SANDY SPRINGS™
GEORGIA

# Heritage Park Improvements - Restrooms

## Bid Set – Technical Specifications

## October 21, 2019

**Pond Project No. 1190708**

POND
Architects ▪ Engineers ▪ Planners

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| Division | Section Title |
|---|---|

**PROCUREMENT AND CONTRACTING DOCUMENTS GROUP**

**DIVISION 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS**
000101 PROJECT TITLE PAGE

**SPECIFICATIONS GROUP**

***General Requirements Subgroup***

**DIVISION 01 - GENERAL REQUIREMENTS**
011000 SUMMARY
013100 PROJECT MANAGEMENT AND COORDINATION
013300 SUBMITTAL PROCEDURES
015639 TEMPORARY TREE AND PLANT PROTECTION
015723 TEMPORARY STORM WATER POLLUTION CONTROL
017700 CLOSEOUT PROCEDURES

***Facility Construction Subgroup***

**DIVISION 03 – CONCRETE**
033000 CAST-IN-PLACE CONCRETE
033543 POLISHED CONCRETE FINISHING

**DIVISION 04 – MASONRY**
042200 CONCRETE UNIT MASONRY
042613 MASONRY VENEER - THIN BRICK
044301 STONE MASONRY VENEER

**DIVISION 05 – METALS**
051200 STRUCTURAL STEEL FRAMING
053100 STEEL DECKING

**DIVISION 06 – WOOD AND PLASTICS**

061000 ROUGH CARPENTRY
061600 SHEATHING
062013 EXTERIOR AND INTERIOR FINISH WOOD CARPENTRY

**DIVISION 07 – THERMAL AND MOISTURE PROTECTION**
072100 THERMAL INSULATION
072600 VAPOR RETARDERS
072726 FLUID-APPLIED MEMBRANE AIR BARRIERS
074113.16 STANDING-SEAM METAL ROOF PANELS
079200 JOINT SEALANTS

**DIVISION 8 – DOORS AND WINDOWS**

081113 HOLLOW METAL DOORS AND FRAMES
087100 DOOR HARDWARE
089119 FIXED LOUVERS

**DIVISION 9 – FINISHES**
092400 CEMENT PLASTERING
099113 EXTERIOR PAINTING
099600 HIGH-PERFORMANCE COATINGS

**DIVISION 10 – SPECIALTIES**
101423.16 ROOM-IDENTIFICATION PANEL SIGNAGE
102800 TOILET, BATH, AND LAUNDRY ACCESSORIES

**DIVISION 12 – FURNISHINGS**
129300 SITE FURNISHINGS

***Facility Services Subgroup***

**DIVISION 22 – PLUMBING**
220517 SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

***Site and Infrastructure Subgroup***

**DIVISION 31 –EARTHWORK**
312000 EARTH MOVING
313219 GEOTEXTILE FOR SOIL STABILIZATION AND LAYER SEPARATION

**DIVISION 32 – EXTERIOR IMPROVEMENTS**
321313 CONCRETE PAVING
321373 CONCRETE PAVING JOINT SEALANTS
321413.19 PERMEABLE INTERLOCKING PAVING
328400 PLANTING IRRIGATION
329200 TURF AND LAWN GRASSES
329300 PLANTS

**DIVISION 33 –UTILITIES**
330500 COMMON WORK RESULTS FOR UTILITIES
334100 STORM UTILITY DRAINAGE PIPING
334600 SUBDRAINAGE

END TABLE OF CONTENTS

# SECTION 011000 - SUMMARY

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Phased construction.

