS. Contractor shall take care to protect existing building features when earthwork and soil compaction is performed near buildings. Contractor's attention is also brought to the fact that Madison Hall is a Historic Structure, located on the State Historic Register. Additional care and coordination with the Owner's Representative is required when working adjacent to Madison Hall.

3.5 DUST CONTROL. The Contractor shall minimize dust from disturbed soil surfaces or other materials that can cause onsite or off-site damage, health hazards, and traffic safety problems. Dusty conditions resulting from the Contractor's operations shall be corrected at no additional cost to the Owner.

3.6 UNDERGROUND FACILITIES. The Contractor shall repair or replace all disturbed underground facilities by methods approved by the Owner's Representative and regulatory agencies.

3.7 CONSTRUCTION STAKEOUT. The Contractor shall perform all construction stakeout work necessary to establish, spatially position, measure, and verify the locations of existing and proposed terrain features of the Project.

A. The following types of Survey Operations shall be performed under the direction of a New York State Licensed Land Surveyor:

- 1.) Location of property or highway boundary markers
- 2.) Tie measurements to, or resetting of control points

B. The following types of Survey Operations shall be performed under the direction of a New York State Licensed Land Surveyor or New York State Licensed Professional Engineer:

- 1.) Establishment or reestablishment of primary or secondary control which shall be used for:
 - a. Establishing location for horizontal or vertical roadway alignment.
 - b. Establishing location for the horizontal or vertical alignment of a structure, or feature for which the coordinates or elevations are indicated on the contract drawings.
 - c. Establishing reference station for Global Positioning System (GPS) control work.
- 2.) Establishing new horizontal or vertical roadway alignment in the field from contract control either by conventional stakeout methods or by use of automated equipment operations. If the Contractor utilizes automated equipment for stakeout, he shall coordinate his locations and grades with the Owners Representative by utilizing an acceptable benchmark method to ensure proper grading.

3.8 UTILITY LOCATING SERVICE.

The Contractor shall be responsible to locate utilities not covered under the Dig Safely New York program. As part of this project, the Contractor shall procure the services of an Underground Utility Locator Service. Utility Locator Service (ULS) shall meet the following requirements:

- At least 5 years experience of providing underground utility location services. Firm providing Utility Locating Service shall be acceptable to the Owner.
- The ULS shall provide the equipment and competent operation required for Ground Penetrating Radar (GPR), electro-magnetic induction, as well as standard pipe and cable locating techniques.
- ULS shall review all utility plans, construction plans, and record plans that are provided by the Owner to determine the precise location of underground utilities in areas that are scheduled for excavation by the Contractor.
- Provide materials required to mark the locations of underground utilities in the field for the Contractor.
- Observe all Federal, State, and Town Safety Regulations.

- Coordinate utility locating and marking with Utility Location that is performed as part of the Dig Safe New York (811) program.
- Record position of buried utilities and provide to the Owner's Representative.

Cost of the Utility Locating Service will be the responsibility of the Contractor. Contractor shall notify the Utility Locating Service such that all required utility clearances are performed prior to the start of any excavation.

3.9 UTILITY TEST PITS

The Contractor shall excavate and backfill test pits in order to determine existing underground utility type, size, elevation and where utility crossings or new utility connections to existing facilities are proposed. The Contractor shall excavate and backfill test pits in a manner approved by the Owner's Representative that prevents damage to wrappings, coatings or other protective coverings, such as by hand digging, vacuum excavation or similar non-destructive locating equipment. The limits of the excavation shall be those sufficient to determine existing utility type, size and/or condition.

Contractor shall coordinate with the Owner's Representative regarding the location of the exposed utility. At a minimum, this effort will include the following:

- Coordinate work with Utility Locator Service.
- Installing a wood stake (nominal 2" x 4" x 24" long) into the ground, as close as possible, at a known offset from the utility.
- Measure and record the horizontal offset distance from the stake to the utility, the vertical depth from the top of stake to top of utility, the size of the exposed utility, and it's apparent material composition.
- Protect wood stake from damage.
- Backfill test pits in kind with the surrounding soils with suitable material as defined in Section 310513. Existing utility to be bedded and covered in kind, with Lining Material as defined in Section 310516.

Utility Test Pit Excavation work shall include the furnishing all labor, materials and equipment necessary to excavate, locate, and backfill the test pit and replace any pavement, shoulder and sidewalk courses, subbase courses, curbs, drives, lawns and other top surfaces required to complete the work.

3.10 DISPOSAL OF EXCESS SOIL MATERIALS OFF-SITE

- A. Disposal: All surplus satisfactory (suitable) soil, is anticipated to be utilized at the Project Site to meet the earthwork needs of the Project.
- B. Any surplus suitable and all unsatisfactory (unsuitable) soil is not to be disposed on the site. It will be the Contractor's responsibility to legally dispose of these materials off Owner's property.

It will be the Contractor's responsibility to coordinate a location for off-site fill materials, and ensure that the following requirements are adhered to at the off-site location (as applicable):

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- Releases from Property Owners.
- Approvals and permits from the local municipality.
- Permits from the U.S. Army Corps of Engineers and NYS DEC if the fill site is near streams, wetlands, or floodplains.
- Adherence to the NYS DEC requirements for stormwater discharges from the fill site , as they apply to General Permit No. GP-0-15-002 (permit for stormwater discharges from construction activity).
- Installation of erosion and sediment control features at the fill site, and grading / stabilization of the fill site.

END OF SECTION 310100

SECTION 310513 – SOILS FOR EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Suitable soil material for fill, backfill and embankment construction.
2. Structural Fill for various locations of backfill and embankment construction.
3. Controlled low strength material.
4. Bioretention Soil for placement at dry swale construction.

B. Related Sections:

1. Division 31 Section 310516 “Aggregates for Earthwork” for various stone and sand aggregates used as part of this project.
2. Division 31 Section 312000 “Earth Moving” for excavation, backfill, placement and compaction of various soil types.
3. Division 31 Section 312319 “Dewatering” for construction dewatering.
4. Division 31 Section 315000 “Excavation Support and Protection” for temporary excavation support and protection systems.

1.2 DEFINITIONS

A. Backfill: Soil material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Borrow Soil: Satisfactory (suitable) soil imported from off-site for use as fill or backfill.

C. Fill: Soil materials used to raise existing grades.

D. Structural Fill: Material as defined in Section 310516, Type A11 Aggregate. On site soil materials meeting this requirement can be substituted for this use. On site material will be considered by the Owner’s Representative for substitution if the Contractor can demonstrate that on site material can be modified to meet the requirements of this material.

E. Select Granular Fill: Material as defined in Section 310516, Type A2 Aggregate. On site soil materials meeting this requirement can be substituted for this use. On site material will be considered by the Owner’s Representative for substitution if the Contractor can demonstrate that on site material can be modified to meet the requirements of this material.

F. Controlled Low Strength Material (Flowable Fill): A flowable, self-compacting, low density cementitious material which shall gain sufficient strength to be walked on and buried within a day, and which shall remain excavatable by hand tools after curing.

- G. Bioretention Soil: Soil for use in dry swales that consists of a uniform mix of sand and topsoil, free of stones, stumps, roots (or other objects larger than 2" in diameter), and free of noxious weeds.
- H. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material 3/4 cu. yd. or more in volume that exceed a standard penetration resistance of 100 blows/2 inches when tested by a geotechnical testing agency, according to ASTM D1586.
- I. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- J. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.
- K. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.3 SUBMITTALS

- A. Product Data: For each type of the following manufactured products required:
 - 1. Soil Materials (if imported from off-site).
- B. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:
 - 1. Classification according to ASTM D2487.
 - 2. Laboratory compaction curve according to ASTM D 1557.

1.4 QUALITY ASSURANCE

- A. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E329 and ASTM D3740 for testing indicated.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Suitable Material (Subsoil Type S-1) – Suitable Material is defined as soil material whose composition is satisfactory for embankment construction. The moisture content of the material has no bearing upon this designation. In general, any mineral (inorganic) soil, blasted or broken rock and similar materials of natural or man made (i.e. recycled) origin, including mixtures thereof, are considered suitable materials. Determination of whether a specific natural or man made material is a suitable material shall be made by the Owner's Representative on the above basis.

Furthermore, Suitable Material shall be soil that falls within Classification Groups GW, GP, GM, SW, SP, SM according to ASTM D2487 “*Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)*”, or a combination of these groups.

1. Material shall be free of rock or gravel larger than 3-inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
2. Soil classified as GM, SP or SM can be used; however, these soil types can be moisture sensitive and difficult to work with. No additional expense shall be incurred by the Owner if the Contractor chooses to use these materials and the required compaction cannot be achieved.

- C. Unsuitable Material – Unsuitable Material is defined as any material containing vegetable or organic matter, such as muck, peat, organic silt, topsoil, or sod, that is not satisfactory for embankment construction. Certain man made deposits of industrial waste, toxic or contaminated materials, sludge, landfill, or other materials may also be determined to be unsuitable, based on an evaluation by the Owner’s Representative.

1. Soils that are Unsuitable Material are further defined as soil within the Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D2487 “*Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)*”, or a combination of these groups.
2. Broken pieces or sections of asphalt pavement, macadam, or similar construction debris material that contains petroleum based products are also considered unsuitable for this Project.
3. The moisture content of a soil has no bearing upon the designation of a soil material as being an unsuitable or suitable soil. (Refer to Section 312000, Earthmoving).

- D. Controlled Low Strength Material (CLSM) – Controlled Low Strength Material (flowable fill) shall have a compressive strength between 40 psi and 150 psi. Contractor to certify that the Controlled Low Strength Material meets the following requirements:

1. Portland Cement, Type 1 or Type 2: Shall comply with ASTM C150. Pozzolans and other cementitious materials shall comply with ASTM C618. Note that if CLSM is to be placed around ductile iron pipes, it shall not contain fly ash. If not placed near metals, Class “C” or Class “F” Fly Ash can be used.
2. Water: Use water, which is potable and free from deleterious amounts of alkali, acid, and organic materials, which would adversely affect the setting time or strength of the CLSM.
3. Aggregates: 100% passing the No. 10 sieve and a maximum of 20% passing the No. 200 sieve.
4. Do not place CLSM in temperatures less than 40° F, nor when freezing temperatures are expected with 24 hours. If these conditions cannot be met, consult with the manufacturer and determine procedures and protection necessary to ensure proper CLSM installation and curing.

- E. Bioretention Soil – Defined as uniform mix of three (3) parts sand and one (1) part topsoil, by volume. This soil shall be free of stones, stumps, roots (or other objects larger than 2” in diameter), and free of noxious weeds. The Bioretention soil shall have a pH range of 5.2 to 7.6, and an organic content of 6% to 7%. In order to meet the requirement of 6% to 7% organic content in the bio soils, the Contractor may add suitable compost material to achieve this

requirement for organic content. Compost that is used shall meet the requirements of NYSDOT 2013 Standard Specifications Section 713-15.

1.) Topsoil shall be onsite material when possible amended to meet the following general requirements:

- pH range between 5.5 and 7.6
- Organic Content not less than 6% or more than 12% (dry weight basis)
- Percent of topsoil (by weight) that passes through a No. 200 (75-µm) US standard sieve is 20% to 65%.

Additional topsoil requirements are included in Specification Section 329113.

2.) Requirements for Sand:

- Meeting the requirements of Sand, A9 Aggregate, as defined in Section 310516.

3.) Soil Amendments to increase organic content shall be peat moss. Peat moss shall be commercially produced, composed of the partly decomposed stems and leaves of any or several species of sphagnum moss.

4.) The Contractor shall provide the Owner's Representative with a copy of the soil test results that show the overall gradation, organic content, and concentration of soil phosphorus. (Concentration of soil phosphorus will not be a basis for acceptance or rejection of the biore-tention soil, but is required for the Owner's records).

- F. Topsoil – Refer to Section 329113 for additional requirements. Topsoil may be naturally occurring or may be manufactured.

If naturally occurring topsoil exists on the site it shall be the surface layer of soil removed during soil stripping operations.

All topsoil shall be free from refuse, material toxic or otherwise deleterious to plant growth, subsoil, sod clumps, seeds or other viable propagules of invasive plants, woody vegetation and stumps, roots, brush, refuse, stones, clay lumps, or similar objects.

Construction and demolition debris as classified under 6 NYCRR Part 360, other than uncontaminated land clearing debris, shall not be used to manufacture or amend topsoil. Sod and herbaceous growth such as grass and non-invasive weeds need not be removed but shall be thoroughly broken up and mixed with the soil during handling or manufacturing operations.

Existing topsoil stripped and stockpiled shall be tested and amended by the Contractor as needed to meet the requirements of Specification Section 329113.

PART 3 - EXECUTION

3.1 STORAGE OF SOIL MATERIALS - Refer to Section 312000 (Earthmoving).

3.2 PLACEMENT OF SOIL MATERIALS IN EMBANKMENT CONSTRUCTION

- Refer to Section 312000 (Earthmoving) for Embankment Construction.

END OF SECTION 310513

SECTION 310516 – AGGREGATES FOR EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Aggregates for subgrades for pavements and utility installation.
2. Subbase course to be placed and compacted in advance of asphalt paving.
3. Aggregate Material for pipe bedding.
4. Fine Aggregate Material for conduit bedding.
5. Foundation Backfill Material.
6. Underdrain Filter Stone.
7. Stone Filling (Heavy & Medium) for Bank and Channel Protection.
8. Stone Filling (Light) for soil erosion control.

B. Related Sections:

1. Division 31 Section “Dewatering” for construction dewatering.
2. Division 31 Section “Excavation Support and Protection” for temporary excavation support and protection systems.
3. This Specification makes reference to the New York State Department of Transportation (NYSDOT) Standard Specifications, version issued September 1, 2017.

1.2 DEFINITIONS

- A. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.
- B. Lining Course: Aggregate layer placed around and above the installed pipe or underground utility in a trench.
- C. Medium and Fine Stone Filling: Shall consist of well graded stone placed as protective material on stream-banks, in channels and elsewhere, as required.
- D. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a Portland cement concrete pavement.
- E. Structural Fill: Subbase Course placed for the construction of the new building and exterior stairs.
- F. Underdrain Filter Stone: Shall consist of crushed stone, gravel, or screened gravel (pea stone) that is similarly graded in size.

1.3 SUBMITTALS

- A. Product Data: For each type of the aggregate product required, certify that the material requirements in Part 2 of this Section are met.

- B. Materials Certificate: Certify that products meet or exceed the New York State Department of Transportation (NYSDOT) 2017 Standard Specifications requirements as follows:
 - 1. Section 203-2: Materials – Select Granular Fill.
 - 2. Section 304-2: Materials - Subbase Aggregate Course.
 - 3. Section 605-2: Materials - Underdrains.
 - 4. Section 620-2: Materials - Stone Filling for Bank and Channel Protection.

1.4 QUALITY ASSURANCE

- A. Furnish each aggregate material from single source throughout the Work
- B. Perform Work in accordance with the NYSDOT, Sept. 1, 2017 Standard Specifications:
 - 1. Section 203: Select Granular Fill.
 - 2. Section 207: Geosynthetics.
 - 3. Section 304: Subbase Course.
 - 4. Section 605: Underdrain Filter Stone.
 - 5. Section 620: Bank and Channel Protection.
- C. Preinstallation Conference: Conduct conference at Project site.
- D. Material Test Reports: For Subbase (A1), Select Granular Fill (A2), and Bedding & Lining Course (A4) provide tests as follows:
 - 1. Laboratory compaction curve according to ASTM D 1557.

PART 2 - PRODUCTS

2.1 AGGREGATE MATERIALS

- A. Subbase Material: Coarse Aggregate Type A1: Conforming to NYSDOT Subbase Item 304.12, Type 2 Subbase. Certify that the Type A1 aggregate meets these requirements, as noted in Section 733-04 of the NYSDOT Materials Specifications.
- B. Select Granular Fill: Course Aggregate Type A2 (Gravel): Conforming to the material requirements for Select Granular Fill, NYSDOT Item 203.07. Certify that the Type A2 aggregate meets these requirements as noted in Section 733-11 of the NYSDOT Materials Specifications.
- C. Drainage Fill Material: Aggregate Type A3: Shall be a crushed angular washed stone that meets the material requirements as per Section 703-02 of the NYSDOT Standard Specifications for Coarse Aggregate. This material shall meet the size designation for # 2 Stone, as shown in Table 703-4 of Section 703-02 of the NYSDOT Standard Specifications.
- D. Bedding and Lining Course: Aggregate Type A4: Crushed Stone; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve. Certify that the Type A4 aggregate meets these requirements.

- E. Underdrain Filter Stone: Fine Aggregate Type A5: Certify that this aggregate will meet the following requirements: Natural stone; washed, free of clay, shale, organic matter; graded in accordance with ASTM C136 (or NYSDOT Underdrain Type 1, Item 605.0901); to the following limits:
 - a. Minimum Size: 1/4 inch.
 - b. Maximum Size: 5/8 inch.
- F. Stone Filling (Heavy): Aggregate Type A6: Certify and furnish materials in accordance with NYSDOT 2006 Standard Specifications for Item 620.05.
- G. Stone Filling (Medium): Aggregate Type A7: Certify and furnish materials in accordance with NYSDOT 2006 Standard Specifications for Item 620.04.
- H. Stone Filling (Fine): Aggregate Type A8: Certify and furnish materials in accordance with NYSDOT 2006 Standard Specifications for Item 620.02.
- I. Sand: Fine Aggregate Type A9: Certify and furnish natural river or bank sand; free of silt, clay, loam, friable or soluble materials, and organic matter; graded in accordance with ASTM C136; within the following limits:

Sieve Size	Percent Passing
No. 4	100
No. 14	90 to 100
No. 200	0 to 5

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.
- B. Protect and maintain erosion and sedimentation controls during earth moving operations.
- C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 STOCKPILING OF AGGREGATE MATERIALS

- A. Stockpile materials on site at locations designated by and coordinated with the Owner's Representative.
- B. Stockpile in sufficient quantities to meet Project schedule and requirements.
- C. Separate different aggregate materials with dividers or stockpile individually to prevent mixing.
- D. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.

- E. Remove stockpile at completion of work. Leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

3.3 INSTALLATION OF SUBBASE COURSE

- A. Install granular subbase in accordance with NYSDOT 2017 Standard Specifications, Section 304-3 (Construction Details - Subbase Course) to compacted depth indicated in Contract Documents.
- B. Place subbase course on subgrades free of mud, frost, snow, or ice.
- C. Spread and place granular subbase in maximum 6-inch layers and compact to 95% modified proctor maximum density with a 10 ton minimum self propelled tandem roller.
- D. Level and contour surfaces to elevations and gradients indicated in Contract Drawings.
- E. If moisture content is too low, add water to assist compaction. If excess water is apparent, remove contaminated granular subbase and aerate to reduce moisture content.
- F. Use mechanical tamping equipment in areas inaccessible to rolling equipment.

3.4 GRANULAR SUBBASE TOLERANCES

- A. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.
- B. Scheduled Compacted Thickness: Within 1/4 inch.
- C. Variation from True Elevation: Within 1/2 inch.

3.5 GRANULAR SUBBASE FIELD QUALITY CONTROL

- A. Compaction testing will be performed in accordance with ANSI/ASTM D1556, ANSI/ASTM D1557, or ASTM D2922.
- B. If tests indicate work does not meet specified requirements, remove work, replace and retest.
- C. Frequency of Tests: One minimum plus one for every 5,000 sq. ft. of pavement.

3.6 PLACEMENT, GENERAL

- A. Place geotextile fabric in accordance with NYSDOT 2017 Standard Specifications, Section 207-3 (Construction Details - Prefabricated Composite Drains for Structures) as indicated on Drawings.
- B. Place stone filling in accordance with NYSDOT 2017 Standard Specifications, Section 620-3 (Construction Details - Bank and Channel Protection) at embankment slopes as indicated on Drawings.

- C. Install to thickness as indicated on Drawings.

3.7 DISPOSAL OF MATERIAL

- A. Materials displaced thru the use of the above operations shall be disposed of by the Contractor offsite. The cost of such clean-up and removal shall be included in the price of the materials. Refer to Specification Section 310100 for off-site disposal of excess soil materials.

END OF SECTION 310516

SECTION 310519 – GEOSYNTHETICS FOR EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Geotextile Fabric.

1.2 DEFINITIONS

- A. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.
- B. Geotextile Fabric: Includes Geotextile Stabilization and Geotextile Separation.

1.3 QUALITY ASSURANCE

- A. Furnish each aggregate material from single source throughout the Work
- B. Manufacturer's Certificate: Certify that products meet or exceed the New York State Department of Transportation (NYSDOT) 2017 Standard Specifications (9/01/2017 version) requirements as follows:
 - 1. Section 207-2: Materials -Geotextiles and Prefabricated Composite Drains for Structures.
- C. Perform Work in accordance with the NYSDOT 2017 (9/01/2017 version) Standard Specifications:
 - 1. Section 207: Geotextiles and Prefabricated Composite Drains for Structures.
- D. Preinstallation Conference: Conduct conference at Project site.

PART 2 - PRODUCTS & SUBMITTALS

2.1 MATERIALS

- A. Geosynthetic material brought to the project site shall be provided in rolls wrapped with covering for protection from mud, dirt, dust, and debris.
- B. Geotextile Filter Fabric: (placed at temporary construction entrances for erosion control, and silt fence) Filter Fabric Type A shall be provided for installation at locations indicated on the drawings and as specified herein. Filter Fabric Type A shall be composed of high-tenacity polypropylene yarns, meeting the requirements of Mirafi® 500X or approved equal. The geotextile fabric shall be inert to commonly encountered chemicals; shall be resistant to mildew, rot, ultraviolet light, insects, and rodents; and shall have the indicated properties:

Physical Property	Test Method	Minimum Average Roll Value
Fabric Weight	ASTM D5261	4.0 oz / yd ²
Grab Strength	ASTM D4632	200 lb
Grab Elongation	ASTM D4632	15 %
Apparent Opening Size	CW-02215	40 (U.S. Standard Sieve Size)

At geotextile separation areas where a non-woven geotextile is specified, Contractor has option of provide Mirafi 140N or approved equal, or a material from item 2.1 C below.

- C. Geotextile Separation Fabric: (place beneath roadway subbase) Shall be in accordance with the NYSDOT Approved List for Geosynthetics for Highway Construction, for the following parameters:
1. Geotextile Separation:
 - a. Meet requirements of Separation (S).
 - b. Default strength class 2.
- D. Geotextile Stabilization Fabric: (place beneath Heavy, Medium, and Fine Stone Fill, (Aggregate Types A6, A7, and A8). Stabilization Fabric shall be in accordance with the NYSDOT Approved List for Geosynthetics for Highway Construction for the following parameters:
- a. Meet requirements of Stabilization (ST).
 - b. Default strength class 1.

Product Submittal: Submit a geotextile fabric product that meets these requirements, and is on the NYSDOT Approved List.

2.2 SUBMITTALS AND CERTIFICATIONS

- A. Submittals and Certifications required are as follows:
1. Catalog data showing that the Geotextile Filter Fabric meets the requirements specified.
 2. Catalog data showing that the Geotextile Separation Fabric meets the requirements specified, as well as verification that it is a material from the NYSDOT Approved List.

Catalog data showing that the Geotextile Stabilization Fabric meets the requirements specified, as well as verification that it is a material from the NYSDOT Approved List.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Place Geosynthetic Materials with reference to Division 31 Section 312000 "Earth Moving".

3.2 CONSTRUCTION METHODS

- A. Separation Fabric and Stabilization Fabric shall be installed in accordance with the details shown on the Contract Drawings and in accordance with the manufacturer's recommendations. Contractor shall protect fabric from exposure to sunlight during transportation and storage. After placement, the stabilization fabric shall not be left exposed for more than two weeks. Traffic or construction equipment shall not operate directly on the stabilization fabric. Seams on adjacent rolls shall be overlapped a minimum of 2 feet. Stabilization fabric which becomes torn or damaged shall be replaced or patched. The patch shall extend three feet beyond the perimeter of the torn or damaged area.

END OF SECTION 310519

SECTION 311000 - SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Attention is directed to the Contract and General Conditions and all Sections of Division 01 – General Requirements which are hereby made a part of the Specification.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.
- C. Coordinate work with that of all other trades affecting or affected by work of the Section. Cooperate with such trades to assure steady progress of all work under the Contract.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Protecting existing trees to remain.
 - 2. Removing existing trees.
 - 3. Clearing and grubbing.
 - 4. Removing above- and below-grade site improvements.
 - 5. Disconnecting, capping or sealing, and abandoning site utilities in place and removing site utilities.
- B. Related Sections include the following:
 - 1. Division 01 Section "Temporary Facilities and Controls" for temporary utilities, temporary construction and support facilities, temporary security and protection facilities, and temporary erosion and sedimentation control procedures.
 - 2. Division 02 Section "Structure Demolition" for demolition of buildings, structures, and site improvements.
 - 3. Division 31 Section "Erosion and Sedimentation Controls" for erosion control.
 - 4. Division 31 Section "Earth Moving" for soil materials, excavating, backfilling, and site grading.
 - 5. Division 32 Section "Soil Preparation" for finish grading including preparing and placing planting soil mixes and testing of topsoil material.

1.3 DEFINITIONS

- A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches (50 mm) in diameter; and free of subsoil and weeds, roots, toxic materials, or other nonsoil materials.

- B. Tree Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated.

1.4 MATERIAL OWNERSHIP

- A. Except for materials indicated to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.5 SUBMITTALS

- A. Photographs or videotape, sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing.
- B. Record drawings, according to Division 01 Section "Project Record Documents," identifying and accurately locating capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 QUALITY ASSURANCE

- A. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.7 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
 - 2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- B. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.
- C. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.
- D. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Division 31 Section "Earth Moving."
 - 1. Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Locate and clearly flag trees and vegetation to remain or to be relocated.
- C. Protect existing site improvements to remain from damage during construction.
 - 1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to Erosion and Sediment Control Plan and Storm Water Pollution Prevention Plan.
- B. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- C. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3 TREE PROTECTION

- A. Erect and maintain temporary fencing around tree protection zones before starting site clearing. Remove fence when construction is complete.
 - 1. Do not store construction materials, debris, or excavated material within fenced area.
 - 2. Do not permit vehicles, equipment, or foot traffic within fenced area.
 - 3. Maintain fenced area free of weeds and trash.
- B. Do not excavate within tree protection zones, unless otherwise indicated.

- C. Where excavation for new construction is required within tree protection zones, hand clear and excavate with air spade to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.
 - 1. Cover exposed roots with burlap and water regularly.
 - 2. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
 - 3. Coat cut faces of roots more than 1-1/2 inches (38 mm) in diameter with an emulsified asphalt or other approved coating formulated for use on damaged plant tissues.
 - 4. Backfill with soil as soon as possible.
- D. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by Architect.

3.4 UTILITIES

- A. Owner will arrange 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. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.
 - 1. Arrange with utility companies to shut off indicated utilities.
 - 2. Owner will arrange to shut off indicated utilities when requested by Contractor.
- C. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify Owner, Engineer and Owner's Representative not less than four days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Engineers written permission.
- D. Excavate for and remove underground utilities indicated to be removed.

3.5 CLEARING AND GRUBBING

- A. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction.
 - 1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
 - 2. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
 - 3. Grind stumps and remove roots, obstructions, and debris extending to a depth of 18 inches (450 mm) below exposed subgrade.

4. Use only hand methods for grubbing within tree protection zone.
 5. Chip removed tree branches and dispose of off-site.
- B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches (200 mm), and compact each layer to a density equal to adjacent original ground.

3.6 SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.
- B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.
 2. Paint cut ends of steel reinforcement in concrete to remain to prevent corrosion.

3.7 DISPOSAL

- A. Disposal: Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.
1. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities.

END OF SECTION 311000

SECTION 312000 EARTH MOVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Attention is directed to the Contract and General Conditions and all Sections of Division 01 – General Requirements which are hereby made a part of the Specification.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.
- C. Coordinate work with that of all other trades affecting or affected by work of the Section. Cooperate with such trades to assure steady progress of all work under the Contract.

1.2 SUMMARY

- A. The Work of this Section includes all labor, materials, equipment and services necessary to complete the earthwork as shown on the drawings and/or specified herein, including but not necessarily limited to the following:
 - 1. Laying out and staking all lines and levels.
 - 2. Preparing subgrades for slabs-on-grade, building foundations, walks, pavements, lawns, and plantings.
 - 3. Base course for pavements.
 - 4. Subsurface drainage backfill for walls.
 - 5. Dewatering.
 - 6. Pneumatic trenching (air spade) within drip line of trees to remain.
 - 7. Separation and filter fabrics. Preparing sub-grades for slabs-on-grade, walks, pavements, turf, grasses and plants.
 - 8. Excavating and backfilling for buildings and structures.
 - 9. Subsurface drainage backfill for walls and trenches.
 - 10. Excavating and backfilling trenches for utilities and pits for buried utility structures.
 - 11. Undercutting
 - 12. Placement and compaction of soil fill materials for embankment construction.
 - 13. Rock Excavation
- B. Related Sections include the following:
 - 1. Division 1 Section “Stormwater Pollution Prevention Plan” for stormwater discharge permit requirements.