### 1.3 PROJECT INFORMATION

A. Project Identification: Heritage Park Improvements - Restrooms

1. Project Location: Sandy Springs, Georgia

B. Owner: City of Sandy Springs

1. Owner's Representative and 24 hour contact: Michael Perry, 770.730.5600

C. Design Professional: Pond and Company, 3500 Parkway Lane, Peachtree Corners, GA 30092

1. Project manager: Brad Jones, PLA, ASLA, 404-748-4747 jonesb@pondco.com

### 1.4 WORK COVERED BY CONTRACT DOCUMENTS

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

1. Construction of a restroom building and related site work at Heritage Park, 6110 Bluestone Road, Sandy Springs, Georgia. The site is home to Heritage Sandy Springs, a non-profit organization, and Heritage Green, an outdoor amphitheater and park owned and maintained by the City of Sandy Springs. The project includes the demolition of existing sidewalks, landscaping and fencing, construction of a 617 SF restroom building with 1,100 SF standing seam metal roof and all associated utility connections, 1,900 SY of concrete sidewalks and pervious pavement, 95 SF of stone veneer walls, landscaping, delegated design irrigation system, and other associated site work and erosion control.

B. Type of Contract

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

1.5 SCHEDULE

A. The Work is anticipated to be completed within 6 months.

B. Before commencing Work of each phase, submit an updated copy of Contractor's construction schedule showing the sequence, commencement, and completion dates for all phases of the Work.

1.6 ACCESS TO SITE

A. General: Contractor shall have use of Project site for construction operations during construction period. Note that the access points are to streets open to residential traffic and City noise and development ordinances apply to the site.

B. Condition of Existing Grounds: The site is a functioning public park which will remain open during construction of the restroom. It will be the contractor’s responsibility to secure the construction site as necessary and coordinate any events with the Owner occurring during the construction period. Installing temporary fencing around the immediate construction and contractor parking onsite is allowed.

1.7 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.
3. All references to “Architect”, “City Representative”, “Project Engineer”, and “Engineer” contained within the Project Specifications and Drawings (except for Geotechnical Engineer or sub-consultant) shall be defined as “Design professional”. The Design professional may be a representative of the City, such as the City’s project manager, or a consultant working on behalf of the City.

END OF SECTION 011000

# SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. General coordination procedures.
2. Coordination drawings.
3. RFIs.
4. Digital project management procedures.
5. Project meetings.

B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.

C. Related Requirements:

1. Section 017700 "Closeout Procedures" for coordinating closeout of the Contract.

### 1.3 DEFINITIONS

A. RFI: Request for Information. Request from Owner, Owner’s representative, or Contractor seeking information required by or clarifications of the Contract Documents.

### 1.4 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. Coordination: Each subcontractor shall coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the Work. Each contractor shall coordinate its own operations with 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 with other contractors to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

C. 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.

D. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and scheduled activities of other contractor 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. Preinstallation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.

## 1.5 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely indicated on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity. Retain "Coordination Digital Data Files" Paragraph below and delete "Coordination Drawing Organization" Paragraph above if requiring electronic files for coordination drawings submittal for review and for record.

B. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:

1. File Preparation Format: Same digital data software program, version, and operating system as original Drawings.
2. File Preparation Format: AutoCAD DWG Version 2018 or earlier, operating in Microsoft Windows operating system.

3. File Submittal Format: Submit or post coordination drawing files using PDF format.

4. Owner's representative will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files.

    a. Owner's representative makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.

1.6 REQUEST FOR INFORMATION (RFI)

A. General: Immediately on discovery of the need for additional information, clarification, or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.

1. Owner's representative will return without response those RFIs submitted to Owner's representative by other entities controlled by Contractor.
2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:

1. Project name.
2. Project number.
3. Date.
4. Name of Contractor.
5. Name of Owner's representative.
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: Software-generated form, acceptable to Owner's representative.

1. Attachments shall be electronic files in PDF format.

D. Owner’s representative's Action: Owner’s representative will review each RFI, determine action required, and respond. Allow seven (7) working days for Owner’s representative's response for each RFI. RFIs received by Owner’s representative 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 Owner’s representative's actions on submittals.
   g. Incomplete RFIs or inaccurately prepared RFIs.

2. Owner’s representative's action may include a request for additional information, in which case Owner’s representative's time for response will date from time of receipt by Owner’s representative of additional information.
3. Owner’s representative'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 GDOT standard specifications.

   a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Owner’s representative in writing within ten (10) days of receipt of the RFI response.

E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly.

1. Project name.
2. Name and address of Contractor.
3. Name and address of Owner’s representative.
4. RFI number including RFIs that were returned without action or withdrawn.
5. RFI description.
6. Date the RFI was submitted.
7. Date Owner’s representative's response was received.
8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
9. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

F. On receipt of Owner’s representative's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Owner’s representative and Construction Manager within seven (7) days if Contractor disagrees with response.

## 1.7 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Owner's representative of scheduled meeting dates and times a minimum of 10 working days prior to meeting.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner's representative, within five (5) days of the meeting.

B. Preconstruction Conference: Owner's representative will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Owner's representative, but no later than 15 days after execution of the Agreement.

1. Attendees: Authorized representatives of Owner, 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. Provide an agenda to attendees.

2. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity when required by other sections and when required for coordination with other construction.

1. Attendees: Authorized representatives of Owner, 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. Provide an agenda to attendees.

2. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Project Closeout Conference: Schedule and conduct project closeout conference (Punch List Walk), at a time convenient to the Owner's representative, but no later than **14** days prior to the scheduled date of Substantial Completion.

1. Conduct the conference to review requirements and responsibilities related to Project closeout.
2. Attendees: Authorized representatives of Owner, and their consultants or vendors; 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.
3. Agenda: Discuss items of significance that could affect or delay Project closeout.

4. Minutes: Entity conducting meeting will record and distribute meeting minutes.

E. Progress Meetings: Conduct progress meetings at regular intervals, no more frequent than on a weekly basis.

1. Coordinate dates of meetings with preparation of payment requests.
2. Attendees: In addition to representatives of Owner's representative, 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.
3. 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.

    b. Review present and future needs of each entity present.

4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.

    a. 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.

F. Coordination Meetings: **Conduct** Project coordination meetings at **regular** intervals as necessary. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.

1. Reporting: Provide an agenda and record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

# SECTION 013300 - SUBMITTAL PROCEDURES

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section Includes:

1. Submittal schedule requirements.
2. Administrative and procedural requirements for submittals.

### 1.3 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Owner’s representative'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 Owner’s representative’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."

### 1.4 SUBMITTAL SCHEDULE

A. Submittal Schedule: Submit, as an action submittal, a list 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 Owner’s representative 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 concurrently with startup construction schedule. 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 Owner's representative's final release or approval.
g. Scheduled dates for purchasing.
h. Scheduled date of fabrication.
i. Scheduled dates for installation.

## 1.5 SUBMITTAL FORMATS

A. Submittal Information: Include the following information in each submittal:

1. Project name.
2. Date.
3. Name of Owner's representative.
4. Name of Owner.
5. Name of Contractor.
6. Name of firm or entity that prepared submittal.
7. Contractor's approval stamp.
8. Names of subcontractor, manufacturer, and supplier.
9. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier; and alphanumeric suffix for resubmittals.
10. Category and type of submittal.
11. Submittal purpose and description.
12. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
13. Drawing number and detail references, as appropriate.
14. Indication of full or partial submittal.
15. Location(s) where product is to be installed, as appropriate.
16. Other necessary identification.
17. Remarks.
18. Signature of transmitter.

B. Options: Identify options requiring selection by Owner's representative.

C. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Owner's

representative on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.

D. Paper Submittals:
   1. Will not be accepted without prior authorization from Owner's representative.

E. PDF Submittals: Prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with submittal number.

## 1.6 SUBMITTAL PROCEDURES

A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

   1. Email: Prepare submittals as PDF package and transmit to Owner's representative by sending via email. Include PDF transmittal form. Include information in email subject line as requested by Owner's representative.

      a. Owner's representative will return annotated file. Annotate and retain one copy of file as a digital Project Record Document file.

   2. Web-Based Project Software: Prepare submittals in PDF form, and upload to web-based Project software website. Enter required data in web-based software site to fully identify submittal.

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 submittals for related parts of the Work specified in different Sections so processing will not be delayed because of need to review submittals concurrently for coordination.

      a. Owner's representative and Owner reserve 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 Owner's representative'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 10 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. **Owner's representative** 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 5 days for review of each resubmittal.
4. Sequential Review: Where sequential review of submittals by Owner's representative's consultants, Owner, or other parties is indicated, allow 5 days for initial review of each submittal. Contractor may be responsible for paying Owner's representative to review more than two resubmittals of a section due to omitted or unacceptable information.