2. Division 31 Section "Site Clearing" for temporary erosion and sedimentation control measures, site stripping, grubbing, and removal of above- and below-grade improvements and utilities.
3. Division 31 Section "Excavation and Fill for Site Utilities" for trenching and backfilling utilities.
4. Division 31 Section "Lightweight Aggregate Structural Fill" for raising grades under slabs at the multi-family building.
5. Division 32 Section "Soil Preparation" for finish grading, including preparing and placing topsoil and planting soil for lawns.
6. Division 32 Section "Plants" for planting bed establishment and tree and shrub pit excavation and planting.
7. Division 32 Section "Turf & Grasses" for lawn establishment.
8. Division 33 Sections "Storm Drainage", "Sanitary Sewerage" and "Water Distribution" for utility improvements.

1.3 DEFINITIONS

- A. Backfill: Soil materials used to fill an excavation.
1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
 2. Final Backfill: Backfill placed over initial backfill to fill a trench.
- B. Bedding Course: Layer placed over excavated subgrade in a trench before laying a pipe.
- C. Borrow: Satisfactory soil imported from off-site for use as fill or backfill.
- D. Drainage Course: Layer supporting slab-on-grade used to minimize capillary flow of pore water.
- E. Excavation: Removal of material encountered above subgrade elevations.
1. Additional Excavation: Excavation below subgrade elevations as directed by Landscape Architect. Additional excavation and replacement will be paid for according to Contract provisions for changes in the Work.
 2. Bulk Excavation: Excavations more than 10 feet (3 m) in width and pits more than 30 feet (9 m) in either length or width.
 3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated dimensions without direction by Landscape Architect. Unauthorized excavation, as well as remedial work directed by Landscape Architect, shall be without additional compensation.
- F. Fill: Soils materials used to raise existing grades.
- G. Rock: Rock materials in beds, ledges, unstratified masses, and conglomerate deposits and boulders of rock material exceeding 1 cu. yd. (0.76 cu. m) for bulk excavation or $\frac{3}{4}$ cu. yd. (0.57 cu. m) for footing, trench, and pit excavation that cannot be removed by rock excavating

equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:

1. Excavation of Footings, Trenches, and Pits: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch (1065 mm) wide, short-tip-radius rock bucket; rated at not less than 120-hp (89 kW) flywheel power with bucket-curling force of not less than 25,000 lbf (111 kN) and stick-crowd force of not less than 18,700 lbf (83 kN); measured according to SAE J-1179.
 2. Bulk Excavation: Late-model, track-mounted loader; rated at not less than 210 hp (157 kW) flywheel power and developing a minimum of 45,000 lbf (200 kN) breakout force; measured according to SAE J-732.
- H. Structures: Building, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- I. Subbase course: Course placed between the subgrade and a cement concrete or hot mix asphalt pavement.
- J. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below base, drainage fill, or topsoil materials.
- K. Utilities include on-site underground pipes, conduits, ducts, cables, and appurtenant structures.

1.4 SUBMITTALS

- A. Product Data: For the following:
1. Subbase (with sieve analysis)
 2. Bedding Course (with sieve analysis)
 3. Structural Fill (with sieve analysis)
 4. Separation fabric.
 5. Filter fabric.
 6. Material submittals shall include NYSDOT approved source numbers, gradations, proctors and soundness test results. Testing to be done within 3 months of the submittal date.
- B. Samples:
1. 12-by-12 inch (300-by-300 mm) sample of separation fabric.
 2. 12-by-12 inch (300-by-300 mm) sample of filter fabric.

1.5 QUALITY ASSURANCE

- A. Pre-excavation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."

1.6 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities servicing facilities occupied by Owner or others unless permitted in writing by Owner's Representative and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Do not proceed with utility interruptions without Owner's Representative's written permission.
 - 2. Contact Dig Safely New York at 1-800-962-7962 before starting site clearing or excavation operations.
 - 3. Coordinate with Owner and utility companies to shut off services if lines are active.
 - 4. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to the satisfaction of utility owner.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available for excavations.
- B. Satisfactory Soils (suitable): ASTM D 2487 soil classification groups GW, GP, GM, SW, SP, and SM or a combination of these groups symbols; free of rock or gravel larger than 3 inches (75 mm) in any dimension, debris, waste, frozen material, vegetation, and other deleterious matter.
- C. Unsatisfactory Soils (unsuitable): ASTM D 2487 soil classification groups GC, SC, ML, MH, CL, CH, OL, OH, and PT, or a combination of these group symbols.
 - 1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
- D. On Site Material: All on-site material to be used as fill shall be soil or soil-rock mixture which is free from organic matter and other deleterious substances. It shall contain no rocks or lumps over 4 inches in greatest dimension.
- E. Imported Fill Material: Imported fill material shall consist of clean, well-graded sand and/or gravel containing less than 15 percent by weight of materials passing a No. 200 sieve and a maximum particle size of 4 inches.
- F. Backfill and Fill: Satisfactory soil materials.
- G. Structural Fill: NYS DOT Type 2 or Type 4 subbase course complying with the requirements of NYS DOT 304-2.

- H. Drainage Stone: Clean, sound, durable, sharp-angled fragments of rock of uniform quality and conforming to NYSDOT Material Designation 703-0201, Size Designation No. 2.
- I. Subbase: NYSDOT Type 2, Crushed stone, consisting of crushed ledgerrock exhibiting 100% fractured faces, adapted from NYSDOT Standard Specifications, Section 304-2.02 Subbase Course items.
- J. Slab Subbase: AASHTO #57 stone with 95-100% passing a 1" sieve, 25-60% passing a ½" sieve, and less than 10% passing a No. 4 sieve.

2.2 ACCESSORIES

- A. Filter Fabric: Nonwoven geotextile, specifically manufactured as a drainage geotextile; made from polyolefins, polyesters, or polyamides; and with the following minimum properties determined according to ASTM D 4759 and referenced standard test methods:
 - 1. Survivability: Class 2; AASHTO M 288.
 - 2. Grab Tensile Strength: 120 lbf (0.5 kN); ASTM D 4632.
 - 3. Tear Strength: 50 lbf (0.2 kN); ASTM D 4533.
 - 4. Puncture Resistance: 65 lbf (0.3 kN); ASTM D 6241.
 - 5. Water Flow Rate: 135 gpm per sq. ft. (5500 l/min per sq. m); ASTM D 4491.
 - 6. Apparent Opening Size: No. 70 (0.212 mm); ASTM D 4751.1.
- B. Separation Fabric: The geotextile fabric for pavement stabilization shall be Mirafi 500X as manufactured by Mirafi, AMOCO 2002, Synthetic Industries 200ST or approved equal. The geotextile fabric shall be woven fabric of only continuous chain polymeric filaments or yarns of polyester. The fabric shall be inert to commonly encountered chemicals, hydrocarbons, mildew, and rot resistant. The fabric shall be UV stabilized with the following properties:

Acceptable		
	<u>Value</u>	<u>Test Method</u>
1. Grab Tensile Strength, kN (lbs)	0.9 (200)	ASTM D4632
2. Elongation at Failure, % MD/ CD	15/ 10	ASTM D4632
3. Mullen Burst Strength, kPa (psi)	2756 (400)	ASTM D3786
4. Trapezoidal Tear Strength, kN (lbs)	0.33 (75)	ASTM D4533
5. Puncture Strength, kN (lbs)	0.40 (90)	ASTM D4833
6. Apparent Opening Size (AOS)	50	US Std. Sieve
	0.30 mm	ASTM D4751
7. Permittivity, sec ⁻¹	0.05	ASTM D4491
8. Flow Rate, l/min/m ² (gal/min/sf)	200 (5.0)	ASTM D4491
9. UV Resistance after 500 hrs, % strength		70 ASTM D4355

2.3 PNEUMATIC EXCAVATION (AIR SPADE)

- A. Pneumatic Excavating Tool: Excavation within drip line of trees to remain shall be performed through the use of a pneumatic excavation tool with the following requirements:

1. The high air velocity excavation tool shall be specifically designed to fracture, pulverize, and displace porous and semi-porous soils without harming or causing damage to tree roots, existing subsurface utilities or other non-porous objects. The Contractor shall submit catalog cuts from the manufacturer verifying that the pneumatic excavation tool meets the following criteria:
 - a. Rated Operating Pressure 6.2 - 7.0 bar
 - b. Air Stream Velocity at Cutting Head 2,200 – 2,500 km/hr
 - c. Air Displacement 4,000 – 5,000 L/min
- B. Air Compressor: The air compressor may be either a portable or truck-mounted unit and shall be adequately sized as required to power the pneumatic excavation tool in accordance with the manufacturer's recommendations for the pneumatic excavating tool.
- C. Vacuum Truck: A vacuum truck should be used to collect excavated spoil directly from the trench or pit.
- D. Containment Structure: To prevent the spread of excavated soil onto adjacent roadways and areas beyond the designated work zone limits, the Contractor shall provide a mobile structure or barrier to contain the material dislodged by the pneumatic excavation tool from the trench or pit. Timber or corrugated metal shields, tents supported on tubular frames, or other structures as approved by Landscape Architect may be used

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine the areas and conditions where earthwork 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 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. Protect subgrades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.
- C. Provide erosion-control measures to prevent erosion or displacement of soils and discharge or soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.3 DEWATERING

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
 - 1. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades and foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water from excavations. Maintain water levels below base of excavation to control hydrostatic pressure on subgrade soils.
 - 2. Establish and maintain temporary drainage ditches and other diversion outside excavation limits to convey rain water and water removed from excavations to collecting or run-off areas. Do not use trench excavations as temporary drainage ditches.
 - 3. Do not discharge sediment laden water into the adjoining storm or sanitary sewer system or open swales. Pump sediment laden water from excavations into a portable sediment tank or a high-strength, non-woven geotextile fabric bag. Size portable sediment tanks in accordance with the New York Guidelines for Urban Erosion and Sediment Control.
- B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
 - 1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
 - 2. Install a dewatering system as needed to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

3.4 EXCAVATION, GENERAL

- A. Unclassified Excavation: Excavation to subgrade elevations regardless of the character of surface and subsurface conditions encountered, including rock, soil materials, and obstructions.
 - 1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
- B. Stability of Excavations: Slope sides of excavations to comply with local codes and ordinances having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated. Maintain sides and slopes of excavations in safe condition until completion of backfilling.
- C. Material Storage: Stockpile satisfactory excavated materials where directed until required for backfill or fill. Place, grade and shape stockpiles for proper drainage.
 - 1. Locate and retain soil materials away from edge of excavations. Do not store within drip line of trees indicated to remain.
 - 2. Dispose of excess soil material and waste materials not re-used.

3.5 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch (25 mm). Extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
 - 1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
 - 2. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions within a tolerance of plus or minus 1 inch (25 mm). Do not disturb bottom of excavations intended for bearing surface.

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated cross section, elevations, and grades.

3.7 APPROVAL OF SUBGRADE

- A. When excavation has reached required subgrade elevations, notify Geotechnical Engineer who will make an inspection of conditions.
- B. If Geotechnical Engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
- C. Proof-roll subgrade below the building slabs and pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Proof-rolling is to be done in the presence of the project Geotechnical Engineer after excavation to required subgrade elevations. Do not proof-roll wet or saturated subgrades.
 - 1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
 - 2. Proof-roll with a self propelled roller in non-vibratory mode weighing at least 14,000 lbs.
 - 3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Geotechnical Engineer, and replace with compacted structural fill as directed.
- D. Additional Excavation:
 - 1. If unsuitable bearing materials are encountered at required subgrade elevations, carry excavations deeper and replace excavated material as directed by the Geotechnical Engineer. Excavation of unsuitable material must extend laterally beyond the edge of the footing or slab for a distance equal to or greater than the required depth of the excavation.
 - 2. Removal of unsuitable material and its replacement as directed will be paid on basis of contract conditions relative to changes in work.

3. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect.

3.8 UNAUTHORIZED EXCAVATION

- A. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimension without specific direction of Geotechnical Engineer. Unauthorized excavation, as well as remedial work directed by Geotechnical Engineer, shall be at Contractor's expense.
- B. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill may be used when approved by Geotechnical Engineer.
 1. Fill unauthorized excavation under other construction or utility pipe as directed by Engineer.

3.9 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow materials and satisfactory excavated soil materials. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.10 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
 1. Surveying locations of underground utilities for record documents.
 2. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
 3. Inspecting and testing underground utilities.
 4. Removing concrete formwork.
 5. Removing trash and debris.
- B. Coordinate backfilling with utilities testing.
- C. Install warning tape directly above utilities, 18 inches below finished grade, except 6 inches below subgrade under pavements and slabs

3.11 FILL

- A. Preparation: Remove vegetation, topsoil, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface before placing fills.
- B. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- C. Place and compact fill material in layers to required elevations as follows:
 - 1. Under grass and planted areas, use satisfactory soil material.
 - 2. Under base course for walks and pavements, use satisfactory soil material.
 - 3. Under footings and foundations, use Granular Base NYSDOT Type 2. Under footings and foundations, use Structural Fill to existing grade elevation. All fill placed above existing grade elevation is to be Lightweight Structural Fill. Reference Specification Section 312353, Lightweight Aggregate Structural Fill.
 - 4.

3.12 MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill layer before compaction to within 2 percent of optimum moisture content.
 - 1. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
 - 2. Remove and replace, or scarify and air-dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.13 COMPACTION OF BACKFILLS AND FILLS

- A. Place backfill and fill materials in layers not more than 8 inches (200 mm) in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches (100 mm) in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- C. Compact soil to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:
 - 1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches (300 mm) of existing subgrade and each layer of backfill or fill material at 95 percent of Modified Proctor at +/- 2% optimum moisture content..
 - 2. Under walkways, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill material at 92 percent.

3. Under lawn or unpaved areas, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill material at 85 percent.
4. For utility trenches, compact each layer of initial and final backfill soil material at 85 percent.

3.14 GRADING

- A. General: Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
 1. Provide a smooth transition between adjacent existing grades and new grades.
 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
 1. Lawn or Unpaved Areas: Plus or minus 1 inch (25 mm).
 2. Pavements: Plus or minus 1/4 inch (13 mm).

3.15 SUBBASE COURSES

- A. Place subbase course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place subbase course under pavements and walks as follows:
 1. Install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
 2. Place subbase course material over subgrade under hot-mix asphalt pavement.
 3. Shape subbase course to required crown elevations and cross-slope grades.
 4. Place subbase course 6 inches or less in compacted thickness in a single layer.
 5. Place subbase course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
 6. Compact subbase course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.
- C. Pavement Shoulders: Place shoulders along edges of subbase and base course to prevent lateral movement. Construct shoulders, at least 12 inches wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

3.16 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.
- B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.
- C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Geotechnical Engineer.
- D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed as the following locations and frequencies:
 - 1. Paved Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 200 sq. ft. (186 sq. m) or less of paved area, but in no case fewer than three tests.
 - 2. Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least 1 test for every 2000 sq. ft. or less of building slab, but in no case fewer than 3 tests.
 - 3. Foundation Wall Backfill: At each compacted backfill layer, at least 1 test for each 100 feet or less of wall length, but no fewer than 2 tests.
 - 4. Trench Backfill: At each compacted initial and final backfill layer, at least 1 test for each 150 feet or less of trench length, but no fewer than 2 tests.

3.17 PROTECTION

- A. Protecting Graded Areas: Protect newly grades areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and re-establish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
 - 1. Scarify or remove and replace soil material to depth as directed by the Owner's Representative; reshape and recompact.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
 - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.
- D. Protection of Persons and Property: Barricade or steel plate open excavations occurring as part of this work and post with warning lights.

1. Operate warning lights as recommended by authorities having jurisdiction.
2. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthworks operations.

3.18 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Coordinate with Owner for placement of suitable (satisfactory) fill material at the Project Site. Remove surplus unsuitable soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property. Refer to Specification Section 310100.

END OF SECTION 312000

SECTION 312319 - DEWATERING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes construction dewatering.
- B. This Section also includes the use of cofferdams, as required to remove and divert water during the installation of culvert pipes near existing water sources.

1.2 PERFORMANCE REQUIREMENTS

- A. Dewatering Performance: Furnish and install a dewatering system of sufficient size and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed.

1.3 QUALITY ASSURANCE

- A. Perform work in accordance with the following Sections:
 - 1. Section 312000: Earth Moving
 - 2. Section 312500: Soil Erosion and Sedimentation Control.
 - 3. Section 315000: Excavation Support and Protection.
- B. Regulatory Requirements: Comply with New York State Department of Environmental Conservation (NYSDEC) regulations for storm water pollution control before beginning dewatering.
- C. Preinstallation Conference: Conduct conference at Project site.

PART 2 - PRODUCTS

2.1 COFFERDAMS

- A. Contractor shall design the cofferdam for the intended use of the installation. Material options for cofferdams shall include:
 - 1. A commercially designed system manufactured specifically for the control of water.
 - 2. A system of temporary steel sheeting, meeting the requirements of ASTM A328M. Temporary steel sheeting may be used, provided that it is in suitable condition, as determined by the Owner's Representative.

3. Tightly sealed, impermeable sand bags may be used if demonstrated by the Contractor that it's application will be suitable for the height of water and type of flow. Sand bags shall be of a reinforced geotextile with ties. No burlap bags shall be used. Sand or gravel may be used as the fill material in the bags. Gravel shall meet the requirements of Type A4 or A5 Aggregate, as per Section 310516. Sand shall meet the requirements of Type A9 Aggregate, as per Section 310516. All materials used for sand/gravel bags shall be double bagged, inversely inserted and each bag individually tied to prevent leakage.
4. No soil laden water shall be in the cofferdam discharge.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide temporary grading to facilitate dewatering and control of surface water.
- B. Monitor dewatering systems continuously.
- C. Protect and maintain temporary erosion and sedimentation controls, which are specified in Division 31 Section "Site Clearing" during dewatering operations.
- D. Install dewatering system utilizing pump equipment, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.
 1. Use filters or other means to prevent pumping of fine sands or silts from the subsurface.
 2. Dewatering must be done so that the velocity of the discharged water doesn't cause scouring of the receiving area.
 3. Discharge water from dewatering pumps shall not be directly discharged without treatment to remove silt and velocity from the groundwater.
- E. Provide an adequate system to lower and control ground water to permit excavation, construction of structures, and placement of fill materials on dry subgrades.
 1. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.
 2. Maintain water table at least 2 ft below bottom of excavations at all times.
- F. Cofferdams shall be maintained in a dewatered condition during foundation construction or culvert pipe and end section installation. The placement of foundation concrete shall not be impeded by water standing or flowing within the cofferdam.

Dewatering equipment and any additional bracing shall be of adequate quality and capacity and shall be so arranged as to permit their proper functioning in connection with the cofferdam. Dewatering equipment and bracing shall be so located to permit construction of the structure in accordance with the plans.

END OF SECTION 312319

SECTION 312500 – SOIL EROSION AND SEDIMENTATION CONTROL

PART 1 - GENERAL

- 1.1 Drawings and General Provisions of the Contract, including the Stormwater Pollution Prevention Plan (SWPPP) for this Project apply to this Section.
- 1.2 WORK INCLUDED
 - A. Installation of Erosion Control Facilities.
 - B. Inspection of Erosion Control Facilities.
 - C. Maintenance of Erosion Control Facilities.
 - D. Repairs to Erosion Control Facilities.
 - E. Removal and disposal of temporary erosion control facilities, where directed by the SWPPP.
- 1.3 REFERENCES
 - A. *New York Standards and Specifications for Erosion and Sediment Controls*, 2005 Version.
 - B. *New York State Stormwater Management Design Manual*, 2010. New York State Department of Environmental Conservation (NYS DEC).
 - C. *NYS DEC SPDES General Permit for Stormwater Discharges from Construction Activity*, Permit No. GP-0-15-002.
 - D. Stormwater Pollution Prevention Plan (SWPPP) for this Project.
- 1.4 REFERENCED REQUIREMENTS
 - A. Local (if applicable)
 - B. County (if applicable)
 - C. State - New York State Department of Environmental Conservation (NYSDEC)
 - D. Federal - United States Army Corps of Engineers (USACE)
- 1.5 ENVIRONMENTAL REQUIREMENTS/PROTECTION OF EXISTING FACILITIES
 - A. Protect the following:
 - 1. Existing storm sewers
 - 2. Wetlands - USCOE and NYSDEC
 - 3. Existing drainage ways

PART 2 - PRACTICES

- A. Refer to New York Standards and Specifications for Erosion and Sediment Controls, 2005 Version.
- B. Refer to the Stormwater Pollution Prevention Plan (SWPPP) for this Project. The SWPPP is a part of the Contract Documents.

PART 3 - EXECUTION

3.1 GENERAL

- A. The Contractor is responsible for controlling sediment from leaving the project site. The Owner will have a qualified inspector perform weekly SWPPP inspections. Contractor to make any corrections that are noted in the SWPPP inspection reports.
- B. Before beginning any work on-site, the Contractor shall become familiar with the SWPPP, and sign the required certifications that are in the SWPPP. Contractor shall keep a copy of the SWPPP on-site at all times.
- B. Pollutants such as fuels, lubricants, bitumens, raw sewage, chlorine, and other harmful materials shall be handled and disposed of by approved methods and shall not be discharged into rivers, streams, impoundments, wetlands, or into natural or man-made channels leading thereto. Washwater or waste from concrete mixing or curing operations shall not be allowed to enter live streams, etc.
- C. In the event of a conflict between these specification requirements and pollution control laws, rules, or regulations of other federal, state, or local agencies, the more restrictive laws, rules, or regulations shall apply.
- D. In case of repeated failures on the part of the Contractor to control pollution/erosion, the right shall be reserved by the Owner to employ outside assistance to provide the necessary corrective measures. Such incurred costs, plus related engineering costs, shall be charged to the Contractor and appropriate deductions made to the Contractor's progress payments.

3.2 INSTALLATION OF EROSION CONTROL FACILITIES

- A. The installation of all erosion control facilities shall be in accordance with the SWPPP unless an alternative construction specification and installation detail has been provided or otherwise directed by the Consultant.
- B. The location and method of construction of all erosion control facilities shall be the responsibility of the Contractor unless an erosion control plan and specifications are provided.
- C. All erosion control facilities shall be installed prior to beginning any work unless a construction sequence has been provided. The erosion control facilities will be installed in accordance with the construction sequence unless otherwise directed by the Consultant.

3.3 INSPECTION OF EROSION CONTROL FACILITIES

- A. An inspection of all erosion control facilities shall be made by the Contractor at least once every seven calendar days and/or within 24 hours of the end of rain event where the total rainfall is 0.5 inches or greater whichever comes first or as otherwise specified. Inspections are further outlined in the Project SWPPP.

3.4 MAINTENANCE OF EROSION CONTROL FACILITIES

- A. Maintenance of all erosion control facilities will be the Contractor's responsibility throughout the project, as outlined in the SWPPP.
- B. Maintenance of all erosion control facilities must be provided after every inspection or as required.
- C. Remove and dispose of temporary erosion control facilities as directed by the Engineer. Remove excess silt and/or debris as directed by the SWPPP.

3.5 REPAIRS TO EROSION CONTROL FACILITIES

- A. All repairs to the erosion control facilities shall be made by the Contractor at no cost to the Owner.
- B. All repairs shall be made immediately upon notification by the Engineer, Qualified Inspector, or when the Contractor finds an erosion control facility not properly functioning or in need of repair or maintenance.

END OF SECTION 312500

SECTION 315000 - EXCAVATION SUPPORT AND PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes temporary excavation support and protection systems.

1.2 RELATED DOCUMENTS

- A. 29 CFR 1926 Subpart P of "Safety and Health Regulations for Construction", as administered by the Federal Occupational Safety and Health Administration (OSHA).

1.3 SUMMARY

- A. Section includes temporary excavation support and protection systems.
- B. Related Sections:
 - 1. Division 31 Section 312000 "Earthmoving".
 - 2. Division 31 Section 312319 "Dewatering" for dewatering system for excavations.

1.4 PERFORMANCE REQUIREMENTS

- A. Design excavation support and protection system including comprehensive engineering analysis by a qualified Professional Engineer, as per Occupational Safety and Health Administration (OSHA) requirements.
- B. Install and maintain excavation support and protection systems without damaging existing buildings, structures, and site improvements adjacent to excavation.
- C. Prevent surface water from entering excavation by grading, dikes or other means.

1.5 ACTION SUBMITTALS

- A. Shop Drawings: For excavation support and protection system signed and stamped/sealed by a qualified Professional Engineer, including data analysis and calculations.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification data for qualified Professional Engineer and qualified Surveyor.
- B. Videotape (or video files) and photographs showing existing conditions of adjacent construction and site improvements that might be misconstrued as damage caused by the absence of, the installation of, or the performance of excavation support and protection systems. Submit before Work begins.
- C. Record drawings identifying and locating capped utilities and other subsurface structural, electrical, or mechanical conditions.

1.7 QUALITY ASSURANCE

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to excavation support and protection system including, but not limited to, the following:
 - a. Geotechnical report of soil boring logs and soil analysis.
 - b. Existing utilities and subsurface conditions.
 - c. Proposed excavations.
 - d. Proposed equipment.
 - e. Monitoring of excavation support and protection system.
 - f. Working area location and stability.
 - g. Abandonment or removal of excavation support and protection system.

1.8 PROJECT CONDITIONS

- A. Interruption of Existing Utilities: Do not interrupt any utility serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:
 - 1. Notify Owner and Owner's Representative no fewer than four (4) days in advance of proposed interruption of utility.
 - 2. Do not proceed with interruption of utility without Owner's written permission.
- B. Project-Site Information: A geotechnical report consisting of soil borings and gradations on soil samples has been prepared for this Project and is available for information only. The opinions expressed in this report are those of the geotechnical investigation and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from the data. Advance additional borings and conduct other exploratory operations necessary for excavation support and protection.
- C. Survey Work: Engage a qualified land surveyor to survey adjacent existing buildings, structures, and site improvements; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.
 - 1. During installation of excavation support and protection systems, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations and positions for comparison with original elevations and positions. Promptly notify the Engineer if changes in elevations or positions occur or if cracks, sags, or other damage is evident in adjacent construction.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Provide materials that are either new or in serviceable condition.
- B. Structural Steel: ASTM A 36/A 36M, ASTM A 690/A 690M, or ASTM A 992/A 992M.

- C. Steel Sheet Piling: ASTM A 328/A 328M, ASTM A 572/A 572M, or ASTM A 690/A 690M; with continuous interlocks. Corners shall be roll-formed corner shapes with continuous interlock.
- D. Wood Lagging: Lumber, mixed hardwood, nominal rough thickness of 3 inches.
- E. Cast-in-Place Concrete: ACI 301, of compressive strength required for application as determined by the Professional Engineer in the design calculation.
- F. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
- G. Tiebacks: Steel bars, ASTM A 722/A 722M.
- H. Tiebacks: Steel strand, ASTM A 416/A 416M.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards that could develop during excavation support and protection system operations.
 - 1. Shore, support, and protect utilities encountered.
- B. Install excavation support and protection systems to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
 - 1. Do not close or obstruct streets, walks, 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. Contractor to determine the applicable type of sheeting to utilize when the protection of adjacent trees and buildings that are directly adjacent to the trenching is required, as shown on the project plans.
- C. Locate excavation support and protection systems clear of permanent construction so that forming and finishing of concrete surfaces are not impeded.
- D. Monitor excavation support and protection systems daily during excavation progress and for as long as excavation remains open. Promptly correct bulges, breakage, or other evidence of movement to ensure that excavation support and protection systems remain stable.
- E. Promptly repair damages to adjacent facilities caused by installing excavation support and protection systems.

3.2 TRENCH SHIELDS

- A. If applicable and suitable for type of work, provide a trench box or trench shield system that meets OSHA requirements.

3.3 SOLDIER PILES AND LAGGING

- A. Install steel soldier piles before starting excavation. Extend soldier piles below excavation grade level to depths adequate to prevent lateral movement. Space soldier piles at regular intervals not to exceed allowable flexural strength of wood lagging. Accurately align exposed faces of flanges to vary not more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment.
- B. Install wood lagging within flanges of soldier piles as excavation proceeds. Trim excavation as required to install lagging. Fill voids behind lagging with soil, and compact.
- C. Install wales horizontally at locations indicated on Drawings and secure to soldier piles.

3.4 SHEET PILING

- A. Before starting excavation, install one-piece sheet piling lengths and tightly interlock to form a continuous barrier. Accurately place the piling, using templates and guide frames unless otherwise recommended in writing by the sheet piling manufacturer. Limit vertical offset of adjacent sheet piling to 36 inches. Accurately align exposed faces of sheet piling to vary not more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment. Cut tops of sheet piling to uniform elevation at top of excavation if the sheet piling shall be a permanent structure.

3.5 TIEBACKS

- A. Tiebacks: Drill, install, grout, and tension tiebacks. Test load-carrying capacity of each tieback and replace and retest deficient tiebacks.
 - 1. Test loading shall be observed by a qualified professional engineer responsible for design of excavation support and protection system.
 - 2. Maintain tiebacks in place until permanent construction is able to withstand lateral soil and hydrostatic pressures.

3.6 BRACING

- A. Bracing: Locate bracing to clear columns, floor framing construction, and other permanent work. If necessary to move brace, install new bracing before removing original brace.
 - 1. Do not place bracing where it will be cast into or included in permanent concrete work unless otherwise approved by the Owner's Representative.
 - 2. Install internal bracing, if required, to prevent spreading or distortion of braced frames.
 - 3. Maintain bracing until structural elements are supported by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.

3.7 REMOVAL AND REPAIRS

- A. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and bear soil and hydrostatic pressures. Remove in stages to avoid disturbing underlying soils or damaging structures, pavements, facilities, and utilities.
 - 1. Fill voids immediately with approved backfill compacted to density specified in Division 31 Section 312000 "Earth Moving."
 - 2. Repair or replace, as approved by Owner's Representative, adjacent work damaged or displaced by removing excavation support and protection systems.

END OF SECTION 315000

SECTION 317001 - CASED HIGHWAY & RAILROAD CROSSINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the cased underground utility crossings of highways and roadways.

1.2 RELATED DOCUMENTS

- A. New York State Department of Transportation (NYSDOT) Standard Specifications, dated May 1, 2018.
- B. Manual for Railroad Engineering, Vol. I & II (American Railroad Engineering Association - AREA)
- C. RelTEK Specifications for Pipeline Occupations of Railroad Property

1.3 SUMMARY

- A. Section includes the installation of a steel casing pipe via jack and bore methods below the railroad, and the placement of PVC, SDR-35 sanitary sewer pipe within the steel casing.
- B. Related Sections:
 - 1. Division 31 Section 310100 "Maintenance of Earthwork".
 - 2. Division 31 Section 310513 "Soils for Earthwork".
 - 3. Division 31 Section 312000 "Earthmoving".
 - 4. Division 31 Section 312319 "Dewatering" for dewatering system for excavations.
 - 5. Division 31 Section 315000 "Excavation Support and Protection".
 - 6. Division 33 Section 333313 "Sanitary Sewer Piping".
 - 7. Division 34 Section 340133 "Maintenance and Protection of Traffic".

1.4 ACTION SUBMITTALS

- A. Products: Material for Casing Pipe, Carrier Pipe, Spacers, and end caps/seals.
- B. Shop Drawings: Layout of Casing Pipe, Carrier Pipe, Spacers, and caps/seals.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification data for qualified Contractor that will be performing the jacking and boring effort.
- B. Record drawings identifying and locating the underground utilities that are to be installed via jack and bore.
- C. Traffic Detour Plan and Maintenance and Protection of Traffic Plan along East Road.

1.6 QUALITY ASSURANCE

- A. Pre-installation Conference: Conduct conference at Project site.

1. Review methods and procedures related to the pipe jack & bore process including, but not limited to, the following:
 - a. Geotechnical report of soil boring logs and soil analysis.
 - b. Existing utilities and subsurface conditions.
 - c. Proposed excavations.
 - d. Proposed equipment.
 - e. Monitoring of excavation support and protection system.
 - f. Working area location and stability.
 - g. Work Zone Protection, Traffic Detour Plan, Maintenance and Protection of Traffic Plan.

1.7 PROJECT CONDITIONS

- A. The Project Owner (Lewis County) has applied for the construction of the installation of a jack and bore pipe under the Railroad. No work related to the installation of these utilities below the railroad property can begin until approved by the Railroad. Once the Owner is notified of approval and the occupational agreement is executed, the railroad official will begin coordination of the aspects of the work that relate to the railroad (flagging, protection of rail features).
 1. Notify Owner and Railroad Official no fewer than fifteen (15) days in advance of start date of construction / excavation for jack & bore work.
 2. Do not proceed with jack & bore work without the Owner's written permission.
 3. Once the jack and boring operation is started, it shall proceed on a 24-hour basis without interruption until completed. The casing pipe shall be maintained accurately to line and grade during the operations of jacking, tunneling or boring.
 4. The driven portions of the casing shall be advanced from the lower end of the casing unless specific permission to do otherwise is obtained by the Contractor from the Owner and Railroad Official.
- B. Project-Site Information: A geotechnical report that includes data from soil borings that were taken each side of the railroad tracks has been prepared for this Project and is available for information only. The opinions expressed in this report are those of the geotechnical investigation and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. The Owner is not be responsible for interpretations or conclusions drawn from the data.
- C. Railroad Workplace Safety: All work within the railroad right of way shall be conducted in accordance with 49 CFR Part 214 Railroad Workplace Safety and the railroad's safety rules. Procedures for compliance with 49 CFR Part 214 shall be addressed within the Project Safety and Health Plan.
- D. Supervision and Railroad Approval: All work on any contract affecting a railroad company's property, right of way facilities shall be carried out under the joint supervision of the Owner and the Railroad in a manner satisfactory to both agencies. Approval by the Railroad Official of the Railroad Company does not absolve the Contractor from any liability resulting from its contractual operations.
- E. Protection of Railroad Service and Facilities. The Contractor shall take special care and vigilance to avoid damage to the trains, tracks or other facilities of the railroad company and

shall conduct its work so as not to interfere with the movement of trains or other operations of the railroad company. Whenever work may affect the safety or movement of trains, the method of doing the work shall be submitted to the Railroad Official of the railroad company for approval. No work affecting safety or movement of trains shall be commenced or prosecuted until written approval of the Railroad Official of the railroad company is received. The approval of the Railroad Official of the railroad will not release the Contractor from any responsibility for any damages to the railroad company caused by the acts of the Contractor or its employees and Subcontractors.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Provide materials that are either new or in serviceable condition.
- B. Structural Steel: ASTM A 36/A 36M, ASTM A 690/A 690M, or ASTM A 992/A 992M.
- C. Casing Pipe: 16" diameter Steel Pipe, Grade 2, Schedule 20 (ASTM A252), as indicated on the Plans.
- D. Carrier Pipe: 8" diameter PVC, SDR-35 Pipe, as per Specification Section 333313.
- E. Spacers: The Casing spacer shall be constructed of a circular, 8-inch or 12 inch wide, 14-gauge stainless steel band, which bolt together forming a shell around the carrier pipe. The spacers shall have a combination of 10-gauge risers MIG welded to the bands and 2-inch wide high strength glass filled polymer runners. The runners and risers shall be placed in position to properly support the carrier pipe within the casing and maintain a minimum clearance of ¾-inch between the casing ID and the spacer OD. All runners shall be attached with stainless steel nuts, to stainless studs, The liner shall be a ribbed PVC extrusion, with a thickness of .090-inch, with hardness of Durometer "A" 85-90. The runners shall be of high pressure molded glass reinforced polymer, 2-inches wide. The ends of the runners shall be beveled to facilitate installation over rough weld beads or deformed casing pipe. All hardware shall be 304 stainless steel. The casing spacers shall be model BWM-SS-8, as manufactured by the BWM Company, Forest City, NC. or approved equal.

PART 3 - EXECUTION

3.1 GENERAL

- A. Unless otherwise shown or specified, the Contractor may at his own option employ any one of the following alternate methods within the limits shown on the plans for the casing to be driven:
 - 1. Jacking
 - 2. Tunneling
 - 3. Boring

- B. The remaining portion of the casing may be constructed by the same method or by open cut in a sheeted trench. Installation of the casing pipe shall be carried out without disturbance of the embankment, pavement, tracks or other railroad or highway facilities and without obstructing the passage of traffic at any time.
- C. Once the operation is started, it shall proceed on a 24-hour basis without interruption until completed. The casing pipe shall be maintained accurately to line and grade during the operations of jacking, tunneling or boring.
- D. The driven portions of the casing shall be advanced from the lower end of the casing unless specific permission to do otherwise is obtained by the Contractor from the Engineer.

3.2 CASING PIPE

- A. The casing pipe shall in each case be of the type, size, and class as shown on the Plans. Casing pipes shall in all respects conform to the applicable portions of the Specifications.
- B. Where a tunneling method is used, the casing pipe shall be constructed from tunnel liner plates of pressed steel, by Armco, Republic Steel Corporation or equal, of the gauge shown or specified. Where shown or specified, liner plates shall be galvanized.
- C. Where steel pipe is used for casing pipes, it shall have the minimum yield strength of 35,000 psi and the minimum ultimate strength of 60,000 psi.

3.3 JACKING

- A. Where a casing pipe of elliptical cross section is used, it shall be placed with the longer diameter in the vertical plan.
- B. Tongue and groove pipe shall be placed with the tongue end at the lower end. Tongue and groove jacking pipe shall be jointed by placing a bituminous coated or tarred rope around each tongue. The inner surface of all joints shall be filled with mortar and brushed smooth.

3.4 TUNNELING

- A. Tunnel Shields shall be used as necessary to prevent caving of material above the tunnel before the liner plates can be installed. Steel liner plates shall be installed as soon as possible after the excavated material is removed. Excavation shall be carried on in such manner that voids behind the liner plates will be held to a minimum.
- B. Such voids as there are shall be filled within the working day with a Portland cement grout placed under pressure. Grout plugs shall be placed in every third ring, on approximately 4-foot centers at the top, the bottom and on the spring line.
- C. All work shall be performed in accordance with applicable rules and regulations of the State Codes pertaining to the construction of tunnels.
- D. Tunneled casings shall have a foundation of concrete placed for the entire length of the interior of the casing pipe before the installation of the sewer or pipeline.

3.5 BORING

- A. The boring machine shall be accurately aligned before the boring is commenced and the Contractor shall take such necessary steps as are required to accurately place the casing with respect to line and grade. The leading edge of the steel casing shall be kept as close to the auger head as possible and shall be advanced at the same rate of speed as the earth auger in order to minimize any unsupported holes in the earth.

3.6 PIPELINE INSTALLATION – GRAVITY SEWER PIPE

- A. Before the pipe is installed in the casing, a spacers shall be laid out within the casing to such an elevation that the pipe when installed shall be at the grade as shown on the plans.
- B. Adequate provisions shall be made when inserting the pipe into the casing to prevent damage to the pipe. Any pipe damaged shall be withdrawn and replaced by the Contractor at his own expense. Upon completion of the installation of the pipe, the ends of the casing pipe shall be closed with a cap assembly. If any void remains between the pipe and the casing, it shall be filled with a Controlled Low Strength Material (CLSM). Refer to Spec. Section 310513 for material requirements of CLSM.

3.7 WORK ZONE PROTECTION

- A. Refer to Spec. Section 340133, Work Zone Protection / Maintenance and Protection of Traffic. Jack and bore work along East Road is to be performed to the requirements of the Town of Lowville.
 - 1. Do not close or obstruct the road, or other adjacent occupied or used facilities without permission from Owner, Town of Lowville, and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

END OF SECTION 317001

SECTION 321200 - FLEXIBLE PAVING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Saw cutting pavements.
 - 2. Hot Mix Asphalt (HMA) paving.
 - 3. Hot Mix Asphalt (HMA) paving overlay.
 - 4. Tack Coat.
- B. Related Sections:
 - 1. Division 31 Section "Earth Moving" for subgrade preparation.
 - 2. Division 31 Section "Aggregates for Earthwork" for aggregate subbase.
 - 3. Division 32 Section "Pavement Markings"

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.
 - 1. Job-Mix Designs: For each job mix proposed for the Work submit material product data and HMA design.
- B. Manufacturer's Certificate:
 - 1. Certify HMA Products meet or exceed New York State Department of Transportation (NYSDOT) 2017 Standard Specifications (9/01/2017 version):
 - a. Section 401: Plant Production.
 - b. Section 402: Hot Mix Asphalt (HMA) Pavements.
 - c. Section 407: Tack Coat

1.3 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A paving-mix manufacturer with NYSDOT approved materials and batch plant equipment.
- B. Installer: Company specializing in performing work of this section with minimum three years experience.
- C. Perform work in accordance with the following NYSDOT Sept 1, 2017 Standard Specifications:
 - 1. Section 402: HMA Pavements.
 - 2. Section 407: Tack Coat.
- D. Mixing Plant:
 - 1. Obtain materials from same source throughout.

2. Conform to the following NYSDOT Sept 1, 2017 Standard Specifications:
 - a. Section 401: Plant Production.
 - b. Section 402: Hot Mix Asphalt (HMA) Pavements.

E. Preinstallation Conference: Conduct conference at Project site.

1.4 PROJECT CONDITIONS

- A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:
 1. Perform work in accordance with NYSDOT Sept 1, 2017 Standard Specifications, Section 402, Table 402-1 – Temperature Requirements (HMA Pavements).

PART 2 - PRODUCTS

2.1 AGGREGATES

- A. Aggregate for Base, Binder, and Top Course Mix: In accordance with NYSDOT Sept 1, 2017 Standard Specifications: Section 401-2.02 (Aggregates).
- B. Mineral Filler: Finely ground particles of limestone, hydrated lime, or other mineral dust, free of foreign matter and in accordance with NYSDOT Sept 5, 2013 Standard Specifications: Section 703-08 (Mineral Filler).

2.2 ASPHALT MATERIALS

- A. Asphalt Binder: AASHTO MP1, PG 64-22. Refer to Part 2.4B of this Section.
- B. Tack Coat: Emulsified asphalt in accordance with NYSDOT Sept 1, 2017 Standard Specifications Section 407-2, Materials (Tack Coat).

2.3 AUXILIARY MATERIALS

2.4 MIXES

- A. Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mixes meeting NYSDOT Sept 1, 2017 Standard Specifications, Section 402-2 (Materials – HMA Pavements) for each pavement course and complying with the following requirements:
 1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
 2. Hot Mix Asphalt (HMA) Mixes to be placed at thickness noted on the plans.
 3. SuperPave Base HMA: NYSDOT Item 402.377911. 37.5 mm Nominal Maximum Aggregate Size, with F3 (low volume road) coarse aggregate friction requirement.

4. SuperPave Binder HMA: NYSDOT Item 402.257911. 25.0 mm Nominal Maximum Aggregate Size, with F3 (low volume road) coarse aggregate friction requirement.
 5. SuperPave Top HMA: NYSDOT Item 402.127311. 12.5 mm Nominal Maximum Aggregate Size, with F3 (low volume road) coarse aggregate friction requirement.
- B. The Performance Graded Asphalt Binder used to produce the SuperPave Hot Mix Asphalt Mixes is defined by AASHTO Provisional Standard MP-1, Standard Specification for Performance Graded Asphalt Binder.
1. The Performance Graded Asphalt Binder shall be PG 64-22, as per NYSDOT (9/1/17) Standard Specification 702-6422.
 2. The HMA design mixtures shall be developed in accordance with the criteria specified in the SuperPave HMA Items that are appropriate for a 50-year 18-kip Equivalent Single Axle Load (ESAL) of 29,785,200.
 3. Under no circumstances shall the Performance Graded Asphalt Binder Content be less than:
 - a. 5.0% for the Top Course Mix (12.5 mm aggregate)
 - b. 4.0% for the Binder Course Mix (25.0 mm aggregate)
- C. Crushed Gravel: When crushed gravel is to be used in the production of SuperPave Hot Mix Asphalt Mixes, the minimum percent of crushed particle shall be as follows:
1. For particle sizes greater than 12.5 mm, 75% one crushed face.
 2. For particle sizes between 12.5 mm and 2.36 mm, 85% two crushed faces.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades. Refer to Section 312000 (Earth Moving).
- B. Proceed with paving only after unsatisfactory conditions have been corrected.
- C. Prepare subbase in accordance with NYSDOT Sept 1, 2017 Standard Specifications: Section 304 (Subbase Course). Prior to installation of the subbase, Geotextile Separation Fabric is to be installed on the compacted subgrade.
 1. Refer to the plans for the location of the Geotextile Separation Fabric.
 - a. Requirements for Geotextile Separation Fabric are specified in Division 31 Section "Geosynthetics for Earthwork."

3.2 SAW CUTTING

- A. Existing pavement and overlay shall be saw cut perpendicular to the roadway surface along neat lines, and to the depth indicated on the plans and typical sections. A power saw approved by the Owner's Representative shall be used for cutting asphalt surface course and asphalt overlay. A power saw shall be used for cutting concrete pavement. After the existing asphalt pavement, concrete pavement, asphalt surface course or overlay has been saw cut through, the contractor may use pry bars, pneumatic tools or other methods approved by the owner's representative, to pry loose the existing pavement from that pavement which is to remain. A pavement breaker, under the supervision of the owner's representative, may be used to break up the pavement to be removed after the pavement has been completely saw cut through and completely free from the pavement to remain.

3.3 PATCHING

- A. Hot-Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade. Fill excavated pavements with hot-mix asphalt base mix for full thickness of patch and, while still hot, compact flush with adjacent surface

3.4 TACK COAT

- A. Apply tack coat in accordance with NYSDOT Sept 1, 2017 Standard Specifications: Section 407-3.02 (Application of Bituminous Material).
- B. Apply tack coat to contact surfaces of curbs and precast drainage structures.
- C. Coat surfaces of manhole and catch basin frames with oil to prevent bond with asphalt pavement. Do not tack coat these surfaces.
- D. Paving over a tack coat should not commence until the emulsion has broken (goes from brown to black) or is tacky when touched.
- E. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
- F. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.5 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.
- B. Tack Coat: Apply in accordance with NYSDOT Sept 1, 2017 Standard Specifications: Section 407-3.02 (Application of Bituminous Material).

3.6 HOT-MIX ASPHALT PLACING

- A. Install Work in accordance with NYSDOT Sept 1, 2017 Standard Specifications, Section 402-3.06: Spreading and Finishing of HMA Pavements.
- B. 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. Spread mix at minimum temperature of 250 deg F.
 - 2. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
- C. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.
- D. 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.

3.7 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.

3.8 COMPACTION

- A. Perform work in accordance with NYSDOT Sept 1, 2017 Standard Specifications, Section 402-3.07 - Compaction (HMA Pavements).
- B. All vibratory compaction equipment for HMA shall be on the NYSDOT Approved List.
- C. 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 with vibratory-plate compactors in areas inaccessible to rollers.
- D. Compaction of Hot Mix Asphalt to follow the guidelines established 70 Series Compaction Methods as noted in Section 402 of the Sept 1, 2017 NYS DOT Standard Specifications. On the first day of paving, a test section will be established, with compaction methods determined with the Contractor and Owner's Representative. The starting method of compaction will consist of a breakdown roller pass followed by four vibratory passes. Density readings will be taken after each roller pass to determine the project target density. This density will be used as the target density for the remainder of the project paving for that particular course of hot mix asphalt.

- E. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
- F. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.9 INSTALLATION TOLERANCES

- A. Pavement Thickness: Compact each course to produce the thickness indicated on the Project Plans within the following tolerances:
 - 1. SuperPave Base Course: Plus or minus $\frac{1}{4}$ inch.
 - 2. SuperPave Binder Course: Plus or minus $\frac{1}{4}$ inch.
 - 3. SuperPave Top Course: Within $\frac{1}{4}$ inch.
- B. Pavement 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. SuperPave Base and SuperPave Binder Course: $\frac{1}{4}$ inch for each course.
 - 2. SuperPave Top Course: $\frac{1}{8}$ inch.
 - 3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is $\frac{1}{4}$ inch.

3.10 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. 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. Do not clean tools and equipment used for HMA paving on the pavement surface, near streams, ponds, drainage structures, or other areas that are tributary to waterways. If a petroleum product is used for cleaning, contain all liquids products during cleaning operations using tarpaulins, sand pads, or other collection methods. Properly dispose of sand and collected petroleum products as petroleum contaminated material at no additional cost to the Owner.

END OF SECTION 321200

SECTION 321273 - PAVEMENT JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract,

1.2 SUMMARY

- A. Section Includes:

1. Cold-applied joint sealants.
2. Expansion and contraction joints in asphalt and concrete pavements.

- B. Related Sections:

1. Division 32 Section "Flexible Paving" for constructing joints between concrete and asphalt pavement.
2. Division 32 Section "Concrete Paving" for joints in concrete sidewalks.

1.3 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Product Certificates: For each type of joint sealant and accessory, from manufacturer.
- C. Manufacturer's Installation Instructions.
- D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for joint sealants.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Source Limitations: Obtain each type of joint sealant from single source from single manufacturer.
- C. Product Testing: Test joint sealants using a qualified testing agency.

1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.

1.6 PROJECT CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
 2. When joint substrates are wet.
 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer based on testing and field experience.
- B. Colors of Exposed Joint Sealants: As indicated by manufacturer's designations.
- C. Cold-Applied Joint Sealants at Concrete Pavement Joints: Single Component, Nonsag, Silicone Joint Sealant for Concrete, ASTM D 5893, Type NS. Approved Products include, but are not limited to:
 1. Crafcro Inc., an ERGON company; RoadSaver Silicone.
 2. Dow Corning Corporation; 888.
 3. Pecora Corporation; 301 NS.
- D. Cold-Applied Fuel Resistant Joint Sealant for Asphalt Pavements: Single Component, Pourable, Traffic-Grade, Modified-Urethane Joint Sealant for Concrete: ASTM C 920, Type S, Grade P, Class 25, for Use T. Products include, but are not limited to:
 1. Pecora Corporation; Urexpan NR-200.
- E. Expansion Joint Material for Concrete Sidewalks and Exterior Slabs:
 1. Provide Asphalt impregnated fiberboard with bond breaker tape that meets the requirements of ASTM D1751. Material to be compatible with joint sealant material that will be placed above it.

F. Joint Sealant Backer Materials:

General: Provide joint-sealant backer materials that are nonstaining; 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.

2.2 PRIMERS

- A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.
- B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.
- B. Joint-Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

- C. Install joint-sealant backings of kind indicated to support joint sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of joint-sealant backings.
 - 2. Do not stretch, twist, puncture, or tear joint-sealant backings.
 - 3. Remove absorbent joint-sealant backings that have become wet before sealant application and replace them with dry materials.
- D. Install joint sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place joint sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- E. Tooling of Nonsag Joint Sealants: Immediately after joint-sealant application and before skinning or curing begins, tool sealants according to the following requirements to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint:
 - 1. Remove excess joint sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.
- F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions unless otherwise indicated.
- G. Hot-applied joint sealants to be applied as per the manufacturer's instructions. Only melt enough material to be poured the same day.

3.4 CLEANING

- A. Clean off excess joint sealant or sealant smears adjacent to joints as the Work progresses, by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

- A. Protect joint sealants, during and after curing period, from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations in repaired areas are indistinguishable from the original work.

3.6 PAVEMENT-JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Joints within cement concrete pavement. Use Joint Sealant Material as described in Part 2.1 C of this Section.
 - 1. Joint Location:
 - a. Expansion and isolation joints in cast-in-place concrete pavement and sidewalks.
 - b. Contraction joints in cast-in-place concrete slabs.
 - c. Joints between concrete sidewalk and granite curbing.
 - d. Other joints as indicated.
- B. Joint-Sealant Application: Fuel-resistant joints at asphalt pavement. Use Joint Sealant Material as described in Part 2.1 D of this Section.
 - 1. Joint Location:
 - a. Joints between concrete and asphalt pavement.
 - b. Joints between concrete curbs and asphalt pavement.
 - c. Joints between existing and proposed asphalt pavement.
 - d. Other joints as indicated.

END OF SECTION 321273

SECTION 321313 – CEMENT CONCRETE PAVEMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Attention is directed to the Contract and General Conditions and all Sections of Division 01 – General Requirements which are hereby made a part of the Specifications.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the Work of this Section.
- C. Coordinate work with that of all other trades affecting or affected by work of the Section. Cooperate with such trades to assure steady progress of all work under the Contract.

1.2 SUMMARY

- A. Section includes: exterior cement concrete for the following:
 - 1. Exterior Cement Concrete for Walkways.
- B. Related Sections include the following:
 - 1. Division 03 Section “Cast-in-Place Concrete” for structural concrete for concrete stairs and ramp.
 - 2. Division 31 Section “Excavation and Backfilling” for subgrade preparation, grading, and base course.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, expansive hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume.

1.4 SUBMITTALS

- A. Product Data: For each type of manufactured material and product indicated.
- B. Design Mixes: For each concrete pavement mix. Include alternate mix designs (subject to review by Landscape Architect) when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
 - 1. Indicate amounts of water to be withheld for later addition at Project site (generally all water shall be added to transit mixer at batch plant).

- C. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials:
- D. Material Certificates: Signed by manufacturers certifying that each of the following materials complies with requirements:
 - 1. Cementitious materials and aggregates. This must include a test performed within the previous month for Alkali-Silica Reaction in aggregates.
 - 2. Form materials and form-release agents.
 - 3. Steel reinforcement and reinforcement accessories.
 - 4. Admixtures.
 - 5. Sealing compounds.
 - 6. Applied finish materials.
 - 7. Adhesives and epoxies.
 - 8. Joint fillers.
 - 9. Joint-filler strips.
 - 10. Repair materials.
 - 11. Detectable warning plates.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed pavement work 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. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.
 - 1. Manufacturer must be certified according to the National Ready Mix Concrete Association's Plant Certification Program.
- C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 to conduct the 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-1 or an equivalent certification program.
- D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant and each aggregate from one source, and each admixture from the same manufacturer.
- E. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code-Reinforcing Steel."
- F. ACI Publications: Comply with the following, unless more stringent provisions are indicated:
 - 1. ACI 301, "Specification for Structural Concrete."
 - 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

- G. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixes.
- H. Preinstallation Conference: Conduct conference at Project site to include Owner, Owner's Representative, Engineer, Landscape Architect, General Contractor and Concrete Subcontractor.
 - 1. Before submitting design mixes, review concrete mix design and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place are to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixes.
 - c. Ready-mix concrete producer.
 - d. Concrete subcontractor.
 - 2. Layout of all walkways shall be reviewed to ensure alignments as demonstrated on Contract Documents.
 - 3. Scoring patterns and layout shall be reviewed prior to execution.

1.6 DELIVERY STORAGE AND HANDLING

- A. Deliver, store and handle steel reinforcement to prevent bending and damage.

1.7 PROJECT CONDITIONS

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities and access to the building.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

- A. Plain-Steel Welded Wire Fabric: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.
- B. Reinforcement Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
- C. Epoxy-Coated Reinforcement Bars: ASTM A 775; with ASTM A 615, Grade 60 (Grade 420), bars.

2.2 REINFORCEMENT ACCESSORIES

- A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcement bars, welded wire fabric, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete or fiber-reinforced concrete of greater compressive strength than concrete, and as follows:

1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.
- B. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A 775/A 775M.

2.3 CONCRETE MATERIALS

- A. General: Use the same brand and type of cementitious material from the same manufacturer throughout the Project.
- B. Portland Cement: ASTM C 150, Type I or II.
 1. Fly Ash: ASTM C 618, Class F or C.
- C. Normal Weight Aggregate: ASTM C 33, uniformly graded, from a single source, as follows:
 1. Class: Severe weathering region, but not less than 3S.
 2. Nominal Maximum Aggregate Size: 1 inch (38mm) Refer to design mix.
 3. Combined Aggregate Gradation: Well graded from coarsest to finest with not more than 18 percent and not less than 10 percent retained on an individual sieve, except that less than 8 percent may be retained on sieves finer than No. 5 (0.3mm).
 4. Do not use fine or coarse aggregates containing substances that cause spalling.
- D. Water: ASTM C 94.

2.4 ADMIXTURES

- A. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride. Refer to design mixes.
- B. Air-Entraining Admixture: ASTM C 260.
- C. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
- D. Water-Reducing and Retarding Admixture: ASTM C 494, Type A.

2.5 CURING MATERIALS

- A. 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.
- B. Moisture-Retaining Cover: ASTM C 171, or white burlap-polyethylene sheet.
- C. Water: Potable.
- D. Evaporation Retarder: NOT PERMITTED.

- E. Curing Compound: NOT PERMITTED.