D. 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 Owner's representative's action stamp.

E. 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.

F. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Owner's representative's action stamp.

## 1.7 SUBMITTAL REQUIREMENTS

A. 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 unsuitable 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. Submit Product Data before Shop Drawings, and before or concurrent with Samples.

B. 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 unless submittal based on Owner's representative's digital data drawing files is otherwise permitted.

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. PDF 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 24 by 36 inches .

C. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other materials.

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
2. Identification: Permanently attach label on unexposed side of Samples that includes the following:

   a. Project name and submittal number.
   b. Generic description of Sample.
   c. Product name and name of manufacturer.
   d. Sample source.
   e. Number and title of applicable Specification Section.
   f. Specification paragraph number and generic name of each item.

3. Email Transmittal: Provide PDF transmittal. Include digital image file illustrating Sample characteristics, and identification information for record.
4. Web-Based Project Software: Prepare submittals in PDF form, and upload to web-based Project software website. Enter required data in web-based software site to fully identify submittal.
5. 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.
   b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

6. 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. Owner's representative, through Owner, will return submittal with options selected.

D. 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.

E. 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 Owner's representatives and owners, and other information specified.

F. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.

G. Certificates:

1. Certificates and Certifications Submittals: Submit 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. Provide a notarized signature where indicated.
2. 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.
3. 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.
4. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
5. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
6. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

H. Test and Research Reports:

1. 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.
2. 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.
3. 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.
4. 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.
5. 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.
6. 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:

    a. Name of evaluation organization.
    b. Date of evaluation.
    c. Time period when report is in effect.
    d. Product and manufacturers' names.
    e. Description of product.
    f. Test procedures and results.
    g. Limitations of use.

1.8 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 insufficient to perform services or certification required, submit a written request for additional information to Owner’s representative.

B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF file paper copies 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.

## 1.9 CONTRACTOR'S REVIEW

A. Action Submittals 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 Owner’s representative and Owner.

B. Contractor's Approval: Indicate Contractor's approval for each submittal with a uniform approval stamp. Include 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.

1. Owner’s representative and Owner will not review submittals received from Contractor that do not have Contractor's review and approval.

## 1.10 OWNER’S REPRESENTATIVE'S AND OWNER’S REVIEW

A. Action Submittals: Owner’s representative and Owner will review each submittal, indicate corrections or revisions required**, and return it**.

1. PDF Submittals: Owner’s representative and Owner will indicate, via markup on each submittal, the appropriate action.

B. Informational Submittals: Owner’s representative and Owner will review each submittal and will not return it, or will return it if it does not comply with requirements. Owner’s representative **and Owner** 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 Owner’s representative and Owner.

D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

E. Owner’s representative and Owner will **return without review** submittals received from sources other than Contractor.

F. Submittals not required by the Contract Documents will be returned by Owner’s representative without action.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013300

# SECTION 015639
# TEMPORARY TREE AND PLANT PROTECTION

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section includes general protection and pruning of existing trees and plants that are affected by execution of the Work, whether temporary or permanent construction.

### 1.3 DEFINITIONS

A. Retain terms that remain after this Section has been edited for a project.
B. Generally, retain either "Caliper" or "Caliper (DBH)" Paragraph below. First paragraph corresponds to diameter measurement used in the landscaping industry; second corresponds to diameter measurement in the timber industry and by some landscapers for trees measuring over 8 inches (200 mm) in diameter. Revise either paragraph below if required for clump and multi-stemmed tree forms and to suit Project. The method of measuring tree caliper for landscape purposes varies. See Evaluations.
C. Caliper: Diameter of a trunk measured by a diameter tape at a height 6 inches (150 mm) above the ground for trees up to and including 4-inch (100-mm) size at this height and as measured at a height of 12 inches (300 mm) above the ground for trees larger than 4-inch (100-mm) size.
D. Retain last option in "Caliper (DBH)" Paragraph below if using this measurement only for larger trees.
E. Caliper (DBH): Diameter breast height; diameter of a trunk as measured by a diameter tape at a height 54 inches (1372 mm) above the ground line.
F. Retain "Plant-Protection Zone" or "Tree-Protection Zone" Paragraph below or both to suit Project; coordinate with Section 311000 "Site Clearing" and Section 312000 "Earth Moving."
G. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction and indicated on Drawings.
H. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and indicated on Drawings.
I. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