2.6 RELATED MATERIALS

- A. Joint-Filler Strips: ASTM D 5249, Type 2, ASTM D 1752 Expansion and Isolation Joint-Filler Strips: Ceramar, closed cell foam, available from W. R. Meadows, Inc, Hampshire, Illinois or approved equal.
- B. Dowel alignment system:
 - 1. Products
 - a. Speed Load PSD1/2x9LT, dowel sleeve in sizes for ½" x 18" dowel bar; by Greenstreak Inc, 800-325-9504, or approved equal.
- C. Clear, Waterborne, Membrane-Forming Sealing Compound: ASTM 1315, Type 1, Class A.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Kure-N-Seal W; Sonneborn, Div. Of ChemRex, Inc.
 - b. Approved equivalent.

2.7 CONCRETE MIXES

- A. Refer to specification 033000.

2.8 FABRICATING REINFORCEMENT

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

2.9 CONCRETE MIXING

- A. Ready-Mixed Concrete: Comply with requirements and with ASTM C 94. Furnish batch ticket information to concrete testing representative.
 - 1. 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.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Proof-roll prepared base surface to check for unstable areas and verify need for additional compaction. Proceed with pavement only after nonconforming conditions have been corrected and subgrade is ready to receive pavement.

- B. Remove loose material from compacted base surface immediately before placing concrete.

3.2 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
- B. Clean forms after each use and coat with form release agent to ensure separation from concrete without damage.

3.3 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
 - 1. Class A, 1/8 inch (3mm).
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 - 1. Install keyways, reglets, recesses, and the like, for easy removal.
 - 2. Do not use rust-stained steel form-facing material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Provide temporary openings for cleanouts and inspection ports where interior of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss on concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- H. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- I. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- J. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

- K. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.4 REMOVING AND REUSING FORMS

- A. General: Formwork that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.
- B. Leave formwork that supports weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
 - 1. Determine compressive strength of in-place concrete by testing representative field or laboratory cure test specimens according to ACI 301.
 - 2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- C. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.
- D. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Landscape Architect.

3.5 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating reinforcement and with recommendations in CRSI's "Placing Reinforcing Bars" for placing and supporting reinforcement.
 - 1. Apply epoxy repair coating to uncoated or damaged surfaces of epoxy-coated reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
 - 1. Shop or field weld reinforcement according to AWS D1.4, where indicated.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Install welded wire fabric in whole sheets as practicable, set on chairs or supports with tie wires to hold at proper elevation. Lap adjoining pieces at least two full meshes, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

- F. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch (50-mm) overlap to adjacent mats.

3.6 JOINTS

- A. General: Construct construction, isolation, and contraction joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.
 - 1. When joining existing pavement, place transverse joints to align with previously placed joints, unless otherwise indicated.
- B. Construction Joints: Install so strength and appearance of concrete is not impaired, at locations indicated or approved by Landscape Architect. Refer to drawings for details. 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. Install epoxy coated dowel bars and plastic dowel sleeves at joints.
 - 2. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of pavement strips, unless otherwise indicated.
 - 3. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
 - 1. Locate expansion joints at intervals of 30 feet (12.192 m) as indicated on the drawings, unless otherwise indicated.
 - 2. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3.2 mm). Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
 - 1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
 - 2. Terminate full-width joint-filler strips not less than ½ inch (13 mm) or more than 1 inch (25 mm) below finished concrete surface where joint sealants are indicated.
 - 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated.

3.7 CONCRETE PLACEMENT FOR WALKS

- A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcement steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.
- B. Remove snow, ice, or frost from subbase surface and reinforcement before placing concrete. Do not place concrete on frozen surfaces.
- C. Moisten subbase 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 the required finish elevation and alignment.
- D. Comply with requirements and with recommendations in ACI 304R for measuring, mixing, transporting, and placing concrete.
- E. Do not add water to concrete during delivery, at Project site, or during placement.
- F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
- G. Consolidate concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures to consolidate concrete according to recommendations in ACI 309R.
- H. Screed pavement surfaces with a straightedge and strike off. Commence initial floating using bull floats or darbies to form an open textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading dry-shake surface treatments.
- I. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 - 1. When air temperature has fallen to or is expected to fall below 40 deg F (4.4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.
 - 2. Do not use frozen materials or materials containing ice or snow.
 - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mix designs.
- J. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R and as follows when hot-weather conditions exist:
 - 1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 deg F (32 deg C). Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 - 2. Cover reinforcement steel with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.

3. Fog-spray forms, reinforcement steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.8 CONCRETE FINISHING FOR WALKS

- A. General: Wetting of concrete surfaces during screeding, initial floating, or finishing operations is prohibited.
- B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and the concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots, and fill low spots. Refloat surface immediately to uniform granular texture.
 1. Medium broom finish: Apply nonslip medium broom finish to exterior concrete walks. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber-bristle broom, perpendicular to main traffic route. Coordinate required final finish with Landscape Architect prior to application.
- C. Rough-Formed Finish: For paver base, provide as-cast concrete texture imparted by forming material with tie holes and defective areas repaired and patched. Remove fins and other projections exceeding ACI 347R limits for class of surface specified.

3.9 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and follow recommendations in ACI 305R for hot-weather protection during curing.
- B. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including slabs and other surfaces.
- C. Cure concrete according to ACI 308.1, by the following method:
 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.
 2. Curing Compound: NOT PERMITTED

3.10 SEALER

- A. Exterior Sealer: Apply two (2) coats of specified sealer to exterior concrete slabs, walks, landings, steps, walls, ramps and curbs according to manufacturer's directions. Apply uniformly in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial

application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.11 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Landscape Architect. Remove and replace concrete that cannot be repaired and patched to Landscape Architect's approval.
- B. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
 - 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than ½ inch (13 mm) in any dimension in solid concrete, but not less than 1 inch (25 mm) in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 - 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
 - 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Landscape Architect.
- C. Perform structural repairs of concrete, subject to Landscape Architect's approval, using epoxy adhesive and patching mortar.
- D. Repair materials and installation not specified above may be used, subject to Landscape Architect's approval

3.12 PAVEMENT TOLERANCES

- A. Comply with tolerances of ACI 117 and as follows:
 - 1. Elevation: 1/4 inch (6 mm).
 - 2. Thickness: Plus 3/8 inch (9 mm), minus 1/4 inch (6 mm).
 - 3. Surface: Gap below 10-foot-long, unleveled straightedge not to exceed 1/4 inch (6 mm).
 - 4. Joint Spacing: 3 inches (75 mm).
 - 5. Contraction Joint Depth: Plus 1/4 inch (6 mm), no minus.
 - 6. Joint Width: Plus 1/8 inch (3 mm), no minus.

3.13 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspection agency to sample materials, perform tests, and submit test reports during concrete placement according to requirements specified in this Article.

- B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C172 shall be performed according to the following requirements:
1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. (76 cu. m) or fraction thereof of each concrete mixture placed each day.
 - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change. SLUMP TEST IS ONLY FOR CONSISTENCY, NOT FOR DETERMINATION OF ACCEPTABLE WATER CONTENT.
 3. Microwave Test: (AASHTO TP23) for water/cementitious ratio in fresh concrete. This test shall be performed on each load of concrete; concrete placement may proceed while test is being performed, however concrete determined to exceed maximum w/cm ratio may not be acceptable.
 4. Air Content: ASTM C 231, pressure method, for normal weight concrete; ASTM C 173, volumetric method, for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each type of air-entrained concrete.
 5. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each set of compressive-strength specimens.
 6. Unit Weight: ASTM C567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
 7. Compression Test Specimens: ASTM C 31/C 31M; one set of five standard cylinders for each compressive-strength test, unless otherwise indicated. Cylinders shall be molded and stored for laboratory-cured test specimens unless field-cured test specimens are required.
 8. Compressive-Strength Tests: ASTM C 39;
 - a. Test two field-cured specimens at 7 days and two at 28 days.
 - b. A compressive strength test shall average compressive strength from two specimens obtained from the same composite sample and tested at age indicated.
 9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, current operations shall be evaluated and corrective procedures shall be provided for protecting and curing in-place concrete.
 10. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive compressive-strength test results equal or exceed specified compressive strength and no individual compressive-strength test result falls below specified compressive strength by more than 500 psi (3.4 MPa).
- C. Test results shall be reported in writing to Landscape Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing agency, concrete type and class, location of concrete batch in pavement, design compressive

strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

- D. Nondestructive testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Landscape Architect but will not be used as sole basis for approval or rejection of concrete.
- E. Additional Tests: At Contractor's expense, testing agency shall make additional tests of the concrete when test results indicate slump, air entrainment, concrete strengths, or other requirements have not been met, as directed by Landscape Architect. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed by Landscape Architect.

3.14 REPAIRS AND PROTECTION

- A. Remove and replace concrete pavement that is broken, damaged, or defective, or does not meet requirements in this Section.
- B. Drill test cores where directed by Landscape Architect when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to pavement with epoxy adhesive.
- C. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.
- D. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 321313

SECTION 321723 - PAVEMENT MARKINGS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Traffic lines and pavement markings.
 - 2. Paint.
 - 3. Glass beads.
- B. Related Sections:
 - 1. Section 321200 Flexible Paving.
 - 2. Section 321313 Concrete Paving.

1.2 REFERENCES

- A. American Association of State Highway and Transportation Officials:
 - AASHTO M247 - Standard Specification for Glass Beads Used in Traffic Paint.
- B. ASTM International:
 - ASTM D711 - Standard Test Method for No-Pick-Up Time of Traffic Paint.
- C. New York State Department of Transportation (NYSDOT) Standard Specifications, September 1, 2017
 - NYSDOT, Section 727-09 – Traffic Paint.
 - NYSDOT, Section 727-05 – Glass Beads for Pavement Markings.

1.3 PERFORMANCE REQUIREMENTS

- A. Paint Adhesion: Adhere to road surface forming smooth continuous film one minute after application.
- B. Paint Drying: Tack free by touch so as not to require coning or other traffic control devices to prevent transfer by vehicle tires within two minutes after application.

1.4 SUBMITTALS

- A. Manufacturer's Installation Instructions: Submit instructions for application temperatures, eradication requirements, application rate, line thickness, type of glass beads, bead embedment and bead application rate, and any other data on proper installation.
- B. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with NYSDOT September 1, 2017 Standard Specifications, Section 640.

1.6 QUALIFICATIONS

- A. Applicator: Company specializing in performing work of this section with minimum three years experience.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Invert containers several days prior to use when paint has been stored more than 2 months. Minimize exposure to air when transferring paint. Seal drums and tanks when not in use.
- B. Glass Beads. Store glass beads in cool, dry place. Protect from contamination by foreign substances.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Conform to Manufacturer's requirements regarding the use of products on site.

PART 2 PRODUCTS

2.1 PAINTED PAVEMENT MARKINGS

- A. Furnish materials in accordance with the New York State Department of Transportation (NYSDOT) standards (Section 640-2 of the September 1, 2017 Specifications).

- B. EQUIPMENT

Continuous Longitudinal Line Application Machine: Use application equipment with following capabilities.

- 1. Dual nozzle paint gun to simultaneously apply parallel lines of indicated width in solid or broken patterns or various combinations of those patterns.
 - 2. Pressurized bead-gun to automatically dispense glass beads onto painted surface, at required application rate.
 - 3. Measuring device to automatically and continuously measure length of each line placed, to nearest foot.
- C. Machine Calibration:
 - 1. Paint Line Measuring Device: Calibrate automatic line length gauges to maintain tolerance of plus or minus 25 feet per mile.
 - 2. Cycle Length/Paint Line Length Timer: Calibrate cycle length to maintain tolerance of plus or minus 6 inches per 40 feet; calibrate paint line length to maintain tolerance to plus or minus 3 inches per 10 feet.
 - 3. Paint Guns: Calibrate to simultaneously apply paint binder at uniform rates as specified with an allowable tolerance of plus or minus 1 mil.
 - 4. Bead Guns: Calibrate to dispense glass beads simultaneously at specified rate. Check guns by dispensing glass beads into gallon container for predetermined fixed period of time. Verify weight of glass beads.
- D. Other Equipment:

1. For application of crosswalks, intersections, stop lines, legends and other miscellaneous items by walk behind strippers, hand spray or stencil trucks, apply with equipment meeting requirements of this section. Do not use hand brushes or rollers. Optionally apply glass beads by hand.

2.2 SOURCE QUALITY CONTROL

- A. Test and analyze traffic paints in accordance with ASTM D711.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Review layout of all pavement markings with Owner's Representative before starting work.

3.2 PREPARATION

- A. Maintenance and Protection of Traffic:
 1. Provide short term traffic control.
 2. Prevent interference with marking operations and to prevent traffic on newly applied markings before markings dry.
- B. Surface Preparation.
 1. Clean and dry paved surface prior to painting.
 2. Blow or sweep surface free of dirt, debris, oil, grease or gasoline.
 3. Spot location of final pavement markings as specified and as indicated on Drawings by applying pavement spots 25 feet on center.
 4. Notify Owner's Representative after placing pavement spots and minimum 3 days prior to applying traffic lines.

3.3 APPLICATION

- A. Install Work in accordance with New York State Department of Transportation (NYSDOT) standards (Section 640-3 of the September 1, 2017 Specifications). Pavement markings to be placed on clean, dry pavement that has a minimum temperature of 50°F. The ambient temperature shall be a minimum of 50°F and rising.
- B. Install paints with a minimum wet film thickness of 20 mils.

3.4 FIELD QUALITY CONTROL

- A. Inspect for incorrect location, insufficient thickness, line width, coverage, retention, uncured or discolored material, and insufficient bonding.
- B. Repair lines and markings, which after application and curing do not meet following criteria:
 1. Incorrect Location: Remove and replace incorrectly placed patterns.
 2. Insufficient Thickness, Line Width, Paint Coverage, Glass Bead Coverage or Retention: Prepare defective material by acceptably grinding or blast cleaning to

remove substantial amount of beads and to roughen marking surface. Remove loose particles and debris. Apply new markings on cleaned surface in accordance with this Section.

3. Uncured or Discolored Material, Insufficient Bonding: Remove defective markings in accordance with this Section and clean pavement surface one foot beyond affected area. Apply new markings on cleaned surface in accordance with this Section.

C. Replace failed or defective markings in entire section of defective markings within 30 days after notification when any of the following exists during prior to project acceptance:

1. Average retroreflectivity within any 528 foot section is less than 1225 mcd/m²/1x for white pavement markings and 100 mcd/m²/1x for yellow pavement markings.
2. Marking is discolored or exhibits pigment loss, and is determined to be unacceptable by three member team based on visual comparison with beaded color plates.
3. More than 15 percent of area of continuous line, or more than 15 percent of combined area of skip lines, within any 528 foot section of roadway is missing.

3.5 PROTECTION OF FINISHED WORK

- A. Protect painted pavement markings from vehicular and pedestrian traffic until paint is dry and track free. Follow manufacturer's recommendations or use minimum of 30 minutes. Consider barrier cones as satisfactory protection for materials requiring more than 2 minutes dry time.

END OF SECTION

SECTION 329113 – PLANTING SOILS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Attention is directed to the Contract and General Conditions and all Sections of Division 01 – General Requirements which are hereby made a part of the Specifications.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the Work of this Section.
- C. Coordinate work with that of all other trades affecting or affected by work of the Section. Cooperate with such trades to assure steady progress of all work under the Contract.

1.2 SUMMARY

- A. Section includes:
 - 1. Planting soil material acquisition.
 - 2. Preparation of soil mixes and testing for conformance.
 - 3. Installation and placement of soils.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 31 Section “Site Clearing and Demolition”.
 - 2. Division 31 Section “Excavation and Backfill”.
 - 3. Section 32 “Turf and Grasses.”
 - 4. Section 32 “Plants.”

1.3 REFERENCES

- A. ANSI: American National Standards Institute.
- B. AOAC: Association of Official Agricultural Chemists.
- C. ASTM: American Society for Testing Materials.

1.4 DEFINITIONS

- A. Backfill: The earth used to replace or the act of replacing earth in an excavation.
- B. Finish Grade: Elevation of finished surface of planting soil.
- C. Planting Soil: Stockpiled or imported topsoil mixed with soil amendments for planting trees, shrubs and ground covers.

- D. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill.
- E. Subsoil: All soil beneath the topsoil layer of the site soil profile, and typified by the lack of organic matter and soil organisms. Sub-soil is unsuitable for plant growth.
- F. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches (50 mm) in diameter; and free of subsoil and weeds, roots, toxic materials, or other non-soil materials.
- G. Turf Soil: Stockpiled or imported topsoil mixed with soil amendments for establishing seed or sod.

1.5 APPLICABLE STANDARDS

- A. American Society for Testing Material (ASTM).
- B. All standards shall include the latest additions and amendments as of the date of advertisement for bids.

1.6 DEFINITIONS

- A. ASA: American Society of Agronomy.

1.7 SUBMITTALS

- A. Topsoil:
 - 1. Product Data: For each type of product indicated, including source.
 - 2. Testing: As described in Quality Assurance.
 - 3. Amendment Recommendations: from qualified Soil Scientist as described in Quality Assurance.
 - 4. Samples: 1 gallon Ziploc bag labeled with source for each stockpiled and imported topsoil source.
- B. Compost:
 - 1. Product Data: For each type of product indicated, including source.
 - 2. Certificates: Provide certificates required by authorities having jurisdiction, especially for any composted materials containing sewage sludge. Approval as EPA Type 1 “exceptional quality” is required as well as that of the State of New York.
 - 3. Testing: As described in Quality Assurance.
- C. Coarse sand:
 - 1. Product Data: For each type of product indicated, including source.
 - 2. Testing: As described in Quality Assurance.

D. All Other Amendments: Product Data.

E. Subgrade:

1. Field percolation test results as described in Part 3 Execution. Percolation tests shall be measured in inches per hour of drainage.

F. Sources for Soil Components and Planting Soil Mixes: Submit information identifying sources for all soil components and the firm responsible for mixing of planting soil mixes.

1. Landscape Architect and Soil Scientist shall have the right to reject any soil supplier.
2. Soil mix supplier shall have a minimum of five years' experience at supplying custom planting soil mixes.
3. Submit supplier name, address, telephone and fax numbers and contact name.
4. Submit certification that accepted supplier is able to provide sufficient quantities of materials and mixes for the entire project.

1.8 QUALITY ASSURANCE

A. Source Limitations for Topsoil and Planting and Turf Soil Mix: Obtain all topsoil and/or planting and turf soil mix, through one source that has been tested according to the requirements below. If there are any additional proposed sources, Contractor must provide topsoil analysis and testing for each source as described below.

B. Soil-Testing Laboratory Qualifications: The Contractor shall engage an independent laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.

1. Testing Agencies: The following firms are acceptable testing agencies for the various components.
 - a. Hummel & Co.: 35 King Street , P.O. Box 606, Trumansburg, New York 14886. tel: 607.387.5694, fax: 607.387.9499.
 - b. Biosolids/Biological Testing: Soil Foods Web New York, 555 Hallock Avenue, Rte. 25A, Suite #7, Port Jefferson Station, NY, 11776, tel: 631.474.8848, fax: 631.474.8847.
 - c. Biosolids/Stability Test and Pathogens/ Metals/ Vector Attraction: Woods End Research Laboratory, P.O. Box 297, Mt. Vernon, ME, 04352, tel: 201.293.2457, fax: 201.293.2488.

C. Topsoil Analysis: For both stockpiled topsoil and additional imported topsoil (if necessary), furnish soil analysis by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity; deleterious material; pH; and mineral and plant-nutrient content of topsoil.

1. Particle Size Analysis: Include sand, silt and clay, sand size distribution, sand particle shape, pH, uniformity coefficient by hydrometer method (ASTM D-422-63).
2. Organic Matter: Percent organic matter by combustion (ASTM F-1647, Method 1).
3. Report of suitability of topsoil for plant growth.

4. State recommended quantities of nitrogen, phosphorus and potassium nutrients and other soil amendments to be added to produce satisfactory topsoil.
 5. Amend topsoil with recommended quantities of nitrogen, phosphorus, potassium nutrients and other soil amendments.
- D. Testing of Subgrade: Prior to placement of the planting soil, test the subgrade for percolation as described in this Section. Coordinate the testing of the subgrade for percolation with the Site work Contractor, Soil Scientist, and Landscape Architect.

1.9 DELIVERY, STORAGE AND HANDLING

- A. Material should not be handled or hauled, placed or compacted when it is wet as after a heavy rainfall or is frozen. Soil should be handled only when the moisture content is less than at field capacity. The Landscape Architect and the Soil Scientist shall be consulted to determine if the soil is too wet to handle.
- B. Store and handle packaged materials in strict compliance with manufacturer's instructions and recommendations. Protect all materials from weather, damage, injury and theft.
- C. Sequence deliveries to avoid delay. On-site storage space is permissible only with written notice from Construction Manager. Deliver materials only after preparations for placement of planting soil have been completed.
- D. Prohibit vehicular and pedestrian traffic on or around stockpiled planting soil.
- E. Soil that is to be stockpiled longer than two weeks, whether on or off site, shall be placed in mounds less than six feet high. If soil stockpiles greater than six feet high are present longer than two weeks then the contractor shall break down and disperse soil so that mounds do not exceed the six foot height restriction for longer than two weeks.
 1. Provide silt fencing around topsoil mounds, and/or as directed in the Storm Water Pollution Prevention Plan (SWPPP).
- F. Vehicular access to the site is restricted. Before construction, the Contractor shall submit for approval a plan showing proposed routing for deliveries and site access.

PART 2 - PRODUCTS

2.1 TOPSOIL

- A. Topsoil: ASTM D 5268, pH range of 5.5 to 7, a minimum of 4 percent organic material content; clean and screened free of deleterious materials and weeds, including but not limited to any plant listed by NYSDEC or other authority as invasive, nuisance or noxious weed species; and free of stones 1 inch (25 mm) or larger in any dimension and other extraneous materials harmful to plant growth.
 1. Topsoil Source: Reuse topsoil stockpiled on-site. Verify suitability of stockpiled soil to support plant growth by testing and amend as noted above. Screen soil free of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.

- a. Supplement with imported or manufactured topsoil from off-site sources when on-site quantities are insufficient. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches (100 mm) deep; do not obtain from agricultural land, bogs or marshes.
- B. All topsoil shall be tested per requirements listed above.

2.2 ORGANIC SOIL AMENDMENTS

- A. Compost: Well-composted, stable, and weed-free organic matter not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings. The compost shall be a dark brown to black color and be capable of supporting plant growth with appropriate management practices in conjunction with addition of fertilizer and other amendments as applicable, with no visible free water or dust, with no unpleasant odor, and meeting the following criteria as reported by laboratory tests. Debris such as metal, glass, plastic, wood (other than residual chips), asphalt or masonry shall not be visible and shall not exceed one percent dry weight.
 - 1. Organic Matter Content: 50 to 60 percent of dry weight. (ASTM F-1647, Method 1).
 - 2. The ratio of carbon to nitrogen shall be in the range of 10:1 to 25:1.
 - 3. One hundred percent of the material shall pass a 3/8-inch (or smaller) screen. (ASTM D-422-63).
 - 4. pH: The pH shall be between 5.5 to 7.5 as determined from a 1:1 soil-distilled water suspension using a glass electrode pH meter. (American Society of Agronomy *Methods of Soil Analysis*, Part 2, 1986).
 - 5. Salinity: Electrical conductivity of a one to two soil to water ratio extract shall not exceed 4.0 mmhos/cm (dS/m).
 - 6. Heavy metal contents shall conform to state and federal regulations.
 - 7. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.
- B. Compost may be obtained at one of the following sources, provided that the test requirements are met:
 - 1. WeCare Compost by We Care Organics, Jordan, New York, 315-689-1937
 - 2. Cayuga Compost (fine) by P&S Excavating, Trumansburg, New York, 607-387-6826
 - 3. Cornell Farm Services, Ithaca, NY: 607-257-2235

2.3 DRY SCREENED SAND

- A. Dry Screened Sand: Sand for producing soil mixes shall be uniformly graded coarse sand consisting of clean, inert, rounded grains of quartz or other durable rock free from loam or clay, surface coatings, mica, and other deleterious materials with the following particle size distribution as determined by ASTM F1632:

U.S. Sieve Size No.	% Passing Minimum	% Passing Maximum
4	100	
8	90	100
16	80	100
30	25	60
50	0	25
100	0	5
270	0	3

1. Maximum size shall be one half-inch largest dimension. The maximum retained on the #4 sieve shall be 5% by weight of the total sample. The ratio of the particle size for 80% passing (D_{80}) to the particle size for 30% passing (D_{30}) shall be 3.0 or less. ($D_{80}/D_{30} < 3.0$) Tests shall be by combined hydrometer and wet sieving in compliance with ASTM D422.

2.4 FERTILIZER

- A. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 4 percent nitrogen and 10 percent phosphoric acid.
- B. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.
- C. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
 1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.
- D. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
 1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.

2.5 PLANTING SOIL MIX

- A. Planting Soil Mix: Mix topsoil with the following soil amendments in the following quantities:
 1. By Weight
 - a. Sand: 65 – 75% by Weight.
 - b. Organic Matter: 5 – 8% by weight.
 - c. Topsoil: 20 – 40% by weight. Silt content must be less than 3 times the clay content.
 2. Approximate Ratio by Volume:
 - a. 1 part compost
 - b. 1 part sand

- c. 1 part topsoil

2.6 TURF SOIL MIX

- A. Turf Soil Mix: Mix topsoil with the following amendments in the following quantities:
 - 1. By Volume:
 - a. 1 part compost
 - b. 3 parts sand
 - c. 2 parts topsoil.

PART 3 - EXECUTION

3.1 COORDINATION

- A. Coordinate activities with other project contractors so that there is no soil disturbance from traffic or other construction activities subsequent to placement.
- B. Pre-Installation Examination Required: The Contractor shall examine previous work, related work, and conditions under which this work is to be performed and shall notify Landscape Architect in writing of all deficiencies and conditions detrimental to the proper completion of this work. Beginning work means Contractor accepts substrates, previous work, and conditions. The Contractor shall not place any planting or turf soil mix until all work in adjacent areas is complete and approved by the Landscape Architect.
- C. Examination of Subgrade
 - 1. The subgrade shall be inspected prior to the start of soil placement for conformance with the Drawings for elevations of subgrade relative to finish grade. Subgrade shall be graded smooth and parallel to the finish grades unless otherwise noted in the Drawings.
 - 2. Percolation tests shall be performed on a minimum of 10% of tree pits and 20% of shrub beds, and on any areas of questionable drainage or as required by Landscape Architect. Provide results of percolation tests as noted in Submittals section. Percolation tests shall be measured in inches per hour of drainage at the base of the plant root level.
 - a. Should any planting areas yield a percolation test result of less than 4" of drainage per hour, stop work on these areas obtain direction from Landscape Architect.

3.2 EXCAVATION AND REMOVAL

- A. Refer to Section 312300 Excavation and Backfill.
- B. Dispose of all excess materials legally off Owner's property.

3.3 MIXING OF SOIL MIXES

- A. Soil Mix Preparation: Examine soil and remove foreign materials, stones over 1/2", and organic debris over 2" in length. Mix-in fertilizers and amendments as recommended by soil testing laboratory and as approved by the Landscape Architect. All preparation and mixing shall be

accomplished when the soil moisture content is less than field capacity. If lime is to be added, it shall be mixed with dry soil before fertilizer is added and mixed.

- B. Adequate quantities of mixed planting and turf soil materials shall be provided to attain, after compaction and natural settlement, all design finish grades.
- C. Soil mixes shall be produced with equipment that blends together each component in a thorough and uniform manner.
- D. Uniformly mix ingredients by windrowing/tiling on an approved hard surface area. Organic matter shall be maintained moist, not wet, during mixing.
 - 1. Test all soil components prior to mixing. After soil component tests have been accepted, planting soil may be mixed.
 - 2. Amendments shall not be added unless approved to extent and quantity by the Landscape Architect and additional tests have been conducted to verify type and quantity of amendment is acceptable.

3.4 COORDINATION AND EXCESS MATERIALS

- A. Coordinate activities with other project contractors so that there is no soil disturbance from traffic or other construction activities subsequent to soil placement.
- B. Excess Planting Soil Mixture and Materials: Remove the excess planting soil mixture and materials from the site at no additional cost to the Owner unless otherwise requested.

END OF SECTION 329113

SECTION 329300 – PLANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Attention is directed to the Contract and General Conditions and all Sections of Division 01 – General Requirements which are hereby made a part of the Specifications.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the Work of this Section.
- C. Coordinate work with that of all other trades affecting or affected by work of the Section. Cooperate with such trades to assure steady progress of all work under the Contract.

1.2 SUMMARY

- A. Section includes:
 - 1. Plantings.
 - 2. Tree pruning & maintenance.
 - 3. Mulches.
 - 4. Landscape Maintenance
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 31 Section “Site Clearing and Demolition”.
 - 2. Division 31 Section “Excavation and Backfill”.
 - 3. Section 329113 “Planting Soils.”
 - 4. Section 329200 “Turf and Grasses”.

1.3 DEFINITIONS

- A. Backfill: The earth used to replace or the act of replacing earth in an excavation.
- B. Balled and Burlapped Stock: Exterior plants dug with firm, natural balls of earth in which they are grown, with ball size not less than diameter and depth recommended by ANSI Z60.1 for type and size of tree or shrub required; wrapped, tied, rigidly supported, and drum laced as recommended by ANSI Z60.1.
- C. Clump: Where three or more young trees were planted in a group and have grown together as a single tree having three or more main stems or trunks.
- D. Container-Grown Stock: Healthy, vigorous, well-rooted exterior plants grown in a container with well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root

mass during shipping and be sized according to ANSI Z60.1 for type and size of exterior plant required.

- E. Final Acceptance: At the end of Maintenance Period, Landscape Architect shall reinspect all lawn to determine whether Satisfactory Lawn has been achieved.
- F. Finish Grade: Elevation of finished surface of planting soil.
- G. Initial Acceptance: Completion of seeding, with adequacy determined by Landscape Architect. Maintenance period shall commence for 60 days after initial acceptance, until Final Acceptance.
- H. Multi-Stem: Where three or more main stems arise from the ground from a single root crown or at a point right above the root crown.
- I. Planting Soil: Stockpiled or imported topsoil mixed with soil amendments for planting trees, shrubs and ground covers.
- J. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill.
- K. Subsoil: All soil beneath the topsoil layer of the site soil profile, and typified by the lack of organic matter and soil organisms. **Sub-soil is unsuitable for plant growth.**
- L. Turf Soil: Stockpiled or imported topsoil mixed with soil amendments for establishing seed or sod.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Verification: For each of the following:
 - 1. Shredded bark mulch in labeled plastic bag.
 - 2. Gravel mulch in labeled plastic bag
- C. Qualification Data: For qualified landscape Installer.
- D. Product Certificates: For each type of manufactured product, from manufacturer, and complying with the following:
 - 1. Manufacturer's certified analysis for standard products.
 - 2. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.
 - 3. Label data substantiating that all plants, trees, shrubs and planting materials comply with specified requirements.
- E. Selection of Plant Materials: Submit to the Landscape Architect the names and locations of nurseries proposed as sources of acceptable plant material within 10 days of notification of award of contract. Inspect all nursery materials to determine that the materials meet the

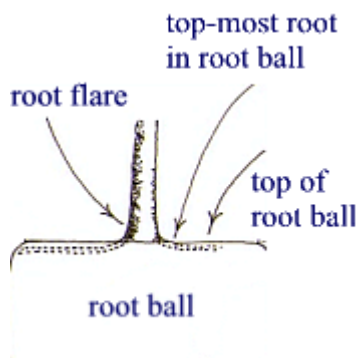
requirements of this section. Proposed shrub materials shall be tagged at the nurseries by the Contractor for inspection by the Landscape Architect. Trees shall be tagged at the nursery by the Landscape Architect. In cases where it is deemed unnecessary and impractical to view material at the nursery (i.e. small quantities or sizes; distant supplier; reliable supplier known for quality material), the Contractor shall notify the Landscape Architect to make alternative arrangements to maintain quality control such as having backup sources ready.

- F. Where requested by the Landscape Architect, photographs of plant material or representative samples of plants shall be submitted in lieu of Landscape Architect's visit to the nursery.
- G. Planting Schedule: Indicating anticipated planting dates for exterior plants.
- H. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of exterior plants during a calendar year. Submit before expiration of required maintenance periods.
- I. Warranty: Sample of special warranty.
- J. Upon delivery, submit bill of sale or shipping slip. Submit plant material certificates of inspection as required by government authorities.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer who has completed ten or more landscaping projects similar in material, design, value, and extent to that indicated for this Project and with a record of successful grass and landscape establishment.
 - 1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on the Project site during times that planting and landscaping are in progress. Field supervisor shall have had a supervisory role on a minimum of three projects of comparable scope.
- B. Plant names indicated with "Standardized Plant Names" as adopted by the latest edition of the American Joint Committee of Horticultural Nomenclature. Names of varieties not listed should conform generally with names accepted by the nursery Trade. Provide stock true to botanical name and legibly tagged. **PLANTS NOT LEGIBLY TAGGED WILL BE REJECTED.**
- C. Provide quality, size, genus, species, variety of trees and shrubs indicated, and root ball size complying with applicable requirements of ANSI Z60.1 "American Standard for Nursery Stock." All plants should be nursery grown under climatic conditions similar to those in the locality of the project.
- D. Measurements: Measure trees and shrubs according to ANSI Z60.1 with branches and trunks or canes in their normal position. Do not prune to obtain required sizes. Take caliper measurements 6 inches (150 mm) above ground for trees up to 4-inch (100 mm) caliper size, and 12 inches (300 mm), above ground for larger sizes. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip-to-tip.

- E. The latest edition of “American Standard for Nursery Stock: is referenced and considered to be a part of this specification. Plants not conforming to the Standard will be rejected.
- F. Trees should be freshly dug during the season of planting, March 1st-May 1st for spring planting and October 15th-December 15th for fall planting. No heeled in or cold storage trees will be accepted. Trees should not have growing buds at time of planting in the spring and will have dormant buds in the fall.
- G. Unless otherwise noted on drawings, all trees should be grown in USDA hardiness zones 7A or colder and no farther south than the 39 parallel (including parts of Maryland, Virginia and West Virginia, Ohio and Indiana) to insure appropriate dormancy in the fall and bud break in the spring. Trees should have been grown in the nursery that they are being harvested from for at least 3 years.
- H. All trees should be free of insects and diseases. New shoot growth should be greater than 12 inches unless the tree is a dwarf, slow-growing type. The size, color and appearance of leaves should be typical of the time of year. Leaves should not be tattered, misshapen, stunted or off-color (chlorotic or necrotic).
- I. All trees should be Balled and Burlapped (B&B) wrapped in natural burlap only and jute twine. Wire baskets are acceptable. Broken, soft or re-balled root balls will be rejected. Root balls should not be allowed to dry out after digging.
- J. There should be no roots greater than 1/10 diameter of the trunk circling more than one-third the way around in the top of the root ball. Roots larger than this may be cut provided they are smaller than one-third the trunk diameter. There should be no kinked roots greater than 1/5 the trunk diameter. Roots larger than this can be cut provided they are less than one-third the trunk diameter. The tops of several tree balls may be randomly inspected to insure that root systems meet the specification.
- K. Trees should be rooted into the root ball so that soil remains intact and trunk and root ball move as one when lifted. The trunk should bend when gently pushed, not pivot at or below soil line.
- L. The point where the top-most root in the root ball emerges from the trunk should be visible at the soil surface. No excess soil will be piled on top of the root flare during the digging process.



- M. There should be one dominant leader more-or-less straight to the top of the tree with the largest branches spaced at least 6 inches apart. There can be a double leader only in the top 10% of the tree and only in primarily decurrent trees. In excurrent trees or those trees that start out excurrent and then become decurrent, there should be only one central leader to the top of the trees.
- N. The tree canopy should be symmetrical, free of large voids, and typical of the species or cultivar. Live crown ratio (distance from bottom of canopy to tree top/tree height) should be at least 50%.
- O. All branches shall be less than 2/3 the trunk diameter, free of bark inclusions, and more-or-less radially distributed around the trunk.
- P. Trees greater than 1.5 inches caliper should be able to stand erect without a supporting stake.
- Q. The trunk and main branches shall be free of wounds (except for properly-made pruning wounds), damaged areas, scrapes, knots, bleeding, and signs of insects or disease. Trees shall not be pruned immediately prior to delivery.
- R. Do not make substitutions. If specified material is not obtainable, submit proof of non-availability to Landscape Architect, together with a proposal for use of an equivalent material.
- S. Inspection: The Landscape Architect may inspect trees and shrubs either at place of growth or at site before planting, for compliance with requirements for genus, species, variety, size, and quality. Landscape Architect retains right to further inspect trees and shrubs for size and condition of balls and root systems, insects, injuries and latent defects, and to reject unsatisfactory or defective material at any time during progress of Work. Remove rejected trees or shrubs immediately from project site.
- T. Pre-installation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Coordination and Meetings."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Packaged Materials: Deliver packaged materials in containers showing weight, analysis, and name of manufacturer. Protect materials from deterioration during delivery and while stored at site.
- B. Deliver exterior plants after preparations for planting have been completed and install immediately. If planting is delayed more than six hours after delivery, set exterior plants and trees in shade, protect from weather and mechanical damage, and keep roots moist.
 - 1. Heel-in bare-root stock. Soak roots that are in dry condition in water for two hours. Reject dried-out plants.
 - 2. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
 - 3. Do not remove container-grown stock from containers before time of planting.

4. Water root systems of exterior plants stored on-site with a fine-mist spray. Water as often as necessary to maintain root systems in a moist condition.
- C. Handle all ball and burlapped stock by the root ball.
 - D. Take all precautions customary in good trade practice in preparing plants for moving. Workmanship that fails to meet the highest standards will be rejected. Summer dug materials will not be accepted. Spring (dormant) dug materials which are shipped “in-leaf” shall be sprayed with an antidessicant. Dig, pack, transport, and handle plants with care to ensure protection against injury. Inspection certificates required by law shall accompany each shipment invoice or order, and on arrival the certificate shall be filed with the Landscape Architect.
 - E. If plants cannot be planted immediately upon delivery, Contractor shall establish suitable holding area for plants. Holding area shall be shaded, protected from weather and mechanical damage. All roots must be kept moist. Properly protect them with soil, wet peat moss, or in a manner acceptable to the Landscape Architect. Protect all plants from drying out. Water root systems of trees and shrubs. Water as often as necessary to maintain root systems in a moist condition. No plant shall be bound with rope or wire in a manner that could damage or break the branches.
 1. Set balled stock on ground and cover ball with soil, peat moss, sawdust or other acceptable material.
 2. Do not remove container-grown stock from containers before time of planting.
 3. Water root systems of trees and shrubs stored on site with a fine-mist spray. Water as often as necessary to maintain root systems in a moist condition.
 - F. Deliver trees and shrubs to the site after preparations for planting have been completed and plant immediately. If planting is delayed more than 6 hours after delivery, set trees and shrubs in shade, protect from weather and mechanical damage, and keep roots moist as described above. Under no circumstances shall plants be set on pavement or left lying on their sides. Plants found in such conditions shall be rejected and contractor shall remove the plants from the site and provide replacements.

1.7 PROJECT CONDITIONS

- A. Utilities: Determine location of above grade and underground utilities and perform work in a manner which will avoid damage. Hand excavate as required. Maintain grade stakes until removal is mutually agreed upon by parties concerned.
- B. Excavation: When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions, notify Landscape Architect before planting.
- C. Protection:
 1. Protect existing utilities, paving, and other facilities from damage caused by planting operations.

1.8 COORDINATION AND SCHEDULING

- A. Proceed with and complete landscape work as rapidly as portions of site become available, working within seasonal limitations for each kind of landscape work.
- B. Tree Digging Restrictions: Provide freshly dug trees to be planted within the same time frame as listed below.
- C. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of substantial completion.
 - 1. Spring Planting: March 15 to June 15.
 - 2. Fall Planting: September 1 to November 1.
- D. Weather Limitations: Proceed with planting only when existing and forecast weather conditions are suitable for work.
- E. Coordination with Seeding, Lawns or Meadows: Plant trees and shrubs after final grades are established and prior to planting of turf, unless otherwise acceptable to Landscape Architect. If planting of trees and shrubs occurs after turf work, protect turf areas and promptly repair damage resulting from planting operations.

1.9 MAINTENANCE

- A. Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after each area is planted and continue until plantings are acceptably healthy and well established, but for not less than maintenance period below.
 - 1. Maintenance Period: Six months from date of Initial Acceptance.
 - 2. When full maintenance period has not elapsed before end of planting season, or if planting is not fully established at that time, continue maintenance during next planting season.
 - 3. Existing plants and lawns to remain within Project Limits: Maintain throughout the time of construction through the conclusion of the Maintenance Period.
- B. Watering of Trees and Shrubs: Watering shall be accomplished by either natural or artificial means. During the growing season (approximately April 1 to October 31), the minimum application shall be equal to five (5) gallons per square yard or one inch layer of water per plant pit over bed areas per week.
- C. Control of Insects, Fungus and Other Diseases: Control of insects, fungus and other diseases shall be accomplished by means of spraying with an insecticide or fungicide, specifically formulated for the pest or disease present and through a comprehensive, defined program. Products and application rates must be approved by Landscape Architect prior to application.
- D. Adjustment of Plants: If any tree, shrub or plant moves from its proper elevation or position, it shall be shifted or raised to its proper level.

- E. Pruning: Pruning as required for common maintenance is to be performed on installed plants and all existing plants to remain within the contract limit line by a trained arborist in accordance with the specifications or the direction of the Landscape Architect.
- F. Watering Saucers and Mulch: Watering saucers and mulch will be maintained for the duration of the maintenance period and then saucers are to be removed.
- G. Re-fertilization: Re-fertilization is to be Ra-Pid-Gro or approved equal, at the rate of one pound of fertilizer to 30 gallons of water per tree 3" caliper and larger, or smaller trees at the rate of one-third pound of fertilizer to 10 gallons of water per tree applied early in the spring (before May 15) after the first growing season. Shrubs and perennials are to be fertilized with the same mixture at the rate of 1 gallon per shrub and 1 pint per perennial, and applied during the same period. Fertilizer is to be approved brand, completely water soluble and containing not less than 23% nitrogen, 21% phosphorus, and 17% potassium.
- H. Weeding: The complete removal of weeds from within the mulched area around each tree and within each planting bed as well as existing planting beds to remain within the contract limit line shall be done every two weeks during the maintenance period.

1.10 WARRANTY

- A. Special Warranty: Installer's standard form in which Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Death and unsatisfactory growth, except for defects resulting from lack of adequate maintenance, neglect, abuse by Owner, or incidents that are beyond Contractor's control.
 - b. Structural failures including plantings falling or blowing over.
 - c. Faulty operation of tree stabilization.
 - 2. Warranty Periods from Date of Substantial Completion:
 - a. Trees and Shrubs: One year.
 - b. Ground Cover and Plants: One year.
 - 3. Include the following remedial actions as a minimum:
 - a. Remove dead exterior plants immediately. Replace immediately unless required to plant in the succeeding planting season.
 - b. Replace exterior plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.
 - c. A limit of one replacement of each exterior plant will be required except for losses or replacements due to failure to comply with requirements.
 - d. Provide extended warranty for replaced plant materials; warranty period equal to original warranty period.

- B. Contractor shall bear the cost of complete replacement(s).
- C. If, after replacement, a plant fails, the Owner will receive a credit based upon the original planted value (approximately three times the wholesale price). All areas damaged by tree or shrub replacement operations are to be fully restored to the project final acceptance condition, as originally specified.

PART 2 - PRODUCTS

2.1 TREE AND SHRUB MATERIAL

- A. General: Furnish nursery-grown trees and shrubs complying with ANSI Z60.1, with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock free of disease, insects, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.
- B. Provide trees and shrubs of sizes, grades, and ball or container sizes complying with ANSI Z60.1 for types and form of trees and shrubs required. Trees and shrubs of a larger size may be used if acceptable to Architect, with a proportionate increase in size of roots or balls.
- C. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which shall begin at root flare according to ANSI Z60.1. Root flare shall be visible before planting.
- D. Label each tree and shrub with securely attached, waterproof tag bearing legible designation of botanical and common name.
- E. Label at least one tree and one shrub of each variety and caliper with a securely attached, waterproof tag bearing legible designation of botanical and common name.
- F. If formal arrangements or consecutive order of trees or shrubs is shown, select stock for uniform height and spread, and number label to assure symmetry in planting.

2.2 SHADE AND FLOWERING TREES

- A. Shade Trees: Single-stem trees with straight trunk, well-balanced crown, and intact leader, of height and caliper indicated, complying with ANSI Z60.1 for type of trees required.
 - 1. Branching Height: One-third to one-half of tree height.
- B. Small Upright Trees: Branched or pruned naturally according to species and type, with relationship of caliper, height, and branching according to ANSI Z60.1; stem form as indicated.
- C. Small Spreading Trees: Branched or pruned naturally according to species and type, with relationship of caliper, height, and branching according to ANSI Z60.1; stem form as indicated.

2.3 DECIDUOUS SHRUBS

- A. Form and Size: Shrubs with not less than the minimum number of canes required by and measured according to ANSI Z60.1 for type, shape, and height of shrub.

1. Shrub sizes indicated are sizes after pruning.

2.4 CONIFEROUS EVERGREENS

- A. Form and Size: Normal-quality, well-balanced, coniferous evergreens, of type, height, spread, and shape required, complying with ANSI Z60.1.

1. Shearing Designation: Natural, never sheared (N).

2.5 BROADLEAF EVERGREENS

- A. Form and Size: Normal-quality, well-balanced, broadleaf evergreens, of type, height, spread, and shape required, complying with ANSI Z60.1.

1. Shearing Designation: Natural, never sheared.

2.6 PLANTS

- A. Perennials: Provide healthy, field-grown plants from a commercial nursery, of species and variety shown or listed, complying with requirements in ANSI Z60.1.

- B. Vines: Provide vines of species indicated complying with requirements in ANSI Z60.1 as follows:

1. Two-year plants with heavy, well-branched tops, with not less than 3 runners 18 inches (450 mm) or more in length, and with a vigorous well-developed root system.
2. Provide field-grown vines. Vines grown in pots or other containers of adequate size and acclimated to outside conditions will also be acceptable.

2.7 GRASS MATERIALS

- A. See section 329113 Planting Soils.

2.8 MULCHES

- 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: Provide bark mulch for mulching plants comprised of either hardwood or softwood shredded bark. No leaves, young green growth, branches, twigs 2" or less in diameter,

wood shavings, sawdust or foreign material such as stones, etc., shall be mixed with the bark mulch. Shredded bark mulch shall not exceed 3" in greatest dimension.

2.9 TREE STABILIZATION MATERIALS

A. Stakes and Guys:

1. Upright and Guy Stakes: Rough-sawn, sound, new hardwood, redwood, or pressure-preservative-treated softwood, free of knots, holes, cross grain, and other defects, 2-by-2-inch nominal (38-by-38-mm actual) by length indicated, pointed at one end.
2. Flexible Ties: Wide rubber or elastic bands or straps of length required to reach stakes or turnbuckles.
3. Guys and Tie Wires: ASTM A 641/A 641M, Class 1, galvanized-steel wire, 2-strand, twisted, 0.106 inch (2.7 mm) in diameter.
4. Hose Chafing Guards: Reinforced rubber or plastic hose at least 1/2 inch (13 mm) in diameter, cut to lengths required to protect tree trunks from damage.

2.10 WEED CONTROL

- ### A.
- If planting occurs between April 1 and September 1, a granular pre-emergent weed suppressant shall be applied in strict accordance with manufacturer's instructions to all areas scheduled to be mulched. Select pre-emergent for compatibility with species to be planted.

PART 3 - EXECUTION

3.1 EXAMINATION

- #### A.
- Examine areas to receive exterior plants for compliance with requirements and conditions affecting installation and performance.
- #### B.
- Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

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

- D. Lay out exterior plants at locations directed by Landscape Architect. Stake locations of individual trees and shrubs and outline areas for multiple plantings.
- E. Wrap trees and shrubs with burlap fabric over trunks, branches, stems, twigs, and foliage to protect from wind and other damage during digging, handling, and transportation.

3.3 PLANTING BED ESTABLISHMENT

- A. Loosen subgrade of planting beds to a minimum depth of 4 inches (100 mm). Remove stones larger than 1 inch (25 mm) in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
 - 1. Apply fertilizer directly to subgrade before loosening.
 - 2. Thoroughly blend planting soil mix off-site before spreading.
 - a. Delay mixing fertilizer with planting soil if planting will not proceed within a few days.
 - 3. Spread planting soil mix to a depth of required to meet finish grades after natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.
 - a. Spread approximately one-half the thickness of planting soil mix over loosened subgrade. Mix thoroughly into top 4 inches (100 mm) of subgrade. Spread remainder of planting soil mix.
- B. Finish Grading: Grade planting beds to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.
- C. Before planting, restore planting beds if eroded or otherwise disturbed after finish grading.

3.4 EXCAVATION FOR TREES, SHRUBS, AND PLANTS

- A. Planting shall be performed only by experienced workmen familiar with planting procedures and under the supervision of a qualified supervisor.
- B. Shrub bed lines shall be approved by the Landscape Architect before start of planting work.
- C. Excavate and remove existing soil from entire area designated as planting beds. Dispose of subsoil removed from landscape excavations. Do not mix with planting soil or use as backfill.
- D. Pits and Trenches: Excavate circular pits with sides sloped inward. Trim base leaving center area raised slightly to support root ball and assist in drainage. Do not further disturb base. Scarify sides of plant pit smeared or smoothed during excavation.
 - 1. Shrub beds: 30" depth when on-grade. As detailed when over structure.
 - 2. Tree pits: Excavate to the depth of root ball

3. Excavate approximately three times as wide as ball diameter for balled and burlapped stock.
- E. Obstructions: Notify Landscape Architect if unexpected rock or obstructions detrimental to trees are encountered in excavations.
 1. Hardpan Layer: Drill 6-inch- (150-mm-) diameter holes 10'-0" O.C. into free-draining strata or to a depth of 10 feet (3 m), whichever is less, and backfill with free-draining material.
- F. Drainage: see percolation test requirements in section 329113 Planting Soils. Notify Architect if subsoil conditions evidence unexpected water seepage or retention in tree or shrub pits.
- G. Fill excavations with water and allow to percolate out before setting trees and shrubs.

3.5 BACKFILLING OF SOIL LAYERS

- A. Placement of Planting Soil:
 1. Placement of planting soil and plant stock shall be carried out simultaneously to prevent excessive traffic over soil lifts and the final grade so as to prevent the creation of undesirable soil compaction.
 2. Planting soils shall never be moved or worked when wet or frozen.
 3. The Contractor shall place barricades as required to prevent any unnecessary compaction of planting soil from vehicles, equipment, or pedestrian traffic.

3.6 FINE GRADING

- A. Prior to fine grading, Contractor shall verify that the rough grading, underdrainage system, and planting soil mixes have been accepted.
- B. Fine Grading: Set sufficient grade stakes for checking the finished grades. Confer with Landscape Architect to assure that finish grades will meet the design intent and gradient requirements. Review grades on site with Landscape Architect. Stakes must be set at the bottom and top of slopes and the centers of plant beds. Grades shall be established which are accurate to 1/10th of a foot either way. Connect contours and spot elevations with an even slope. All grading will insure drainage away from structures.
 1. After planting soil mix has been spread, it shall be carefully prepared by scarifying and hand raking. All large stiff clods, lumps, brush, roots, stumps, litter and other foreign matter, and stones over one inch in diameter shall be removed from the planting soil. Planting soil shall also be free of smaller stones in excessive quantities as determined by the Landscape Architect.
 2. Fine grade planted areas to smooth, free draining, even surfaces with fine texture. Rake and drag areas to flatten ridges and fill depressions, except as select areas shown on drawings. Control moisture content to maintain optimum conditions, but do not create a muddy condition.

3. Maintenance and Restoration: Restore prepared areas to specified condition if eroded, settled, or otherwise disturbed after fine grading and prior to lawn planting.

3.7 PROTECTION

- A. Protect newly graded areas from traffic, freezing and erosion. Keep free of trash, debris or construction materials from other work.
- B. Repair and re-establish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or compaction due to subsequent construction operations or weather conditions. Scarify or remove and replace material to a depth as directed by the Landscape Architect; reshape and re-compact at optimum moisture content to the required density.
- C. Where settling occurs, before final acceptance or during the warranty period, remove finish surfacing, backfill with additional approved material, compact to specified rates, and restore any disturbed areas to a condition acceptable to the Owner.

3.8 PLANTING TREES AND SHRUBS

- A. Before planting, verify that root flare is visible at top of root ball according to ANSI Z60.1.
- B. Set balled and burlapped and container grown stock plumb and in center of pit or trench with top of root ball 1 inch (25 mm) above adjacent finish grades.
 1. Remove burlap and wire baskets from tops of root balls and partially from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
 2. Place planting soil mix around root ball in layers, tamping to settle mix and eliminate voids and air pockets. When pit is approximately one-half backfilled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed. Water again after placing and tamping final layer of planting soil mix.
- C. Organic Mulching: Apply 4 inch average thickness of organic mulch extending 12 inches (300 mm) beyond edge of planting pit or trench. Do not place mulch within 3 inches (75 mm) of trunks or stems.
- D. Inspect tree trunks for injury, improper pruning, and insect infestation; take corrective measures required before wrapping. Wrap trees of 2-inch (50-mm) caliper and larger with trunk-wrap tape. Start at base of trunk and spiral cover trunk to height of first branches. Overlap wrap, exposing half the width, and securely attach without causing girdling.
- E. Dish top of backfill to allow mulching. Provide 5' mulch ring for all trees in lawn.
- F. Apply granular weed suppressant according to strict manufacturer's specifications to soil surface prior to placing mulch to all mulched areas.
- G. Provide spaded edge at all plant beds adjacent to lawns: 4 – 6" depth.

3.9 TREE AND SHRUB PRUNING

- A. Remove only dead, dying, or broken branches. Do not prune for shape.
- B. Prune remaining trees affected by temporary and new construction or as noted on drawings.
- C. Pruning Standards: Prune trees according to ANSI A300 as follows.
 - 1. Type of Pruning: Crown cleaning and thinning, to remove dead, dying or diseased branches, weak branches and watersprouts, as well as selective removal of branches to increase light penetration, air movement and to reduce weight.
- D. Prune, thin, and shape trees and shrubs as directed by Landscape Architect.
- E. Prune, thin, and shape trees and shrubs according to standard horticultural practice. Prune trees to retain required height and spread. Unless otherwise indicated by Landscape Architect, do not cut tree leaders; remove only injured or dead branches from flowering trees. Prune shrubs to retain natural character.
 - 1. Cut branches with sharp pruning instruments; do not break or chop.

3.10 TREE STABILIZATION

- A. Trunk Stabilization: Where indicated, provide trunk stabilization as follows:
 - 1. Upright Staking and Tying: Stake trees of 2- through 5-inch (50- through 125-mm) caliper. Stake trees of less than 2-inch (50-mm) caliper only as required to prevent wind tip-out. Use a minimum of 2 stakes of length required to penetrate at least 18 inches (450 mm) below bottom of backfilled excavation and to extend dimension shown above grade. Set vertical stakes and space to avoid penetrating root balls or root masses.
 - 2. Use 2 stakes for trees up to 12 feet (3.6 m) high and 2-1/2 inches (63 mm) or less in caliper; 3 stakes for trees less than 14 feet (4.2 m) high and up to 4 inches (100 mm) in caliper. Space stakes equally around trees.
 - 3. Support trees with bands of flexible ties at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree.
 - 4. Support trees with two strands of tie wire encased in hose sections at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree.
- B. Guying and Staking: Guy and stake trees exceeding 14 feet (4.2 m) in height and more than 3 inches (75 mm) in caliper unless otherwise indicated. Securely attach no fewer than 3 guys to stakes 30 inches (760 mm) long, driven to grade.
 - 1. For trees more than 6 inches (150 mm) in caliper, anchor guys to pressure-preservative-treated deadmen 8 inches (200 mm) in diameter and 48 inches (1200 mm) long buried at least 36 inches (900 mm) below grade. Provide turnbuckle for each guy wire and tighten securely.
 - 2. Support trees with bands of flexible ties at contact points with tree trunk and reaching to turnbuckle. Allow enough slack to avoid rigid restraint of tree.

3. Support trees with strands of cable or multiple strands of tie wire encased in hose sections at contact points with tree trunk and reaching to turnbuckle. Allow enough slack to avoid rigid restraint of tree.

3.11 PLANTING BED MULCHING

- A. Mulch backfilled surfaces of planting beds and other areas indicated. Provide mulch ring around trees in lawn areas.
 1. Organic Mulch: Apply 4-inch average thickness of organic mulch, and finish level with adjacent finish grades. Do not place mulch against plant stems.

3.12 PLANT MAINTENANCE

- A. Maintain plantings as well as existing vegetation to remain within the contract limit line by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings. Spray or treat as required to keep trees and shrubs free of insects and disease.
- B. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.
- C. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use practices to minimize the use of pesticides and reduce hazards.
- D. Apply pesticides and other chemical products and biological control agents in accordance with authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.
- E. Treat, repair, or replace damaged plantings.