### 1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Review methods and procedures related to temporary tree and plant protection including, but not limited to, the following:
      a. Tree-service firm's personnel, and equipment needed to make progress and avoid delays.
      b. Arborist's responsibilities.
      c. Quality-control program.
      d. Coordination of Work and equipment movement with the locations of protection zones.
      e. Trenching by hand or with air spade within protection zones.
      f. Field quality control.

### 1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.
B. Tree Pruning Schedule: Written schedule detailing scope and extent of pruning of trees to remain that interfere with or are affected by construction.
   1. Species and size of tree.
   2. Location on site plan. Include unique identifier for each.
   3. Reason for pruning.

4. Description of pruning to be performed.
5. Description of maintenance following pruning.

**1.6 INFORMATIONAL SUBMITTALS**

A. Qualification Data: For arborist and tree service firm.
B. Certification: From arborist, certifying that trees indicated to remain have been protected during construction according to recognized standards and that trees were promptly and properly treated and repaired when damaged.
C. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing the Work.
D. Existing Conditions: Documentation of existing trees and plantings indicated to remain, which establishes preconstruction conditions that might be misconstrued as damage caused by construction activities.

1. Use sufficiently detailed photographs or video recordings.
2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

E. Quality-control program.

**1.7 QUALITY ASSURANCE**

A. Arborist Qualifications: Certified Arborist as certified by ISA.
B. Tree Service Firm Qualifications: An experienced tree service firm that has successfully completed temporary tree and plant protection work similar to that required for this Project and that will assign an experienced, qualified arborist to Project site during execution of the Work.
C. Quality-Control Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work without damaging trees and plantings. Include dimensioned diagrams for placement of protection zone fencing and signage, the arborist's and tree-service firm's responsibilities, instructions given to workers on the use and care of protection zones, and enforcement of requirements for protection zones.

**1.8 FIELD CONDITIONS**

A. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Moving or parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

B. Do not direct vehicle or equipment exhaust toward protection zones.
C. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

A. Backfill Soil: Stockpiled soil from location shown on Drawings of suitable moisture content and granular texture for placing around tree; free of stones, roots, plants, sod, clods, clay lumps, pockets of coarse sand, concrete slurry, concrete layers or chunks, cement, plaster, building debris, and other extraneous materials harmful to plant growth.
B. Organic Mulch: Free from deleterious materials and suitable as a top dressing for trees and shrubs, consisting of one of the following:

1. Type: Shredded hardwood.
2. Size Range: 3 inches (76 mm) maximum, 1/2 inch (13 mm) minimum.

3. Color: Natural.

C. Protection-Zone Fencing: Fencing fixed in position and meeting the following requirements:

1. Plastic Protection-Zone Fencing: Plastic construction fencing constructed of high-density extruded and stretched polyethylene fabric with 2-inch (50-mm) maximum opening in pattern and weighing a minimum of 0.4 lb/ft. (0.6 kg/m); remaining flexible from minus 60 to plus 200 deg F (minus 16 to plus 93 deg C); inert to most chemicals and acids; minimum tensile yield strength of 2000 psi (13.8 MPa) and ultimate tensile strength of 2680 psi (18.5 MPa); secured with plastic bands or galvanized-steel or stainless-steel wire ties; and supported by tubular or T-shape galvanized-steel posts spaced not more than 96 inches (2400 mm) apart.

a. Height: 48 inches (1200 mm).
b. Color: High-visibility orange, nonfading.