3.13 CLEANUP AND PROTECTION

- A. During planting, keep adjacent paving and construction clean and work area in an orderly condition.
- B. Protect exterior plants (those planted, and those existing to remain within the contract limit line) from damage due to landscape operations, operations by other contractors and trades, and others. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.

3.14 DISPOSAL

- A. Disposal: Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of them off Owner's property.

3.15 INSPECTION AND ACCEPTANCE

- A. Planted areas will be inspected at completion of installation and accepted subject to compliance with specified materials and installation requirements.
- B. Inspection to determine final acceptance of planted areas will be made by the Landscape Architect upon Contractor's request. Provide notification at least 10 working days before requested inspection date.
 - 1. Landscape work may be inspected for acceptance in parts agreeable to Landscape Architect, provided work offered for inspection is complete, including maintenance.
- C. Where inspected landscape work does not comply with requirements, replace rejected work and continue specified maintenance until re-inspected by Landscape Architect and found to be acceptable. Remove rejected plants and materials promptly from project site.
- D. Warranty inspection of the entire project will be done at the end of the 1-year warranty period.

END OF SECTION 329300

SECTION 330500 - COMMON WORK RESULTS FOR UTILITIES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Piping joining materials.
 - 2. Piping system common requirements.

1.2 DEFINITIONS

- A. Exposed Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions.
- B. Concealed Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.3 ACTION SUBMITTALS

- A. As per the Material Specification.

1.4 INFORMATIONAL SUBMITTALS

- A. As per the Material Specification.

PART 2 - PRODUCTS

2.1 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 - 1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch (3.2-mm) maximum thickness, unless otherwise indicated.
 - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
 - 2. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

- B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- D. Solvent Cements for Joining Plastic Piping:
 - 1. ABS Piping: ASTM D 2235.
 - 2. CPVC Piping: ASTM F 493.
 - 3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
 - 4. PVC to ABS Piping Transition: ASTM D 3138.
- E. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- A. Install piping according to the following requirements and utilities Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on the Coordination Drawings.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping to permit valve servicing.
- E. Install piping at indicated slopes.
- F. Install piping free of sags and bends.
- G. Install fittings for changes in direction and branch connections.
- H. Select system components with pressure rating equal to or greater than system operating pressure.
- I. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
 - 1. A wall pipe or sleeve will be required for all pipe passing through concrete or masonry block walls. Wall fittings and sleeves shall be as indicated on the Drawings and as specified in the applicable piping Specification Section.

3.2 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and utilities sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Plastic Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 appendixes.
 - 3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
 - 4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
 - 5. PVC Nonpressure Piping: Join according to ASTM D 2855.
 - 6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.
- E. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.
- F. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.
- G. Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.
- H. Concrete collars: Areas of dissimilar pipe connections or spot repairs on pipes may require an exterior concrete collar, as noted on the plan and associated detail. Concrete that is cast for the collar shall extend around the entire perimeter of the pipe, such that it will bear onto undisturbed ground below the pipe.

END OF SECTION 330500

SECTION 330526 – UTILITY IDENTIFICATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Warning Tape to be placed in utility trenches.

B. Related Sections:

1. Division 31 Section 312000 “Earth Moving” for utility trench excavation.

C. Work Included:

The Work included in this section shall pertain to the identification of potable water, sanitary sewer, fire protection water, storm sewer, underground electric, underground communication, and underground propane buried in the site. The work shall also include but not be limited to the installation of identification/warning tape, copper tracing wire at non-ferrous utility pipes (as confirmed with the Owner’s Representative), and color coding on pipe.

PART 2 - PRODUCTS

2.1 IDENTIFICATION/WARNING TAPE

- A. General: Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:

1. Potable and Fire Protection Water Main Tape:
 - a. Color: Blue with Black Lettering
 - b. Lettering: “CAUTION: WATER LINE BURIED BELOW” or similar wording.
2. Sanitary Sewer Main Tape:
 - a. Color: Green with Black Lettering
 - b. Lettering: “CAUTION: SANITARY LINE BURIED BELOW” or similar wording.
3. Storm Sewer Main Tape:
 - a. Color: Green with White Lettering
 - b. Lettering: “CAUTION: STORM LINE BURIED BELOW” or similar wording.
4. Underground Electric Tape:
 - a. Color: Red with Black Lettering

- b. Lettering: “CAUTION: ELECTRIC LINE BURIED BELOW” or similar wording.
- 5. Telephone or Communications Tape:
 - a. Color: Orange with Black Lettering
 - b. Lettering: “CAUTION: COMMUNICATIONS BURIED BELOW” or similar wording.
- 6. Propane Tape:
 - a. Color: Yellow with Black Lettering
 - b. Lettering: “CAUTION: PROPANE BURIED BELOW” or similar wording.

All lettering on the warning tape shall appear legibly on the tape and shall run the entire length of the pipe.

B. TRACER WIRE FOR WATER LINES

- 1. In addition to providing a warning tape with an encased metallic core, all underground water lines shall have a continuous, insulated 12 gauge solid copper wire, installed directly on top of the centerline of pipe for locating. Tracer wire shall be color coded yellow below the thermoplastic insulation recommended for direct bury. Wire connectors shall be water tight to provide electric continuity. Fasteners at structures to ground level shall be made of non corrosive material.

PART 3 – EXECUTION

3.1 INSTALLATION OF IDENTIFICATION/WARNING TAPE:

- A. Install warning tape directly over the piping (both ferrous and non ferrous), as shown in the Project Drawings.
- B. Install warning tape above the outside edge of the related utility structure, such that the warning tape is placed 24 inches below grade or a minimum of 12 inches above the structure. Do not embed warning tape within any asphalt or concrete pavements.

3.3 INSTALLATION OF TRACER WIRE

- A. Tracer wire shall be installed along all new non-ferrous pipes and conduits, with the exception of sanitary and storm sewer lines. The wire shall be installed directly above the respective utility and shall be placed in such a manner as to be able to properly trace all utility pipe/conduits without loss or deterioration of the signal or without the transmitted signal migrating off the tracer wire.
- B. Except for approved splice locations, tracer wire shall be continuous and without splices from each trace wire point.

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- A. For the relocated gas line by others, the Contractor shall coordinate the placement and terminal connection of tracer wire with the Utility Company. Spliced connection between the main (primary) line tracer and branch connection tracer wire shall only be allowed at the metal valve box connections. Splices shall be watertight. All splices shall get a wrapping of waterproof electrical tape.

END OF SECTION 330526

SECTION 331116 - WATER UTILITY PIPING

PART 1 - GENERAL

1.1 WORK INCLUDED

This section covers the furnishing and installation of 4 through 12 inch buried polyvinyl chloride (PVC) pressure pipe for potable water services. PVC pressure pipe shall be furnished complete with all fittings, jointing materials, anchors, blocking, encasement, and other necessary appurtenances (including valves and hydrants).

AWWA C-900 PVC Water Pipe shall be furnished where indicated on the drawings, the water main replacement work (labeled "W" on the plans), includes the following items:

- A. Ductile Iron (DI) cement lined pipe for underground and underwater piping that is part of this project, including all of the underground domestic water pipe that is to extend along East Road, at the Project Site, and extending to hydrants and buildings.
- B. Corporation cocks, curb boxes and stops, tapping sleeves, and service clamps.
- C. Tapped connections consisting of connections made to the proposed Ductile Iron Pipeline and existing pipe by means of the threaded or bolted attachment of a corporation cock or valve to the pipe.
- D. Pipe fittings and appurtenances
- E. Polyethylene encasement of ductile iron water lines.
- F. Pipeline Pressure and Leakage Testing
- G. Related Documents:
 - Section 312000 Earth Moving
 - Section 312500 Soil Erosion and Sedimentation Control
 - Section 331300 Cleaning and Disinfection of Water Distribution Systems
 - Section 330500 "Common Work Results for Utilities".

1.2 REFERENCES

- A. AWWA C150 DI Pressure Pipe and Fabricated Fittings, for Water Distribution
- B. AWWA C104 / ANSI A21.4 - Cement Mortar Lining for Ductile Iron Pipe and Fittings for Water;

as well as AWWA C105 / ANSI A21.5 - Polyethylene Encasement for Ductile Iron Pipe Systems

- C. AWWA C110 / ANSI A21.10 - Ductile Iron and Grey Iron Fittings 3-inches through ~~48~~-inches for Water
- D. AWWA C111 / ANSI A21.11 - Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings
- E. AWWA C 151 / ANSI A21.51 - Ductile Iron Pipe, Centrifugally Cast for Water
- F. AWWA C 153 / ANSI A21.53 - Ductile Iron Compact Fittings, 3-inches through 24 inches for Water
- G. ASTM A536 – Standard Specification for Ductile Iron Castings
- H. AWWA C600 - Installation of Ductile Iron Water Mains and Their Appurtenances
- I. AWWA C651 – Disinfecting Water Mains
- J. AWWA C800 – Underground Service Line Valves and Fittings
- K. AWWA M44 – Distribution Valves
- L. New York State Department of Health, Bureau of Public Water Supply Protection – Guidelines for Designing Backflow Prevention Assembly Installations, Supplement to the 1981 Cross Connection Control Manual.
- M. New York State Department of Transportation (NYSDOT) Standard Sheet 663-01 (Water Main Pipe Installation Details), as well as details included in the contract drawings.
- N. Great Lakes Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers Recommended Standards for Waterworks (Ten State Standards).

1.3 SHOP DRAWINGS

- A. Submit detailed Shop Drawings and/or catalog cuts and data on all Ductile Iron Pipe and Fittings which are proposed to be used in the work. Certified copies of the manufacturer's affidavit stating that pipe and fittings were manufactured and tested in accordance with applicable provisions in the above-specified Standards shall be submitted. Prior to obtaining any material in connection with this Section, detailed shop drawings, installation guides, and data on pipes, fittings, couplings, supports, anchors, bolts, nuts, and other necessary accessories shall be submitted.

PART 2 - PRODUCTS

2.2 MATERIALS

Pipe	AWWA C150 DI Pipe.
Fittings	Cast iron; ANSI/AWWA C110/A21.10, 250 psi pressure rating, except shorter laying lengths will be acceptable.
Joints	
PVC to PVC	ANSI/AWWA C900 or C905, stab type, with elastomeric synthetic rubber gaskets. Gaskets of natural rubber will not be acceptable.
PVC to Cast Iron	ANSI/AWWA C111/A21.11, except gaskets shall be synthetic rubber. Natural rubber will not be acceptable.
Tapping Saddles	Ductile iron, with galvanized steel straps and synthetic rubber sealing gasket, 250 psi pressure rating.
Restrained Joints	ASTM F1674, EBAA Iron 2000 series (4 inch through 20 inch) or concrete thrust blocking.
Tapping Sleeves	Ductile iron, 250 psi pressure rating.
Polyethylene Encasement	Tube or sheet, ANSI/AWWA C105/A21.5.
Joint Tape	Self-sticking, PVC or polyethylene, 10 mils thick; Chase "Chasekote 750", Kendall "Polyken 900", or 3M "Scotchrap 50".
Coal Tar Epoxy	High-build coal tar epoxy; Ameron "Amercoat 78HB Coal Tar Epoxy", Carboline "Bitumastic 300 M", Tnemec "46H-413 Hi-Build Tneme-Tar", or Sherwin-Williams "Hi-Mil Sher-Tar Epoxy".
Conductive Tracer	Detection tape, 3 inches wide; aluminum foil core, 0.5 mil thick, encased in a protective inert plastic jacket; 5,000 psi min tensile strength; 2.5 lbs per inch per 1,000 feet min mass; color coded in accordance with APCA Uniform Color Code; Allen Systems "Detectatape", Lineguard "Type III", or Reef Industries "Terra Tape D".

Ductile Iron Pipe: Ductile Iron Pipe shall be pressure class of 350 or thicker, and the cement lining shall be 1/16 inch thick.

Ductile Iron Pipe Joints (when used)

1. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end.
2. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
3. Gaskets: AWWA C111, rubber.
4. Mechanical joints may be used for closures, subject to meeting thrust restraint requirements, or as shown on the Contract Drawings. Mechanical joints shall be assembled in accordance with AWWA C111. Mechanical joints to be made with restraining glands shall be installed in compliance with manufacturer's recommendations.

Ductile Iron Fittings

1. Fittings for buried ductile iron pipe shall be ductile iron with mechanical joint unless indicated otherwise on the Contract Drawings. Mechanical joint fittings shall be compact body, manufactured and tested in accordance with AWWA C-153.
2. The pressure class for all fittings shall be 350 psi.
3. Mechanical joints for fittings shall be in accordance with AWWA C-111. The required joint accessories including ductile iron glands, high strength low-alloy steel tee bolts and nuts, plain backed rubber gaskets, and joint lubricant shall be supplied by the pipe manufacturer.

Gate Valves

1. Nonrising-Stem, High-Pressure, Resilient-Seated Gate Valves:
 - a. Description: Ductile-iron body and bonnet; with bronze or ductile-iron gate, resilient seats, bronze stem, and stem nut.
 - 1) Standard: AWWA C509.
 - 2) Minimum Pressure Rating: 250 psig .
 - 3) End Connections: Mechanical Joint.
 - 4) Interior Coating: Complying with AWWA C550.
 - B. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over valve and with a barrel approximately 5 inches in diameter.

F. Misc.

1. Corporation Stops: Bronze construction, flared joint Ford Meter Box Company #FB600 Ballcorp, or as manufactured by Mueller, Hayes, Red Hed or equal. Comply with AWWA C800.
2. Curb Stops (if required) Bronze construction, flared joint Ford Meter Box Company ball valve, Mueller "Oriseal", Red Hed, Hayes "Nuseal" or equal. Comply with AWWA C800.
3. Service Boxes Service Boxes for Curb Valves: Similar to AWWA M44 requirements for cast-iron valve boxes. Include cast-iron telescoping top section of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over curb valve and with a barrel approximately 3 inches in diameter.
 - a. Shutoff Rods: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and slotted end matching curb valve.

G. Fire Hydrants –

Dry-Barrel Fire Hydrants:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Mueller Co.; Water Products Div.
 - b. Kennedy Valve, a division of McWane, Inc.
 - c. East Jordan Iron Works, Inc.
 3. Description: Freestanding, with one NPS 4-1/2 and two NPS 2-1/2 outlets, 5-1/4-inch main valve, drain valve, and NPS 6 mechanical-joint inlet. Include interior coating according to AWWA C550. Hydrant shall have cast-iron body, compression-type valve opening against pressure and closing with pressure.
 - a. Standard: AWWA C502.
 - b. Pressure Rating: minimum 250 psig.
- H. Polyethylene encasement for ductile iron water lines. – Encasement material shall be 8-mil thick polyethylene conforming to AWWA C105.

PART 3 - EXECUTION

- 3.1 INSPECTION. Pipe and fittings shall be carefully examined for cracks and other defects immediately before installation; spigot ends and bells shall be examined with particular care. All defective pipe and fittings shall be removed from the site of the work.
- 3.2 LAYING PIPE. Pipe shall be protected from lateral displacement by pipe embedment material installed as specified in the Trenching and Backfilling section. Pipe shall not be laid in water or other unsuitable conditions.

Pipe shall be laid with bell ends facing the direction of laying, except when reverse laying is specifically permitted by Owner's Representative.

Foreign matter shall be prevented from entering the pipe during installation.

Whenever pipe laying is stopped, the open end of the line shall be sealed with a watertight plug. All water shall be removed from the trench prior to removing the plug.

A conductive tracer shall be buried above PVC pipe, not more than 18 inches below the ground surface.

- A. Cleaning. The interior of all pipe and fittings shall be thoroughly cleaned before installation and shall be kept clean until the work has been accepted.

- B. Alignment. Piping shall be laid to the lines and grades indicated on the drawings. Pipelines or runs intended to be straight shall be laid straight. Deflections from a straight line or grade shall not exceed the maximum deflections specified by the manufacturer.

Unless otherwise specified or indicated on the drawings, and subject to acceptance by Owner's Representative, either shorter pipe sections or fittings shall be installed as required to maintain the indicated alignment or grade.

- 3.3 CUTTING PIPE. Cutting shall comply with the pipe manufacturer's recommendations and with Chapter 7 of AWWA Manual M23. Cuts shall be smooth, straight, and at right angles to the pipe axis. After cutting, the end of the pipe shall be dressed to remove all roughness and sharp corners and shall be beveled in accordance with the manufacturer's instructions.
- 3.4 JOINTS. Joints shall be stab-type with full restraint at each joint unless otherwise indicated on the drawings. All buried pipe to be restrained.
- A. Stab Type Joints. Jointing shall conform to the instructions and recommendations of the pipe manufacturer. All surfaces for gasketed joints shall be lubricated immediately before the joint is completed. Gaskets and lubricants shall be supplied by the pipe manufacturer, shall be suitable for use in potable water, shall be compatible with the pipe materials, shall be stored in closed containers, and shall be kept clean. Each spigot shall be suitably beveled to facilitate assembly.
- B. Mechanical Joints. Mechanical joints shall be carefully assembled in accordance with the manufacturer's recommendations. If effective sealing is not obtained, the joint shall be disassembled, thoroughly cleaned, and reassembled. Over-tightening of bolts to compensate for poor installation practice will not be permitted.

Fittings for pipe sizes 4-inches thru 12-inches shall be mechanical joint, AWWA C153, 350 psi working pressure rated, ductile iron for use with the type of pipe specified. Fittings shall be cement mortar lined per AWWA C104 and shall have a 1 mil thick exterior petroleum asphaltic coating. T-bolts shall be AWWA C111, high strength, low alloy steel. Fittings and all accessories shall be of domestic manufacture; U.S. Pipe Trim-Tyte, Union Foundry, Tyler; no substitutions.

- 3.5 CONNECTIONS WITH EXISTING PIPING. Connections with existing pipes shall be made using fittings suitable for the conditions encountered. Each connection with an existing pipe shall be made at a time and under conditions which will least interfere with service to customers, and as authorized by Owner. Facilities shall be provided for proper dewatering and for disposal of water removed from the dewatered lines and excavations without damage to adjacent property.

Special care shall be taken to prevent contamination of potable water lines when dewatering, cutting into, and making connections with existing pipe. No trench water, mud, or other contaminating substances shall be permitted to enter the lines. The interior of all pipe, fittings, and valves installed in such connections shall be thoroughly cleaned and then swabbed with, or dipped in, a 200 mg/L chlorine solution.

- 3.6 SERVICE CONNECTIONS. Tapping saddles or tapping sleeves shall be used for all service connections 2 inches and smaller. Direct tapping of PVC pipe will not be permitted. Fittings shall be used for service connections larger than 2 inches.
- 3.7 CONCRETE ENCASEMENT. Concrete encasement shall be installed as indicated on the drawings.

Concrete and reinforcing steel shall be as specified in the Cast-in-Place Concrete section. All pipe to be encased shall be suitably supported and blocked in proper position and shall be anchored against flotation.

- 3.8 RESTRAINED JOINTS. All bell-and-spigot or all-bell tees, Y-branches, bends deflecting 11-1/4 degrees or more, valves, and plugs which are installed in piping subjected to internal hydrostatic heads in excess of 30 feet shall be provided with suitable restraint.

Concrete blocking shall extend from the fitting to solid, undisturbed earth and shall be installed so that all joints are accessible for repair. The dimensions of concrete reaction blocking shall be as indicated on the drawings or as directed by Engineer.

Reaction blocking, anchorages, or other supports for fittings installed in fills or other unstable ground shall be provided as indicated by the drawings or as directed by Engineer.

All steel clamps, rods, bolts, and other metal accessories used in tapping saddles or reaction anchorages subject to submergence or in contact with earth or other fill material, and not encased in concrete, shall be coated in accordance with the Protective Coatings section.

All steel clamps, rods, bolts, and other metal accessories used in tapping saddles or reaction anchorages subject to submergence or in contact with earth or other fill material, and not encased in concrete, shall be protected from corrosion by two coats of medium consistency coal tar applied to clean, dry metal surfaces. The first coat shall be dry and hard before the second coat is applied.

- 3.09 PRESSURE AND LEAKAGE TESTS. After installation, water piping shall be hydrostatically tested for defective workmanship and materials as specified in the Pipeline Pressure and Leakage Testing – Part 3.16 of this Specification Section. Testing of piping system shall be completed prior to final cleaning and disinfection.

- 3.10 LEAKAGE. All water piping shall be watertight and free from leaks. Each leak which is discovered within the correction period stipulated in the General Conditions shall be repaired by and at the expense of Contractor.

- 3.11 CLEANING and DISINFECTION – Refer to Section 331300.

3.12 Installation of 2 inch water service line:

- 1.) The maximum size threaded taps permitted are listed as follows:

	PIPE SIZE (inches)						
	4	6	8	12	16	20	24 and larger
Ductile Iron Pipe With Service Clamp	2	2	2	2	2	2	2
Without Service Clamp	1	1½	1¾	2	2	2	2
Polyvinyl Chloride Pipe With Service Clamp Only	-	2	2	2	2	2	2

Notes Regarding Service Taps:

- Tapped connections shall be installed only by or under the direction of personnel who have performed similar operations for at least five years.
- Curb stops shall be located where directed by the Owner's Representative and shall be properly jointed and supported.
- Threaded taps shall be performed using machines which are satisfactory for cutting, threading, and inserting a corporation cock in the pipe while the pipe is under pressure and without disrupting service.

2.) Active Services: Contractor to install corporation stop, copper pipe, and connect to existing service pipe using an approved coupling. If disturbed, curb boxes shall be re-set plumb and adjusted to the proper elevation. Boxes shall be independently supported by two bricks (or a 4"x8"x16" concrete block) and shall not ride on the curb stop. If the trench has settled, service boxes shall be readjusted to the final grade.

3.) Piping System for 2" Copper: Install pipe using one continuous length with no intermediate fittings between the point of connection to the existing service pipe. Handle and install all materials in accordance with the recognized manufacturer or industry standards; use proper tools and employ high quality workmanship. Install warning tape in the trench, as per Section 330526.

4. Cleaning and Disinfection of Copper Water Service Line:

- Prevent contamination of the service line and water supply.
- Prior to connecting the new service line, thoroughly flush the service line with potable water until the water runs clear for at least one minute. Dispose of flushed water without damaging property.
- Disinfect the service line in accordance with Section 331300.

5. Backfill and Restoration of Copper Water Service Line:

- Pressure test the service lines as outlined in Part 3.16.

- Bed with sand, and backfill and compact as shown on the drawings, and the relevant specification sections.
- Return all surfaces and other disturbed structures to a condition equal to or better than the condition at the start of construction. Refer to Section 310100 (Maintenance of Earthwork).

3.12 ANCHORAGE INSTALLATION

- A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:
 - 1. Concrete thrust blocks.
 - 2. Locking mechanical joints.
- B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:
 - i. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.
- C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.
- D. Thrust block locations may not be shown on the drawings, but blocks shall be provided for all pressure pipe fittings, changes in pipe alignment/direction, and at all other points where there is a possibility of joint separation under pressure and no other method of restraint is specified. Provide anchors and supports where necessary for fastening work into place. Thrust blocks shall be placed between solid ground and the pipe or fittings to be anchored as detailed. Thrust blocks shall be as detailed on the drawings, or where not detailed, in accordance with AWWA C600 and pipe manufacturer's recommendations.

3.13 VALVE INSTALLATION

- A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.
- B. AWWA Valves Other Than Gate Valves: Comply with AWWA C600 and AWWA M44.
- C. UL/FMG, Valves Other Than Gate Valves: Comply with NFPA 24.
- D. Corporation Valves and Curb Valves: Install each underground curb valve with head pointed up and with service box.

3.14 TRENCH INSTALLATION – Refer to Section 312000 “Earth Moving”.

3.15 UTILITY IDENTIFICATION – Refer to Section 330526 “Utility Identification”.

3.16 PIPELINE PRESSURE AND LEAKAGE TESTING

- A. Contractor shall notify local regulatory agencies and the Watertown District of the New York State Department of Health (NYS DOH) to determine if any special procedures or permits are required for disposal of water used for pressure and leakage testing and to identify acceptable locations for disposal of the water. All requirements and costs associated with notifications and obtaining any discharge permit or approvals shall be responsibility of Contractor.

Owner's Representative shall be present during testing and shall be notified of the time and place of testing at least 3 days prior to commencement of the work. All work shall be performed to the satisfaction of Owner's Representative. Refer to Exhibit A at the end of this Section (Contractor's Material and Test Certificate for Underground Piping).

- B. Testing Schedule and Procedure. A testing schedule and test procedure shall be submitted to the Owner's Representative for review and acceptance not less than 21 days prior to commencement of testing. The schedule shall indicate the proposed time and sequence of testing of the piping. The testing procedure shall establish the limits of the piping to be tested, the positions of all valves during testing, the locations of temporary bulkheads, and all procedures to be followed in performing the testing.

- C. Special Testing Requirements. Special testing requirements include the following:

- Initial flushing and cleaning of pipeline.
- Filling pipeline.
- Hydrostatic pressure and leakage testing.
- Disinfection.
- Final cleaning, flushing, and neutralization of heavily chlorinated water.
- Bacteriological tests.

Unless otherwise acceptable, temporary bulkheads shall be provided during testing so that the test pressures are not applied to existing or new valves and hydrants, or to existing water lines, or to any portion of water lines installed under this Contract that have already been put into service.

A temporary pressure gauge shall be installed at each end of the limits of the pipeline to be tested.

The tests shall be conducted before connections are made to existing water lines, or to any portion of water lines installed under this Contract that have already been put into service.

All auxiliary hydrant valves shall be closed during pressure testing so that the test pressure is not applied to the hydrant valves.

Unless otherwise acceptable, upon completion of testing and disinfection, connections made to existing water lines or to any portion that has been put into service of new water lines installed under this Contract, shall be visually inspected for leakage after placing the water line into service and before backfilling the connection.

- D. Water. Water for testing shall be furnished from on-site facilities, Contractor to Coordinate with Owner. The water shall be kept out of the remainder of the piping.

- E. Test Equipment. All necessary connections between the piping to be tested and the water source, together with pumping equipment, water meter, pressure gauges, and all other equipment, materials, and facilities required to perform the specified tests, shall be provided by the Contractor. All required flanges, valves, bulkheads, bracing, blocking, and other sectionalizing devices shall also be provided. All temporary sectionalizing devices shall be removed upon completion of testing. Vents shall be provided in test bulkheads where necessary to expel air from the piping to be tested.

Test pressures shall be applied by means of a force pump sized to produce and maintain the required pressure without interruption during the test.

Water meters and pressure gauges shall be accurately calibrated and shall be subject to review and acceptance by Owner's Representative.

Permanent gauge connections shall be installed at each location where test gauges are connected to the piping during the required tests. Drilling and tapping of pipe walls will be permitted. Upon completion of testing, each gauge connection shall be fitted with a removable plug or cap acceptable to Owner's Representative.

- F. Testing Procedure:

1.0 FILLING AND VENTING. Before filling the piping with water, care shall be taken to ensure that all air release valves and other venting devices are properly installed and in the open position. Hand-operated vent valves shall not be closed until an uninterrupted stream of water is flowing from each valve. The rate of filling the piping with water must not exceed the venting capacity of the installed air vent valves and devices.

2.0 BLOCKING AND BACKFILLING. Piping shall be adequately blocked, anchored, and supported before the test pressure is applied.

3.0 PRESSURE TESTING. After the piping to be tested has been filled with water, the test pressure shall be applied and maintained without interruption within plus or minus 5 psi of test pressure for 2 hours plus any additional time required for the Owner's Representative to examine all piping being tested and for Contractor to locate any defective joints and pipe materials.

a. Pipeline Test Pressure. The hydrostatic pressure maintained during the pressure test shall be 150 psig.

4.0 PIPING LEAKAGE. All piping shall be watertight and free from leaks. Each leak that is discovered within the correction period stipulated in the General Conditions shall be repaired by and at the expense of Contractor.

5.0 PIPELINE LEAKAGE TESTING. Following completion of pressure testing and acceptance by Consultant, the pipeline piping shall be subjected to a leakage test. The duration of the leakage test shall be 2 hours plus the additional time required for the Owner's Representative to make an accurate determination of leakage.

a. Leakage Test Pressure. The hydrostatic pressure maintained during the leakage test shall be at least 75 percent, but not more than 100 percent, of the pressure specified for pressure testing of the piping and shall be

maintained within plus or minus 5 psi during the entire time that leakage measurements are being performed.

b. Leakage Measurement. Measurement of leakage shall not be attempted until all trapped air has been vented and a constant test pressure has been established. After the pressure has stabilized, piping leakage shall be measured with a suitable water meter installed in the pressure piping on the discharge side of the force pump.

c. Allowable Leakage. The term "leakage", as used herein, refers to the total amount of water that must be introduced into the piping during the leakage test to maintain the test pressure.

No piping will be accepted if and while it exhibits a leakage rate in excess of that determined by the indicated formulas:

$$Q = 0.0075 \text{ DLN (using inch-pound units)}$$

Where

Q = allowable leakage in gallons per hour

D = nominal diameter of pipe in inches

L = length of section tested in thousand feet

N = square root of average test pressure in pounds per square inch

Whenever the piping to be tested contains pipe of different diameters, the allowable leakage shall be calculated separately for each diameter and the corresponding length of piping. The resulting allowable leakage rates shall be added to obtain the total allowable leakage for the entire piping.

All joints in piping shall be watertight and free from visible leaks during the leakage test. Each leak that is discovered within the correction period shall be repaired by and at the expense of Contractor regardless of the amount that the total leakage may have been below the specified allowable leakage rate during the leakage test.

If the leakage test indicates a higher than allowable leakage rate, Contractor shall locate and repair leaking joints and other defective work to the extent necessary to reduce the leakage to an acceptable value.

END OF SECTION 331116

EXHIBIT A

CONTRACTOR'S MATERIAL AND TEST CERTIFICATE FOR UNDERGROUND PIPING

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Contractor's Material and Test Certificate for Underground Piping

PROCEDURE

Upon completion of work, inspection and tests shall be made by the contractor's representative and witnessed by an owner's representative. All defects shall be corrected and system left in service before contractor's personnel finally leave the job.

A certificate shall be filled out and signed by both representatives. Copies shall be prepared for approving authorities, owners, contractor, and the State Fire Marshal. It is understood the owner's representative's signature in no way prejudices any claim against contractor for faulty material, poor workmanship, or failure to comply with approving authority's requirements or local ordinances.

Property Name			
Property Address		City	State Zip
PLANS	Accepted by approving authorities (names)		
	Address		
	Installation conforms to accepted plans ☐ Yes ☐ No		
	Equipment used is approved ☐ Yes ☐ No If no, state deviations		
INSTRUCTIONS	Has person in charge of fire equipment been instructed as to location of control valves and care and maintenance of this new equipment? ☐ Yes ☐ No If no, explain		
	Have copies of appropriate instructions and care and maintenance charts been left on premises? ☐ Yes ☐ No If no, explain		
LOCATION	Supplies buildings		
UNDERGROUND PIPES AND JOINTS	Pipe types and class	Type joints	
	Pipe conforms to _____ Standard	☐ Yes ☐ No	
	Fittings conform to _____ Standard	☐ Yes ☐ No	
	Joints needed anchorage clamped, strapped or blocked in accordance with _____ standard	☐ Yes ☐ No	
TEST DESCRIPTION	FLUSHING: Flow the required rate until water is clear as indicated by no collection of foreign material in burlap bags at outlets such as hydrants and blow-offs. Flush at flows not less than 390 GPM (1476 L/min) for 4-inch pipe, 880 GPM (3331 L/min) for 6-inch pipe, 1560 GPM (5905 L/min) for 8-inch pipe, 2440 GPM (9235 L/min) for 10-inch pipe, and 3520 GPM (13323 L/min) for 12-inch pipe. When supply cannot produce stipulated flow rates, obtain maximum available. HYDROSTATIC: Hydrostatic tests shall be made at not less than 200 psi (13.8 bars) for two hours or 50 psi (3.4 bars) above static pressure in excess of 150 psi (10.3 bars) for two hours. LEAKAGE: New pipe laid with rubber gasketed joints shall, if the workmanship is satisfactory, have little or no leakage at the joints. The amount of leakage at the joints shall not exceed 2 quarts per hour (1.89 L/hr) per 100 joints irrespective of pipe diameter. The leakage shall be distributed over all joints. If such leakage occurs at a few joints, the installation shall be considered unsatisfactory and necessary repairs made. The amount of allowable leakage specified above can be increased by 1 fl oz per inch valve diameter per hour (30 mL/25 mm/hr) for each metal seated valve isolating the test section. If dry barrel hydrants are tested with the main valve open so the hydrants are under pressure, an additional 5 oz per minute (150 mL/min) leakage is permitted for hydrant.		
FLUSHING TESTS	New underground piping flushed according to _____ standard by (company) ☐ Yes ☐ No If no, explain		
	How flushing flow was obtained ☐ Public water ☐ Tank or reservoir ☐ Fire pump	Through what type of opening ☐ Hydrant butt ☐ Open pipe	
	Lead-ins flushed according to _____ standard by (company) ☐ Yes ☐ No If no, explain		
	How flushing flow was obtained ☐ Public water ☐ Tank or reservoir ☐ Fire pump	Through what type of opening ☐ Y connection to flange spigot ☐ Open pipe	

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HYDROSTATIC TEST	All new underground piping hydrostatically tested at _____ psi for _____ hours		Joints covered ☐ Yes ☐ No	
LEAKAGE TEST	Total amount of leakage measured _____ gallons _____ hours			
	Allowable leakage _____ gallons _____ hours			
HYDRANTS	Number installed	Type and make	All operate satisfactorily ☐ Yes ☐ No	
CONTROL VALVES	Water control valves left wide open If no, state reason		☐ Yes ☐ No	
	Hose threads of fire department connections and hydrants interchangeable with those of the fire department answering alarm		☐ Yes ☐ No	
REMARKS	Date left in service _____ _____ _____			
Signature	Name of installing contractor			
	Contractor's Address		City	State Zip
	Tests witnessed by			
	For property owner (signed)		Title	Date
	For installing contractor (signed)		Title	Date

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Additional Explanation and Notes:

END OF SECTION

SECTION 331300 – CLEANING AND DISINFECTION OF WATER DISTRIBUTION SYSTEMS

PART 1 - GENERAL

1.1 SCOPE. This Section covers cleaning and disinfection of all potable water lines installed under this Contract.

1.2 GENERAL.

- A. Coordination. Contractor shall coordinate flushing and disinfection work with adjacent work as necessary to preclude work interferences or duplication of effort and to expedite the overall progress of the work.

Contractor shall provide all necessary piping, piping connections, temporary valves, backflow preventers, flow meters, sampling taps, pumps, disinfectant, neutralization agents, chlorine residual test apparatus, and all other items of equipment or facilities necessary to complete the disinfection work.

Water for flushing and disinfection work will be provided as stipulated in the Temporary Facilities section.

In all cases where it is necessary to interrupt service, permission of Owner shall be obtained at least two days before the service will be interrupted.

Unless otherwise specified, final cleaning work shall not be performed until after hydrostatic testing of the lines and any resulting repair work completed.

The Contractor shall notify the Engineer prior to the work to allow the Engineer to be present during cleaning and / or disinfection of the water lines.

- B. Related Work. Other sections directly related to Work covered in this section are:

331116 –Water Utility Piping

- C. Governing Standard. All disinfection work shall conform to the requirements of ANSI/AWWA C651. If any local requirements conflict with the provisions of this section, the local requirements shall govern.

1.3 SUBMITTALS.

- A. Cleaning and Disinfection Plan. Contractor shall submit a detailed cleaning and disinfection plan to Consultant 14 days prior to starting any cleaning and disinfection work. The plan shall cover the method and procedure proposed, necessary coordination, qualification of personnel performing the disinfection work, sequence of operations, the limits of the pipelines to be cleaned and disinfected, the positions of all valves, location of temporary bulkheads, materials and quantities of each to be used, equipment to be used, manner of filling and flushing the pipelines, chlorine injection points, sample points, bacteriological testing location and schedule, potable water source, method of metering the water if required, neutralization and disposal of wasted water, and all other methods and procedures to be followed in performing the cleaning

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and disinfection work.

- B. Testing. Bacteriological testing shall be performed by Contractor.

The chlorine residual test shall be performed by Contractor. The test log shall be made available to Consultant upon request and shall be provided to Consultant upon completion of all chlorine residual testing.

- C. Project Record Documents.

- a. Disinfection Report. Disinfection Report shall include:

1. Type and form of disinfectant used.
2. Date and time of disinfectant injection start and time of completion.
3. Test locations.
4. Initial and 24-hour disinfectant residuals (quantity in treated water) in ppm for each outlet tested.
5. Date and time of flushing start and completion.
6. Disinfectant residual after flushing in ppm for each outlet tested.

- b. Bacteriological, Chemical and Organic Chemical Report shall include:

1. Date issued, project name and testing laboratory name, address and telephone number.
2. Time and date of water sample collection.
3. Name of person collecting samples.
4. Test locations.
5. Initial and 24-hour disinfectant residuals in ppm.
6. Coliform bacteria and chemical test results.
7. Certification that water conforms or fails to conform to New York State drinking water standards.
8. Laboratory Director's signature and authority

- D. Qualifications.

- a. Water Treatment Firm: Company specializing in disinfecting potable water systems specified in this Section with minimum three (3) years experience.
- b. Testing Firm: Company specializing in testing potable water systems, approved by the New York State Department of Health.

1.4 QUALITY ASSURANCE.

- A. Chlorine Residual Tests. Contractor shall provide the necessary apparatus for making the chlorine residual tests by the drop dilution method as set forth in Appendix A of ANSI/AWWA C651. Test results shall be recorded in a logbook that includes for each test: the location, date, time, test results, and test kit manufacturer.
- B. Bacteriological Tests. Sampling and testing of water in the lines shall be performed after final flushing in accordance with Section 5 of ANSI/AWWA C651, including a standard heterotrophic plate count for each sample.
- C. Redisinfection. Should the bacteriological tests indicate the presence of coliform organisms at

any sampling point, the lines shall be reflushed, resampled and retested. If check samples show the presence of coliform organisms, then the lines shall be rechlorinated until acceptable results are obtained.

PART 2 - PRODUCTS

- 2.1 MATERIALS. All materials furnished by Contractor shall conform to the requirements of ANSI/AWWA C651 and shall be clean and free of debris that could infer questionable test results.
- A. Liquid Chlorine. Liquid chlorine shall conform to AWWA B301.
 - B. Calcium Hypochlorite (Dry). Calcium hypochlorite shall conform to AWWA B300.
 - C. Sodium Hypochlorite (Solution). Sodium hypochlorite shall conform to AWWA B300.
 - D. Chlorine Residual Test Kit. Chlorine, residual concentration shall be measured using an appropriate range, drop count, titration kit or an orthotolidine indicator comparator with wide range color discs. The color disc range shall be selected to match chlorine concentration limits. Test kits shall be maintained in good working order and available for immediate test of residuals at point of sampling. Test kits manufactured by Hach Chemical or Hellige are acceptable.

PART 3 - EXECUTION

3.1 APPLICATION.

- A. The plan for Water Main Cleaning and Disinfection shall be coordinated and approved by the Watertown District of New York State Department of Health, (NYS DOH). Concurrence and approval shall be received from the NYS DOH prior to putting any line in service.

Cleaning. Pipelines, including all associated valves and fittings, shall be cleaned to the satisfaction of the Consultant.

Small pipelines shall be cleaned by flushing with water at the maximum velocity which can be developed, but not less than 2.5 feet per second, unless otherwise permitted by Engineer. Flushing shall continue until the pipeline is free of dirt, debris, and other foreign materials. Cleaning shall precede disinfection.

Large pipelines may be flushed as specified for small pipelines, cleaned with a hose, or cleaned by other methods acceptable to Engineer. Flushing or other cleaning methods shall continue until the pipeline is free of dirt, debris, and other foreign materials. Cleaning shall precede disinfection.

Flushing shall be accomplished through the installed valves or fittings, blow-offs or through temporary flushing connections installed for that purpose.

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Booster pumps shall be used if needed to obtain the necessary volume or velocity of water. Pumping equipment installed under this Contract shall not be used for flushing, nor shall the flushing water be passed through them or other installed equipment; temporary bypass piping at each pump or installed equipment shall be provided as needed.

- B. Disinfection Procedure. The new pipelines shall be disinfected by the tablet method, continuous feed method, or slug method. Potable water shall be used in conjunction with the chlorination agent.

For the continuous feed or slug method, the chlorination agent shall be injected into the line at the supply end of each new line or valved section thereof.

Admission of disinfectant solution into or the flushing thereof through existing mains shall be held to the minimum possible, and then only after adequate measures have been taken to prevent any such solution of chlorinated wastewater from entering branch service connections to water customers.

During disinfection, all valves and hydrants shall be operated to ensure that all appurtenances are disinfected. Valves shall be operated such that the chlorine solution in the line being chlorinated will not flow back into the supply line. Check valves shall be used if needed.

Existing mains which may become contaminated during work requiring connections to the new water line, involving either tapping or cutting into operations, shall be flushed and disinfected in accordance with Section 4 of ANSI/AWWA C651.

- C. Final Flushing. Upon completion of chlorination, but before sampling and bacteriological testing, all heavily chlorinated water shall be removed from the lines by flushing with potable water until the chlorine residual in the lines is not higher than that generally prevailing in the adjacent existing system. Final flushing shall be accomplished as specified for cleaning of pipelines.
- D. Disposal of Chlorinated Wastewater. All chlorinated wastewater to be discharged shall be neutralized by chemical treatment and disposed in accordance with the requirements of the governing agency specified herein. Schedule and coordinate rates of flow and locations of discharge of disinfection and flushing water with Engineer and local regulatory agencies (Watertown District of the NYSDOH) to ensure compliance with all applicable rules and regulations.

END OF SECTION 331300

SECTION 333313 - SANITARY UTILITY SEWER PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Sanitary Sewer Pipe and fittings, including connections and testing.
 - 2. Cleanouts.
 - 3. Installation of sanitary sewer piping and related fittings.
- B. Related Sections:
 - 1. Division 31 Section "Earth Moving" for excavation, trenching, and backfilling requirements.
 - 2. Division 31 Section "Dewatering" for dewatering requirements.
 - 3. Division 32 Section "Aggregates for Earthwork" for aggregates for backfill around pipe.
 - 4. Division 33 Section 330500 "Common Work Results for Utilities".

1.2 DEFINITIONS

- A. HDPE: High density polyethylene plastic.
- B. PE: Polyethylene plastic.
- C. PVC: Polyvinyl chloride plastic

1.3 QUALITY ASSURANCE

- A. Required Tests:
 - a. After alignment tests have been completed, and before flows are allowed in the line, conduct leakage tests.
 - b. Test entire system for exfiltration in presence of Owner's Representative. Limit leakage to 100 gal. per inch of pipe dia. per mile of length per 24 hr.
 - c. Limit leakage to stated maximum limit, except that an allowance of an additional 10% of gallonage will be allowed for each additional 2 ft. of head over a basic 2 ft. minimum above all pipe soffits.
 - d. Contractor to pay for all leakage tests and required repairs and reconstruction.

1.4 SUBMITTALS

- A. Gravity Main Sewer Pipe: Provide Manufacturer's Certificate to certify that pipe and fittings have been inspected and tested at the point of origin, and are in compliance with specified requirements.
- B. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from storm drainage system piping.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Do not store plastic pipe, and fittings in direct sunlight.
- B. Protect pipe, pipe fittings, and seals from dirt and damage.
- C. Handle manholes according to manufacturer's written rigging instructions.

1.6 PROJECT CONDITIONS

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

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

- A. SDR 35 PVC Gravity Sewers: SDR 35 Polyvinyl chloride (PVC) pipe and fittings shall conform to ASTM D3034, SDR 35.
 - 1. Manufacture SDR 35 pipe from Type 1, Grade 1, PVC 12454-C conforming to ASTM D1784 and meeting requirements of ASTM D2122 and ASTM D2412.
 - 2. Pipe shall have integral wall thickened bells or extruded couplings with gasket seals. Solvent weld joints will not be permitted.
 - 3. Pipe joints shall be gasket push-on type (bell and spigot) complying with ASTM D3212 and ASTM F477.
 - 4. Pipe shall be UL/FM approved.
 - 5. Fittings shall conform to the same specifications as pipe in which they are to be installed.
- B. Cast Iron soil pipe and fittings for traps: Conform to ASTM A74, heavy duty weight bell and spigot pipe with the following acceptable gasket types:
 - 1. Dual Tite

2. Rich-Seal
3. Ty-Seal
4. Approved Equal

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground sanitary sewer piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
- B. Grade trench bottom to indicated elevation of pipeline and shape bottom of trench so that pipe will be uniformly supported along entire length of barrel.
- C. Pipe installation and jointing shall be in accord with pipe manufacturer's specifications and instructions for type of pipe used and applicable requirements specified herein. All pipe having a defective joint, bell, or spigot is unacceptable, shall be rejected, removed from site, and replaced with an acceptable unit.
- D. Install pipe to homing mark on spigot. On field cut pipe, provide a homing mark on spigot end in accord with manufacturer's recommendations.
- E. Maintain pipe alignment and joint closure until sufficient haunching and backfill is in place to adequately hold pipe in position.
- F. Prevent foreign materials from entering pipe while it is being placed in trench. Do not place debris, tools, articles of clothing, or other materials in pipe at any time.
- G. As each length of pipe is placed in trench, assemble joints and bring pipe to intended line and grade. Bed and secure pipe in place.
- H. When pipe laying is delayed for 10 min. or more, close open ends of pipe using a watertight plug or other approved means to ensure that absolute cleanliness is maintained inside pipe.
- I. At penetrations of manhole and similar structures, smoothly cut penetrating ends of pipe parallel to interior surface of structure. Maximum interior protrusion of pipe shall be the minimum necessary for proper sealing of pipe connection to structure. Use resilient connectors as indicated on the project drawings.
- J. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
- K. Install aggregate at sides and over top of pipe. Install top cover to minimum compacted thickness of 12 inches, compact to 95 percent, per ASTM D1557 (refer to Section 312000, "Earth Moving").

- L. Blocking will not be permitted under the pipe.
- M. No pipe shall be laid upon a foundation in which frost exists nor at any time when the Owner's Representative shall deem that there is danger of the formation of ice or the penetration of frost at the bottom of the excavation.
- N. Refer to Division 31 Section "Earth Moving" for backfilling and compacting requirements. Do not displace or damage pipe when compacting.
- O. Pipe Jointing: Install pipe, fittings, and accessories in accordance with ASTM D2321. Seal joints watertight. Pipe installation and jointing shall be in accord with pipe manufacturer's specifications and instructions for type of pipe used and applicable requirements specified herein.
- P. Ensure that interior of pipe and jointing seal is free of sand, dirt, trash, or other foreign materials before installation. All pipe or fitting that has been installed containing dirt or other deleterious material shall be removed, cleaned, and relaid. Extreme care shall be taken to keep bells of pipe free from sand, dirt, or rocks so that joints may be properly assembled without overstressing the bells.
- Q. Reconnect existing service laterals as they are encountered along the pipe run to be replaced. Lateral connection details are provided in the plans.

3.2 IDENTIFICATION

- A. Materials and their installation are specified in Division 33 Section "Utility Identification." Arrange for installation of warning tape directly over piping and at outside edge of underground sanitary structures.

3.3 FIELD QUALITY CONTROL

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
- B. Inspect gravity pipe for proper slope prior to backfill. Four inch diameter pipe shall have a minimum slope of 1/8 inch per foot.
 - 1. Submit separate reports for each system inspection.
 - 2. Defects requiring correction include the following:
 - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
 - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
 - c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
 - d. Infiltration: Water leakage into piping.
 - e. Exfiltration: Water leakage from or around piping. Refer to Part 1.3A of this Specification.

3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
 4. Reinspect and repeat procedure until results are satisfactory.
- C. Leaks and loss in test pressure constitute defects that must be repaired.
- D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.4 CLEANING

- A. Clean interior of piping of dirt and superfluous materials.

END OF SECTION 333313

SECTION 334100 - STORM UTILITY DRAINAGE PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Storm Drainage Pipe and fittings.
 - 2. Underdrain Piping.
 - 3. Reinforced Concrete Pipe for storm drains at limited cover locations.
- B. Related Sections:
 - 1. Division 31 Section "Earth Moving" for excavation, trenching, and backfilling requirements.
 - 2. Division 31 Section "Dewatering" for dewatering requirements.
 - 3. Division 31 Section "Aggregates for Earthwork" for aggregates for backfill around pipe.
 - 4. Division 33 Section 330500 "Common Work Results for Utilities".

1.2 DEFINITIONS

- A. HDPE: High density polyethylene plastic.
- B. PE: Polyethylene plastic.
- C. PVC: Polyvinyl chloride plastic
- D. SICPP: Smooth interior corrugated polyethylene pipe.
- E. RCP: Reinforced concrete pipe
- F. PCPUT: Perforated Corrugated Underdrain Tile

1.3 QUALITY ASSURANCE

- A. Perform work in accordance with the New York State Department of Transportation (NYSDOT) September 1, 2017 Standard Specifications:
 - 1. Section 603-3: Culverts and Storm Drains.
 - 2. Section 605-3: Underdrains.
- B. ASTM C91-89 Masonry Cement.
- C. ASTM C62-89a Building Brick.
- D. ASTM A48-83 (Reapproved 1990) - Gray Iron Castings.

1.4 SUBMITTALS

- A. Provide manufacturers data for each type of pipe specified.
- B. Manufacturer's Certificate: Certify that the HDPE pipe (SICPP) products meet or exceed AASHTO M294 requirements.
- C. Manufacturer's Certificate: Certify that the PVC pipe products meet or exceed AASHTO M278 requirements.
- D. Manufacturer's Certificate: Certify that the RCP pipe products meet or exceed AASHTO M 170 requirements for class II, III, IV, and V reinforced concrete pipe.
- E. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from storm drainage system piping.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Do not store plastic pipe, and fittings in direct sunlight.
- B. Protect pipe, pipe fittings, and seals from dirt and damage.
- C. Handle manholes according to manufacturer's written rigging instructions.

1.6 PROJECT CONDITIONS

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

PART 2 - PRODUCTS

2.1 PE PIPE AND FITTINGS

- A. Corrugated PE Drainage Pipe and Fittings 4" to 6" diameter (PCPUT Underdrain): AASHTO M 252M, Type S, with smooth waterway for coupling joints.
 - 1. Soiltight Couplings: AASHTO M 252M, corrugated, matching tube and fittings.
 - 2. Perforated corrugated polyethylene underdrain tubing and fittings: AASHTO M252, inside nominal diameter as shown on the drawings (4" and 6").

2.2 Perforated PVC PIPE AND FITTINGS

- A. Smooth walled PVC plastic pipe, fittings, and couplings, 4" and 6" diameter, for use as an underdrain outlet pipe, (when outletting to daylight). PVC underdrain outlet pipe, couplings, and fittings shall conform to AASHTO M278 Class PS46.

2.3 HDPE PIPE AND FITTINGS

- A. Storm Drainage Piping (typical for storm sewer pipe, 12" diameter and up):
 - 1. HDPE (High Density Polyethylene) Corrugated Plastic Pipe: Smooth Interior Corrugated Polyethylene Pipe: Conform to ASTM D3350 (poly pipe material), and ASTM F 405; inside nominal diameter of as shown on the Drawings, bell and spigot style rubber ring sealed gasket joint.
 - a. Fittings: HDPE
 - b. Standard Joints: ASTM F477, elastomeric gaskets.
 - c. Silt tight Joints: Pipes installed in areas where silt tight joints are specified on the drawings shall be watertight according to the requirements of ASTM D3212. Gaskets shall meet the requirements of ASTM F477. Gaskets shall be installed by the pipe manufacturer and covered with a removeable, protective wrap to ensure the gasket is free from debris. A joint lubricant per the manufacturer shall be used on the gasket during assembly. (HDPE Pipe with silt tight joints: Hancor Bue Seal or approved equal).

2.4 NONPRESSURE TRANSITION COUPLINGS

- A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.
- B. Sleeve Materials:
 - 1. For Concrete Pipes: ASTM C 443, rubber.
 - 2. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

2.5 REINFORCED CONCRETE PIPE AND END SECTIONS

- A. At Locations explicitly noted on the plans. Meet Requirements of ASTM C76, plain end, and AASHTO M 170, Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe. Reinforced Concrete Pipe shall have bell and spigot type ends, with flexible water-tight elastomeric gaskets.
- B. Determine class of pipe by depth of cover over pipe at rough graded elevations as follows:
 - 1. Less than 2 feet of cover over pipe = Class V Pipe
 - 2. 2 feet to 3 feet of cover over pipe = Class IV Pipe
 - 3. 3 feet to 6 feet of cover over pipe = Class III Pipe

- 4. Over 6 feet of cover over pipe = Class II Pipe
- C. Reinforced Concrete End Sections shall be supplied as per the details shown on the project drawings.

2.6 GALVANIZED STEEL END SECTIONS FOR HDPE STORM PIPE

- A. Galvanized Steel End Sections shall be manufactured from material meeting the requirements of AASHTO M218. The end section units shall conform to the shape, dimensions, and thickness shown on NYSDOT Standard Sheet 603-02. (Pipe diameter is based on the outside diameter of the HDPE pipe). Galvanized Steel End Sections shall be installed at locations where HDPE storm culvert pipes outlet to daylight.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
- C. Install pipe, fittings, and accessories in accordance with ASTM D2321. Seal joints watertight.
Lay pipe to slope gradients noted on drawings with maximum variation from indicated slope of 1/8 inch in 10 feet. The grade and alignment of each pipe shall be determined and maintained by the use of an approved laser system or approved batter boards (over the trench or parallel lines).
- D. The laser system shall be operated according to the manufacturer's recommendations and safety standards. The line and grade of the laser shall be checked at not more than 50-feet away from the starting point and then periodically throughout the course of the working day. Any variation from the line and grade shall be immediately reported to the Owner's Representative.
- E. Install aggregate at sides and over top of pipe. Install top cover to minimum compacted thickness of 12 inches, compact to 95 percent, as per ASTM D1557 (refer to Section 312000 "Earth Moving").
- F. Blocking will not be permitted under the pipe.

- G. No pipe shall be laid upon a foundation in which frost exists nor at any time when the Owner's Representative shall deem that there is danger of the formation of ice or the penetration of frost at the bottom of the excavation.
- H. Refer to Division 31 Section "Earth Moving" for backfilling and compacting requirements. Do not displace or damage pipe when compacting.

3.2 CONNECTIONS

- A. Make connections to existing underground manholes or drainage structures.
 - 1. When required, connection to existing storm sewers shall be made by connecting to the existing drainage structure without disturbing the existing storm sewer. The opening for the new pipe shall be core drilled or by a method approved by the Owner's Representative. The new pipe is to be placed at invert shown on the plans. Opening for pipe to be water tight.
 - 2. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

3.3 IDENTIFICATION

- A. Materials and their installation are specified in Division 33 Section 330526 "Utility Identification". Arrange for installation of warning tape directly over piping and at outside edge of underground storm sewer structures.
 - 1. Install Drainage Outlet Markers (as described in Section 330526) at the end section outlets of proposed culvert pipes.

3.4 FIELD QUALITY CONTROL

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
 - 1. Submit separate reports for each system inspection.
 - 2. Defects requiring correction include the following:
 - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
 - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
 - c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
 - d. Infiltration: Water leakage into piping.
 - e. Exfiltration: Water leakage from or around piping. The total leakage of any section tested shall not exceed the rate of 100 gallons per mile of pipe per 24 hours per inch of nominal pipe diameter; plus leakage allowance for manholes included in the test section. Sewer sections that fail test shall be repaired prior to retesting. A period of not less than 24 hours shall be maintained between draining of line for repair and refilling of pipeline for retesting.

3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
 4. Reinspect and repeat procedure until results are satisfactory.
- B. Leaks and loss in test pressure constitute defects that must be repaired.
- C. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.5 CLEANING

- A. Clean interior of piping of dirt and superfluous materials.

END OF SECTION 334100

SECTION 334413 – PRECAST CONCRETE MANHOLES AND CATCH BASINS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Precast Concrete Manholes for Sanitary or Storm Sewer Systems.
 - 2. Precast Concrete Catch Basins.
- B. Related Sections:
 - 1. Division 31 Section "Earth Moving" for excavation, trenching, and backfilling requirements.
 - 2. Division 31 Section "Dewatering" for dewatering requirements.

1.2 DEFINITIONS

- A. FRP: Fiberglass-reinforced plastic.
- B. HDPE: High density polyethylene plastic.
- C. PE: Polyethylene plastic.
- D. PVC: Polyvinyl chloride plastic
- E. SICPP: Smooth interior corrugated polyethylene pipe.

1.3 QUALITY ASSURANCE

- A. Perform work in accordance with the New York State Department of Transportation (NYSDOT) September 1, 2017 Standard Specifications:
 - 1. Section 604: Drainage Structures.
 - 2. Section 655: Frames, Grates and Covers.
- B. NYSDOT Standard Sheets: 604-01, 604-02, 655-03, and 655-04.
- C. ASTM C91-89 Masonry Cement.
- D. ASTM A48-83 (Reapproved 1990) - Gray Iron Castings.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. Manholes: Include plans, elevations, sections, details, frames, and covers.