D. Protection-Zone Signage: Shop-fabricated, rigid plastic or metal sheet with attachment holes prepunched and reinforced; legibly printed with nonfading lettering and as follows:

1. Size and Text: As shown on Drawings.
2. Lettering: 3-inch- (75-mm-) high minimum, white characters on red background.

**PART 3 - EXECUTION**

**3.1 EXAMINATION**

A. Erosion and Sedimentation Control: Examine the site to verify that temporary erosion- and sedimentation-control measures are in place. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.
B. Prepare written report, endorsed by arborist, listing conditions detrimental to tree and plant protection.

**3.2 PREPARATION**

A. Locate and clearly identify trees, shrubs, and other vegetation to remain. Flag Tie a 1-inch (25-mm) blue vinyl tape around each tree trunk at 54 inches (1372 mm) above the ground.
B. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.

**3.3 PROTECTION ZONES**

A. Protection-Zone Fencing: Install protection-zone fencing along edges of protection zones before materials or equipment are brought on the site and construction operations begin in a manner that will prevent people from easily entering protected areas except by entrance gates. Construct fencing so as not to obstruct safe passage or visibility at vehicle intersections where fencing is located adjacent to pedestrian walkways or in close proximity to street intersections, drives, or other vehicular circulation.

1. Posts: Set or drive posts into ground one-third the total height of the fence without concrete footings. Where a post is located on existing paving or concrete to remain, provide appropriate means of post support acceptable to Owner’s representative.
2. Access Gates: Install where indicated; adjust to operate smoothly, easily, and quietly; free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Protection-Zone Signage: Install protection-zone signage in visibly prominent locations in a manner approved by Owner’s representative. Install one sign spaced approximately every 50 feet (15 m) on protection-zone fencing, but no fewer than four signs with each facing a different direction.
C. Maintain protection zones free of weeds and trash.
D. Maintain protection-zone fencing and signage in good condition as acceptable to Owner’s representative and remove when construction operations are complete and equipment has been removed from the site.

1. Do not remove protection-zone fencing, even temporarily, to allow deliveries or equipment access through the protection zone.
2. Temporary access is permitted subject to preapproval in writing by arborist if a root buffer effective against soil compaction is constructed as directed by arborist. Maintain root buffer so long as access is permitted.

**3.4 EXCAVATION**

A. General: Excavate at edge of protection zones and for trenches indicated within protection zones according to requirements in Section 312000 "Grading" unless otherwise indicated.
B. Trenching within Protection Zones: Where utility trenches are required within protection zones, excavate under or around tree roots by hand or with air spade, or tunnel under the roots by drilling, auger boring, or pipe jacking. Do not cut main lateral tree roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots as required for root pruning. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots.
C. Redirect roots in backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and redirect them without breaking. If encountered immediately adjacent to location of new construction and redirection is not practical, cut roots approximately 3 inches (75 mm) back from new construction and as required for root pruning.
D. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

**3.5 ROOT PRUNING**

A. Prune tree roots that are affected by temporary and permanent construction. Prune roots as follows:
   1. Cut roots manually by digging a trench and cutting exposed roots with sharp pruning instruments; do not break, tear, chop, or slant the cuts. Do not use a backhoe or other equipment that rips, tears, or pulls roots.
   2. Cut Ends: Do not paint cut root ends.
   3. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
   4. Cover exposed roots with burlap and water regularly.
   5. Backfill as soon as possible according to requirements in Section 312000 "Grading."
B. Root Pruning at Edge of Protection Zone: Prune tree roots 12 inches (300 mm) outside of the protection zone by cleanly cutting all roots to the depth of the required excavation.
C. Root Pruning within Protection Zone: Clear and excavate by hand or with air spade to the depth of the required excavation to minimize damage to tree root systems. If excavating by hand, use narrow-tine spading forks to comb soil to expose roots. Cleanly cut roots as close to excavation as possible.