2. Catch basins, stormwater inlets, and dry wells: Include plans, elevations, sections, details, frames, covers, and grates.
- B. Field quality-control reports.
- C. Manufacturers: Manufacturers of Precast Drainage Structures and Manholes shall appear on the NYSDOT Approved List of Precast Concrete Manufacturers for QA/QC Production (Group 2, Drainage Units). Acceptable manufacturers for precast reinforced concrete manholes and Drainage Structures include but are not limited to:
1. The Fort Miller Co., Inc.
 2. Lakelands Precast, Inc
 3. Binghamton Precast & Supply
 4. Kistner Concrete Products

Acceptable manufacturers for castings and manhole steps shall appear on the NYSDOT Approved List and include but are not limited to:

1. Neenah Foundry Co.
2. East Jordan Iron Works (formerly Syracuse Castings Sale Corp.)
3. Campbell Foundry Co.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Do not store plastic pipe, and fittings in direct sunlight.
- B. Protect pipe, pipe fittings, and seals from dirt and damage.
- C. Handle manholes according to manufacturer's written rigging instructions.
- D. Handle catch basins and stormwater inlets according to manufacturer's written rigging instructions.

1.6 PROJECT CONDITIONS

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

PART 2 - PRODUCTS

2.1 MANHOLES

- A. Standard Precast Concrete Manholes shall appear on the NYSDOT Approved List of Precast Concrete Manufacturers for QA/QC Production (Group 2, Drainage Units):
1. Description: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
 2. Diameter: 48 inches minimum unless otherwise indicated.
 3. Ballast: Increase thickness of precast concrete sections or add concrete to base section as required to prevent flotation.
 4. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
 5. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover, and height as required to adjust manhole frame and cover to indicated elevation and slope.
 6. At the option of the Contractor, precast reinforced concrete manhole sections may be constructed on poured-in-place concrete slab foundations with thickness and reinforcing equal to or exceeding that as designated in ASTM C478. Design drawings and calculations regarding poured-in-place manhole foundations shall be submitted to the Owner's Representative.
 7. Precast concrete manhole sections shall fit together readily and unless specifically noted, the connections shall be jointed with self-contained "O" ring gaskets. The inside and outside of the joint shall be grouted with an approved non-shrink grout.
 8. Top sections shall have a surface suitable to receive concrete brick masonry or precast adjusting rings.
- B. Brick Manholes and Storm Water Structures:
1. Masonry for manholes and storm water structures shall include all manhole and inlet structures of common brick and cement mortar, brick courses for vaults or concrete or precast concrete manholes where required to bring the frames and covers to grade and the building in of metal castings, pipes, sleeves and other items required in the work complete as shown, specified and directed. All common brick shall be ASTM Des:C62, Grade SW. There shall be at least two brick courses provided for all concrete or precast concrete pipe manholes and vaults.
 2. Mortars shall be mixed in the proportions that follow:
 - a. 1 sack of masonry cement (94 pounds)
 - b. 3 cubic feet of dry sand (240 pounds)
 3. Masonry cement shall be Brixment, Huron, Alpha or equal, ASTM Des: C91, Type II.
 4. Sand shall be of graded quality conforming to the requirements of ASTM Des:C144. Water shall be clean, potable water, free from injurious or deleterious materials.
 5. All bricks shall be of the best quality, hard burned brick, shall be whole, sound, straight, hard, uniform in structure with true faces and shall be of standard size.
 6. Bricks shall be sampled and tested for absorption in accordance with ASTM Des: C67. Absorption shall not exceed 9 percent. Tests shall be at an independent testing laboratory and all tests shall be at the expense of the Contractor. Certified test reports shall be furnished to the Owner's Representative.

7. The bricks shall be culled and sorted when delivered upon the ground by experienced men furnished by the Contractor and all bricks condemned shall be immediately removed from the site of the work.
8. The bricks shall be laid in mortar of a kind and quality specified above. They shall be laid with a shove joint and all spaces between bricks shall be solidly and completely filled with mortar. The bricks shall be laid to a line with the bed in the line of the radii of the curves and with close joints not exceeding 1/4-inch. Bricks shall be thoroughly moistened before laying. Each brick shall be completely bedded in mortar at its bottom side and end at one operation. Joints on face work shall be struck and neatly pointed. Care shall be taken to have the interior surface smooth and regular. Competent masons shall be employed for this work.
9. No masonry shall be erected when the temperature has dropped below 45 degrees F, unless it is rising and at no time when it has dropped below 40 degrees F except by permission of the Owner's Representative. When masonry work is permitted below 40 degrees F, provisions shall be made for heating and drying the materials and the completed work shall be protected in accordance with the Structural Clay Products Technical Institute Notes, Volume I, No. 1. Masonry shall not be laid with ice or frost on its surface and no masonry shall be laid on frozen work. Any work which freezes before the mortar has set shall be removed and replaced at the Contractor's own expense.
10. Unfinished work shall be stepped back for jointing new work and no toothing shall be permitted unless specifically approved. Before new work is started, loose mortar shall be removed to expose the joint and shall be thoroughly wetted 12 hours before laying the new work.
11. The inside and outside face of the brick work of each manhole shall be neatly plastered with mortar not less than 3/8-inch thick, of the quality above-specified and trowelled smooth.
12. The Contractor shall provide all necessary forms and centers required for laying brick masonry. They shall be true to the required curves, shapes, and sizes, strong enough to withstand all operations incidental to the placing of the brick work and the face against which the work is to be laid shall be satisfactorily smooth and clean.
13. Directions as to the time of removing forms and centers shall be strictly followed and the removing shall be done with great care so as to avoid injury to the work.
14. All fresh work shall be protected from injury of all kinds and any injured work shall be made good by the Contractor in a manner satisfactory to the Owner's Representative. All new work, unless immediately covered with earth, shall be kept moist until the mortar has become hard and will not crack in the sun.

C. Manhole Frames, Grates and Covers:

1. Manhole frames and covers, grates, inlets, steps and other castings shall be in accordance with the NYSDOT Approved List of Precast Concrete Manufacturers for QA/QC Production (Group 2, Drainage Units). Where required, manhole covers shall have the word "Storm Sewer", "Sanitary Sewer" or other appropriate designation cast as shown on the Contract Drawings. Sizes and types of frames, grates, and covers are identified on the Project Plans,
2. All castings for manhole frames and covers shall each have machined bearing surfaces.

2.2 DAMPPROOFING

- A. Manholes shall have dampproofing. The dampproofing shall be Hydrocide 648 by Sonneborn Building Products; Dehydratine 4 by A.C. Horn Inc.; Meadows Trowel Mastic (Type 3) or equal.

2.3 CONCRETE

- A. Refer to Division 03 Section “Cast-in-Place Concrete” for information regarding concrete properties, mixes, placement, and curing.

2.4 CATCH BASINS

- A. Shall meet the requirements for the sizes shown on the project plans.

2.5 DRAINAGE STRUCTURE COVERS AND GRATES

- A. Shall be of good quality, designed for H-20 traffic loading. Manufactured by East Jordan Iron Works, as specified on the project plans, or approved equal. Catch Basin Grates that are installed in walkway areas shall be ADA approved, with heel-proof openings.

PART 3 - EXECUTION

3.1 PRECAST MANHOLE AND CATCHBASIN INSTALLATION

- A. Excavation and Backfill:
 - 1. Excavate for manholes and drainage structures in accordance with Division 31 Section "Earth Moving" in location and to depth shown. Provide clearance around sidewalls of structure for construction operations.
 - 2. If groundwater is encountered, prevent accumulation of water in excavations in accordance with Division 31 Section "Dewatering". Place drainage structures in dry trench.
 - 3. Where possibility exists of watertight structure becoming buoyant in flooded excavation, anchor structure to avoid flotation.
 - 4. Backfill excavations for manholes and drainage structures in accordance with Division 31 Section "Earth Moving."
- B. Install manholes and drainage structures supported at proper grade and as shown on Drawings.
- C. Form and place manhole and drainage structures cylinder plumb and level, to correct dimensions and elevations. As Work progresses, install cast frames for fabricated grates (drainage structures) and covers (manholes).
- D. Cut and fit for pipe.
- E. Grout base of shaft sections to achieve slope to exit piping. Trowel smooth. Contour as indicated on Drawings.

- F. Lift precast components at lifting points designated by manufacturer.
- G. When lowering manholes and drainage structures into excavations and joining pipe to units, take precautions to ensure interior of pipeline and structure remains clean.
- H. Set precast structures bearing firmly and fully on crushed stone bedding (Type A1 subbase), compacted in accordance with provisions of Division 32 Section “Aggregate for Earthwork” (Section 310516) or on other support system shown on Drawings.
- I. Assemble multi-section structures by lowering each section into excavation. Lower, set level, and firmly position base section before placing additional sections.
- J. Remove foreign materials from joint surfaces and verify sealing materials are placed properly. Maintain alignment between sections by using guide devices affixed to lower section.
- K. Joint sealing materials may be installed on site or at manufacturer’s plant.
- L. Verify manholes and drainage structures installed satisfy required alignment and grade.
- M. Remove knockouts or cut structure to receive piping without creating openings larger than required to receive pipe. Fill annular space with mortar.
- N. Shape inverts through manhole and drainage structures as shown on Drawings. Install sumps as shown on the drawings.
- O. Dampproofing: Outer surfaces of precast and cast-in-place manholes and structures below finished grade shall be given two coats of bituminous dampproofing at the rate of 30 to 60 sq ft per gallon as directed by the Owner’s Representative and in accordance with manufacturer’s instructions.

3.2 FRAME AND COVER INSTALLATION

- A. Set cover frames and covers level without tipping, to correct elevations, using mortar and masonry. Install radially laid concrete brick with 1/4 inch thick vertical joints at inside perimeter. Lay concrete brick in full bed of mortar and completely fill joints. Where more than one course of concrete brick is required, stagger vertical joints.
- B. All structures shall be constructed as shown on the applicable detail sheets of the Contract Drawings, including formed bench walls and troughs, steps where specified, base, walls and top sections either concentric cone, eccentric cone or flat slab, adjusting rings of brick or precast sections and frames and covers and/or inlet grates as specified.
- C. The Contractor shall, at his own cost and expense, reset any and all manhole frames and covers and/or inlet grates as required to meet the finish grade of pavements replaced by the Contractor as specified herein.
- D. Frames and covers shall be thoroughly cleaned. Where the shop coating has become damaged it shall be spot coated with Bitumastic. The frame shall be set in a full bed of mortar. If masonry courses are required to bring the frame to grade, the top course shall have a flat, level surface to receive the frame.

- E. Invert channels where required shall be as shown on the Contract Drawings smooth with semi-circular bottom conforming to the inside of the adjacent sewer section. Changes in direction of flow shall be made with a smooth curve of as large a radius as the size of the manhole will permit. The invert channels may be formed directly in the concrete of the manhole base or be built up with brick and mortar to be a part of the precast base. The floor of the manhole outside the channels shall be smooth and shall slope toward the channels as shown on the Contract Drawings. Channel bottoms shall be sloped as necessary to prevent any free drop inside the manhole, except when drop manholes are used.
- F. Set cover frames and covers level without tipping, to correct elevations.

3.3 FIELD QUALITY CONTROL

- A. Inspect interior of structure to determine any damage that needs to be repaired and for leakage. Inspect after approximately backfill is in place, and again at completion of Project. Reinspect and repeat procedure until results are satisfactory.

3.4 LEAKAGE TESTS

- A. Leakage tests shall be made and observed by the Owner's Representative on each manhole or structure. The test shall be the exfiltration test made as described in this Specification.
- B. No adjustment in the leakage allowance will be made for unknown causes such as leaking plugs, absorptions, etc, i.e. it will be assumed that all loss of water during the test is a result of leaks through the joints or through the concrete. Furthermore, take any steps necessary to assure the Owner's Representative that the water table is below the bottom of the manhole throughout the test.
- C. If the groundwater table is above the highest joint in the manhole, and if there is no leakage into the manhole as determined by the Owner's Representative, such a test can be used to evaluate the water-tightness of the manhole. However, if the Owner's Representative is not satisfied, lower the water table and carry out the test as described herein.
- D. Leakage Tests for Structures: The Owner's Representative will visually inspect structure(s) for possible leaks before backfilling of structures is allowed. All joints shall be sealed to the satisfaction of the Owner's Representative. The Owner's Representative may require an exfiltration test as described for manholes on any structure for which he/she deems the test appropriate.
- E. The equivalent leakage allowance shall be 4.5 gallons per manhole per 24 hours for 48-inch diameter manholes, and shall be 5.7 gallons per manhole per 24 hours for 60-inch and above diameter manholes.

3.5 CLEANING

- A. All new manholes shall be thoroughly cleaned of all silt, debris and foreign matter of any kind, prior to final inspection.

3.6 FIELD QUALITY CONTROL

Inspect interior of structure to determine any damage that needs to be repaired and for leakage. Inspect after approximately backfill is in place, and again at completion of Project. Reinspect and repeat procedure until results are satisfactory.

END OF SECTION 334413

SECTION 340133 - MAINTENANCE AND PROTECTION OF TRAFFIC

PART 1 GENERAL

1.1 SUMMARY

- A. Maintenance and Protection of Traffic shall consist of all work necessary to provide for the safe and efficient movement of traffic through or around work zones, and to protect workers, area vehicle operators, property, and pedestrians from damage to person and property which may result, directly or indirectly, from any construction operations. Maintenance and Protection of Traffic shall be completed under the direction of a trained, competent person, as shown in the contract documents, and this Specification.
- B. Maintenance and Protection of Traffic is required at all work zones where vehicle operators and pedestrians are within 75 ft of the work area. This includes but is not limited to construction areas within the Town of Lowville right-of way.
- C. The duration of this work shall be from the date any work is started on the contract site, including mobilization of equipment, signs, and offices, until the date of contract final acceptance. Temporary materials and components that are furnished by the Contractor shall remain the property of the Contractor. This includes any temporary fence, signs, road cones, construction barricades, barrels, lights, and Heavy Duty Equipment Ground Mats.

1.2 REFERENCES

- A. Town of Lowville: Permit and Requirements for working in the Town right-of-way.
- B. New York State Department of Transportation (NYSDOT):
 - 1. Standard Specifications, May 1, 2018 – Section 619 (Work Zone Traffic Control); and Section 729 (Materials).
 - 2. Standard Sheets, 619-10, 619-11, 619-20, and 619-60.
- C. The 2009 Federal Manual of Uniform Traffic Control Devices (NMUTCD) and the New York State Supplement.

1.3 SUBMITTALS

- A. Shop Drawings: Indicate layout, of Work Zone Setups along roadways, site entrances, and parking lot intersections.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with NYSDOT May 1, 2018 Standard Specifications, Section 619.
- B. Use traffic control delineation devices meet the material requirements of NYSDOT Section 619.

- C. The Contractor shall designate a work zone traffic control competent person who has the primary responsibility and sufficient authority for implementing the work zone traffic control plan and other safety and mobility aspects as necessary. The Contractor's work zone traffic control competent person shall be appropriately experienced and adequately trained in traffic control operations by recognized training programs, including the American Traffic Safety Services Association (ATSSA), the National Safety Council, unions, or construction industry associations, or by an individual instructor from such a program in accordance with the level of decisions that the individual will be required to make, reflecting current industry practices.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Furnish materials in accordance with NYSDOT, Section 619 of the May 1, 2018 NYSDOT Standard Specifications. This includes construction barricades (Type II and Type III), temporary concrete barrier, road cones, warning lights, and construction barrels (drums).
- B. Temporary Fence and Temporary Gates:
 - 1. Fabric: The fabric shall be woven with a 9 gauge aluminum-coated steel wire in a 2-inch mesh and shall meet the requirements of ASTM A491.
 - 2. Posts, Rails, and Braces: Posts, rails and braces furnished for use in conjunction with aluminum-coated steel fabric shall be of acrylic-coated steel pipe. Posts, rails, and braces shall be continuous without splices.
 - a. Line posts, rails and braces shall be acrylic-coated steel pipe conforming to the requirements of Federal Specification RR-F-191/3, for Class I Steel Pipe, Grade B.
 - b. Federal Specification RR-F-191/3 specifies a zinc coating weight of not less than 1.0 ounces per square foot for Grade B pipe with an external chromate coating of 30 micrograms per square inch and an acrylic coating of 0.0005 inches or greater.
 - c. The dimensions of the posts, rails and braces shall be in accordance with Tables I through VI of Federal Specification RR-F-191/3.
 - 3. GATES
Acrylic-coated steel gates. Gate frames shall consist of acrylic-coated steel pipe. At the Contractor's option, the Gate frames can be Galvanized coated steel. The fabric shall be of the same type material as used in the fence.

PART 3 EXECUTION

3.1 BASIC WORK ZONE TRAFFIC CONTROL

- A. Work shall consist of controlling vehicle, bicycle, and pedestrian traffic over a reasonably smooth traveled way which shall be marked by signs, delineators, channelizing devices, pavement markings, and other devices as shown in the contract documents or as directed by the Owners Representative. Work after sunset and before sunrise shall include additional requirements for nighttime operations including, but not limited to, a written plan for nighttime operations, additional worker and equipment protection, additional channelizing devices and contract site patrol. The Contractor shall conduct its operations to ensure the safety and convenience of travelers as well as the safety of all workers on the contract.
- B. Travelers include, but may not be limited to motorists (cars, heavy trucks, tractor trailers), agricultural equipment, and pedestrians. Work shall be scheduled to keep the time and distance that existing pavement is removed or substantially disturbed to a minimum and consistent with the physical requirements of the contract. Unless otherwise indicated in the contract documents, the distance over which traffic is maintained on an unpaved surface shall not exceed 200 ft at any one time. During seasonal shutdown periods, no part of the roadway shall be closed to traffic unless provided for in the contract documents.
- C. Basic work zone traffic control shall include the following:
 - 1. Maintaining the surface condition of the traveled way so that it is free of debris and dust, maintaining positive drainage.
 - 2. Maintaining the traveled way to facilitate safe, efficient travel and permit snow and ice control by others during winter months and during any period that work is suspended.
 - 3. Maintain existing road signs, markers, and temporary construction fencing.
 - 4. Installing, moving, and maintaining construction signs.
 - 5. Providing Flaggers as needed when necessary to provide adequate traffic control.
 - 6. Providing and installing pavement patching materials as needed to keep the pavement maintained for traffic.
 - 7. Installing road plates as necessary when excavations next to traffic need to be left open at the end of a workday.

3.2 MAINTAINING TRAVELED WAY

- A. The Contractor shall generally maintain a traveled way suitable for moving traffic, in accordance with the contract documents and ensure construction equipment, vehicles, and materials are safely stored during non-working hours so as not to constitute a hazard to vehicles and pedestrians. Construction operations shall be conducted to ensure a minimum of delay to traffic. Stopping traffic for more than 5 minutes shall not be permitted unless specifically authorized in the contract documents or in writing by the Owner's Representative. All operations shall be carried out in a manner that provides workers with safe access to the worksite and protects workers from moving traffic. The work zone traffic control competent person shall routinely inspect all work zone traffic control equipment and devices.
- B. If necessary, lane closures shall be manned with a minimum of two Flaggers. Flaggers shall be able to communicate with radio equipment, and utilize "STOP" and "SLOW"

paddles. If approved by the Town of Lowville, the Contractor may utilize Portable Traffic Signals, meeting the requirements of Section 729-20 of the NYSDOT 2018 Standard Specifications.

- C. Mailboxes: If it is determined that a mailbox is in conflict with work operations, that Contractor shall notify the Owner's Representative. The Contractor shall not move any mailbox which contains mail. The Contractor will advise the owner to remove mail before the box is moved. Mailboxes shall be mounted, either permanently or temporarily, on a post. Before acceptance of the work, any mailbox which has been disturbed or moved shall be restored by the Contractor at a location consistent with the requirements of the U.S. Postal Service and the contract documents.

3.3 PAVEMENT EDGE DROP-OFF PROTECTION

- A. A drop-off is an abrupt difference in surface elevation of more than 2 inches at approximately 1V:3H or steeper.
- B. The Contractor shall provide pavement edge drop-off protection in accordance with Drums (Barrels) spaced at 40 ft, or other approved channelizing devices. Channelizing devices used to mark drop-offs shall be placed, as practicable, to not reduce the available travel lane width, at the elevation of the open travel lane in order to provide maximum target value and visibility for motorists. A drop-off of greater than 24 inches within 10 feet from the edge of the traveled way that is 100 feet or less in length will be allowed with channelizing devices consisting of drums, extra tall cones or oversized vertical panels only at a maximum spacing of 20 feet for short durations not to exceed one work shift. Unless otherwise noted in the contract documents, the Contractor shall begin work to eliminate unprotected drop-offs created by contract work within 7 calendar days of the completion of the work creating the drop-off. Work shall continue in a timely manner until such time as the unprotected drop-off condition is eliminated.

3.4 PLACEMENT OF TYPE III CONSTRUCTION BARRICADES

- A. Type III construction barricades shall be installed at all locations where a segment of the roadway or sidewalk is closed to traffic. Type III construction barricades shall be maintained upright, in proper alignment and orientation. If ballast is used to maintain alignment and position of the barricade, it shall consist of dry sand contained in a closed waterproof bag, and shall be placed at ground level. Barricade rails shall be oriented such that the stripes slope downward toward the side on which traffic is to pass. If traffic may pass to either side, adjacent barricades shall be arranged such that the stripes slope downward toward each side starting at the center. Where no passage is intended or permitted, the stripes shall slope downward toward the center of the barricade or barricades.
- B. At night, each Type III construction barricade used to close a roadway, a segment of a roadway or a sidewalk shall be equipped with one flashing warning light.

3.5 PLACEMENT OF TEMPORARY FENCE

- A. Temporary fence posts shall be installed directly in the ground as shown on the details in the Plans. Contractor has an option to install temporary fence into temporary concrete barrier, as approved by the Engineer. Care shall be maintained by the Contractor to not disturb existing utilities. As shown in the Temporary Fence Details, short duration Temporary Fence may utilize a stockade base with 6' high sections, as approved by the Engineer. The wire fabric shall be firmly attached to the posts and braced in the manner shown on the Plans. All wire shall be stretched taut and shall be installed to the required elevations. The fence shall generally follow the contour of the ground, with the bottom of the fence fabric no less than 1 inch or more than 4 inches from the ground surface. Grading shall be performed where necessary to provide a neat appearance.
- B. It is the Contractor's responsibility mow grass that is within the limits of the temporary fence. Grass height shall not exceed four inches.

3.6 COORDINATION WITH THE TOWN OF LOWVILLE

- A. A portion of the Project involves work within the Town of Lowville Right-of-Way (East Road). Contractor shall coordinate with the Town of Lowville Highway Department a minimum of 5 business days prior to performing work within the right-of-way. In addition to the previously noted Work Zone Protection Requirements that are noted in this Specification, the Contractor shall also make arrangements such that access to driveways and residences along East Road are maintained during the Project.

3.7 COORDINATION WITH THE RAILROAD CROSSING

- A. A portion of this Project includes the cased underground utility crossing the roadway (East Road) and Railroad using jack and bore techniques. For the anticipated duration of work in which the jack and bore process is active, if it not possible to maintain a single lane of traffic through the work area, the Contractor shall coordinate with the Owner and Town of Lowville to provide a signed off-site detour.
- B. In addition to meet the requirements of the Railroad as noted in Section 317001, the Contractor shall also meet the Town of Lowville requirements, providing at least 15 business day advance notice to the Town of Lowville Highway Superintendent prior to starting any of the Railroad jack and bore operations for cased utility crossings.
- C. The off-site detour signage shall include two Portable Variable Message Signs (PVMS), meeting the requirements of Section 729-16, for a "Standard Size" PVMS, (8 characters per line, up to 18" high characters when three lines displayed). PVMS signs shall be visible from 800 ft during the day and 600 ft during the night. Note that PVMS are intended to supplement other traffic control devices by displaying symbolic or word messages, but are not to be used alone to replace conventional traffic control device.

- D. The nature of the Railroad Crossing Work is expected to entail require Nighttime Operations by the Contractor. The Contractor shall meet the following additional requirements for work zone traffic control during nighttime operations.
- a. Nighttime Operations and Lighting Plan. Fifteen working days prior to the start of nighttime operations, the Contractor shall submit a written Nighttime Operations and Lighting Plan to the Owner and Town of Lowville for approval. The plan shall detail all aspects of the traffic control setup, the functions, responsibilities and identities of the nighttime traffic control competent person and other details as necessary. It shall include a contingency plan identifying foreseeable problems and emergencies that may arise, and the approach that will be used to address them. This plan shall be revised and updated by the Contractor as necessary during the progress of the work to accommodate conditions on the contract. The Contractor shall submit a Nighttime Operations and Lighting Plan to the Owner, at a scale and printed size similar to the contract plans and appropriate to adequately describe the work, including the following:
- Layout showing location of light towers, including typical spacing, lateral placement and mounting height, and clearly show the location of all lights necessary for all work to be done at night.
 - Description of light towers to be used and electrical power source.
 - Specific technical details on all lighting equipment, including brand names, model numbers, power rating and photometric data.
 - Details of any hoods, louvers, shields or other means to be used to control glare.
 - Attachment and mounting details for lights to be attached to equipment.
 - Lighting calculations confirming that the illumination requirements will be met by the layout.
- The Contractor shall maintain a supply of emergency flares for use in the event of unanticipated situations such as traffic accidents, equipment breakdowns, failure of lighting equipment, etc.
- b. Lighting for Nighttime Operations. Prior to the first night of nighttime operations, the Contractor shall set up and operate the lighting equipment at night as a trial run to demonstrate its ability to establish a safe, properly illuminated, nighttime operation. The Contractor shall furnish the Engineer with a photometer, capable of measuring the level of illumination, for use as necessary to check the adequacy of illumination throughout nighttime operations.
- c. Existing street and highway lighting shall not eliminate the need for the Contractor to provide lighting. Consideration will be given to the amount of illumination provided by existing lights in determining the wattage and/or quantity of lights to be provided. Such consideration shall be presented in the Contractor's lighting plan. In the event of any failure of the lighting system, nighttime operation(s) shall be discontinued until the required level of illumination is restored.
- d. Expectations for Nighttime Illumination Levels are outlined below:

- Level I (5 foot-candles). Level I illumination shall be provided for all areas of general construction operations to include all work operations by Contractors personnel, including work zone traffic control set-up and operations, staging, excavation, cleaning and sweeping, pavement marking, spoil disposal, landscaping, planting and seeding, layout and measurements ahead of the actual work, borrow areas, spoil areas, and truck cleanout areas. Level I illumination shall be provided near the beginning of lane closure tapers and at road closures for nighttime work zones, including the setup and removal of the closure tapers. Level I illumination shall be provided a minimum of 400 feet ahead and 800 feet behind a paving or milling machine, or for the entire area of concrete placement or pavement work if less than this distance. This area shall be extended as necessary to incorporate all vehicle and equipment operations associated with the paving operation. The only exception to the requirement for Level I illumination throughout the area of construction operations is that finish rollers can work beyond the area of Level I illumination using floodlights mounted on the roller.
- Level II (10 foot-candles). Level II illumination shall be provided for flagging stations, asphalt paving, milling, and concrete placement and/or grading operations, 50 feet ahead of and 100 feet behind heavy equipment, including a paving or milling machine.
- Level III (20 foot-candles). Level III illumination shall be provided for pipeline and jack and bore casing work, pavement crack filling, joint repair, pavement patching and repairs, installation of site lights equipment or other electrical/mechanical equipment, and other tasks involving fine details or intricate parts and equipment.

END OF SECTION 340133

SECTION 344113 - TRAFFIC SIGNS

PART 1 GENERAL

1.1 SUBMITTALS

- A. Shop Drawings: Show shop drawings, not necessarily to scale, but sufficient enough in detail to show color, wording, lettering size and style, overall sign size, construction details and installation details for each type of sign.

PART 2 PRODUCTS

2.1 TRAFFIC SIGNS

- A. Construction Materials: Comply with the applicable requirements of the New York State Department of Transportation (NYS DOT) Standard Specifications (9/01/2017 version), Section 645.
- B. Posts: Galvanized steel. Provide NYSDOT Type “A” sign posts, as per NYSDOT 645 (nominal 2”x2” galvanized steel).
- C. Provide signs that meet the National Manual of Uniform Traffic Control Devices (NMUTCD) requirements, per the NMUTCD designations that are provided on the Project Drawings.
- D. Permanent signs to be installed are shown on the Project Plans, with a correlating size and NMUTCD number.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Erect signs in their designated locations, as indicated and in accordance with the approved shop drawings and the applicable requirements of NYS DOT Section 645-3, and NYS DOT 645 Series Standard Sheets.
- B. Protect surfaces and finishes from abrasion and other damage during handling and installation.
- C. Replace damaged or faulty signs.

END OF SECTION 344113