**3.6 CROWN PRUNING**

A. Prune branches that are affected by temporary and permanent construction. Prune branches as directed by arborist.
   1. Prune to remove only injured, broken, dying, or dead branches unless otherwise indicated. Do not prune for shape unless otherwise indicated.
   2. Do not remove or reduce living branches to compensate for root loss caused by damaging or cutting root system.
   3. Pruning Standards: Prune trees according to ANSI A300 (Part 1).
      a. Type of Pruning: Cleaning raising reducing and thinning where indicated.
B. Unless otherwise directed by arborist and acceptable to Owner’s representative, do not cut tree leaders.
C. Cut branches with sharp pruning instruments; do not break or chop.
D. Do not paint or apply sealants to wounds.
E. Provide subsequent maintenance pruning during Contract period as recommended by arborist.

F. Chip removed branches and use as a temporary mulch or properly dispose of.

**3.7 REGRADING**

A. Lowering Grade: Where new finish grade is indicated below existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

B. Raising Grade: Where new finish grade is indicated above existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

C. Minor Fill within Protection Zone: Where existing grade is 2 inches (50 mm) or less below elevation of finish grade, fill with backfill soil. Place backfill soil in a single uncompacted layer and hand grade to required finish elevations.

**3.8 FIELD QUALITY CONTROL**

A. Inspections: Engage a qualified arborist to direct plant-protection measures in the vicinity of trees, shrubs, and other vegetation indicated to remain and to prepare inspection reports.

**3.9 REPAIR AND REPLACEMENT**

A. General: Repair or replace trees, shrubs, and other vegetation indicated to remain or to be relocated that are damaged by construction operations in a manner approved by Owner’s representative.

1. Submit details of proposed pruning and repairs.
2. Perform repairs of damaged trunks, branches, and roots within 24 hours according to arborist's written instructions.
3. Replace trees and other plants that cannot be repaired and restored to full-growth status, as determined by Owner’s representative.

B. Trees: Remove and replace trees indicated to remain that are more than 66 percent dead or in an unhealthy condition or are damaged during construction operations that Owner’s representative determines are incapable of restoring to normal growth pattern.

1. Small Trees: Provide new trees of same size and species as those being replaced for each tree that measures 4 inches (100 mm) or smaller in caliper size.
2. Large Trees: Provide two new tree(s) of 4-inch (100-mm) caliper size for each tree being replaced that measures more than 6 inches (150 mm) in caliper size.
   a. Species: As selected by Owner’s representative.
3. Plant and maintain new trees as specified in Section 329300 "Plants."

C. Excess Mulch: Rake mulched area within protection zones, being careful not to injure roots. Rake to loosen and remove mulch that exceeds a 4-inch (100-mm) uniform thickness to remain.

D. Soil Aeration: Where directed by Owner’s representative, aerate surface soil compacted during construction. Aerate 10 feet (3 m) beyond drip line and no closer than 36 inches (900 mm) to tree trunk. Drill 2-inch- (50-mm-) diameter holes a minimum of 12 inches (300 mm) deep at 24 inches (600 mm) o.c. Backfill holes with an equal mix of augured soil and sand.

**3.10 DISPOSAL OF SURPLUS AND WASTE MATERIALS**

A. Disposal: Remove excess excavated material, displaced trees, trash, and debris and legally dispose of them off Owner's property.

**END OF SECTION 015639**

# SECTION 015723 - TEMPORARY STORM WATER POLLUTION CONTROL

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Temporary stormwater pollution controls.

B. Related Requirements

1. Section 015639 “Temporary Tree Protection”, for tree protection measures before and during construction.

2. Section 312000 “Earth Moving”

### 1.2 STORMWATER POLLUTION PREVENTION PLAN

A. The Contractor shall comply with the Stormwater Pollution Prevention Plan (SWPPP) for this project, which is to follow the approved applicable Project Drawings and Specifications related to erosion and sedimentation control.

B. Contractor shall comply with applicable codes, rules, ordinances, regulations, and laws of local, municipal, state or federal authorities having jurisdiction over project including, but not necessarily limited to:
1. “Manual for Erosion and Sediment Control in Georgia” published by the State Soil and Water Conservation Committee of Georgia.
2. State of Georgia Erosion and Sedimentation Control Act of 1975 as amended.

### 1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Design professional, and contractor.
2. Review requirements of the SWPPP, including permitting process, worker training, and inspection and maintenance requirements.

### 1.4 INFORMATIONAL SUBMITTALS

A. Georgia EPD Notice Of Intent (NOI) For Coverage Under the 2017 Re-Issuance of the NPDES General Permits To Discharge Storm Water Associated With Construction Activity

B. Stormwater Pollution Prevention Plan (SWPPP): Within 15 days of date established for commencement of the Work, submit completed SWPPP.

C. Stormwater Pollution Prevention (SWPPP) Training Log: For each individual performing Work under the SWPPP.

D. Inspection reports.

1.5 QUALITY ASSURANCE

A. Stormwater Pollution Prevention Plan (SWPPP) Coordinator: Experienced individual or firm with a record of successful water pollution control management coordination of projects with similar requirements.

1. SWPPP Coordinator shall complete and finalize the SWPPP form.
2. SWPPP Coordinator shall be responsible for inspections and maintaining of all requirements of the SWPPP.

B. Installers: Trained as indicated in the SWPPP.

PART 2 - PRODUCTS

2.1 TEMPORARY STORMWATER POLLUTION CONTROLS

A. Provide temporary stormwater pollution controls as required by the SWPPP.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with all best management practices, general requirements, performance requirements, reporting requirements, and all other requirements included in the SWPPP.

B. Locate stormwater pollution controls in accordance with the SWPPP.

C. Conduct construction as required to comply with the SWPPP and that minimize possible contamination or pollution or other undesirable effects.

1. Inspect, repair, and maintain SWPPP controls during construction.

a. Inspect all SWPPP controls not less than every seven days, and after each occurrence of a storm event, as outlined in the SWPPP.

D. Remove SWPPP controls at completion of construction and restore and stabilize areas disturbed during construction.

END OF SECTION 015723

# SECTION 017700 - CLOSEOUT PROCEDURES

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 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.

### 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.

C. Field Report: For pest control inspection.

### 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, operation and maintenance manuals, 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 tools, spare parts, extra materials, and similar items, and deliver to location designated by Owner’s representative. Label with manufacturer's name and model number.

    a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Owner’s or Owner's representative’s signature for receipt of submittals.

5. Submit testing, adjusting, and balancing records.
6. Submit sustainable design submittals not previously submitted.
7. 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. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
6. Advise Owner of changeover in utility services 30-45 days ahead of date needed.
7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.

8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
9. Complete final cleaning requirements.
10. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.

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 and tests. On receipt of request, Owner’s representative will either proceed with inspection or notify Contractor of unfulfilled requirements. Owner’s representative 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 Owner’s representative, that must be completed or corrected before certificate will be issued.

1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for final completion.

## 1.7 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 Owner’s representative's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Owner’s representative. 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.
4. Submit pest-control final inspection report.
5. Submit final completion photographic documentation.

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, Owner’s representative will either proceed with inspection or notify Contractor of unfulfilled requirements. Owner’s representative 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. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.8 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order, starting with exterior areas first.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:

a. Project name.
b. Date.
c. Name of Owner's representative.
d. Name of Contractor.
e. Page number.

4. Submit list of incomplete items in the following format:

a. MS Excel electronic file. Owner's representative **,** will return annotated file.
b. PDF electronic file. Owner's representative, will return annotated file.
c. Web-based project software upload. Utilize software feature for creating and updating list of incomplete items (punch list).

1.9 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Owner's representative for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.

B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.

D. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

1. Submit on digital media acceptable to Owner's representative

E. Warranties in Paper Form:

1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.

F. Provide additional copies of each warranty to include in operation and maintenance manuals.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

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

1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

## 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. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:

a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.

c. Rake grounds that are not planted, mulched, or paved to a smooth, even-textured surface.
d. Remove tools, construction equipment, machinery, and surplus material from Project site.
e. Remove snow and ice to provide safe access to building.
f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
h. Sweep concrete floors broom clean in unoccupied spaces.
i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
k. Remove labels that are not permanent.
l. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
o. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
p. Clean luminaires, lamps, globes, and reflectors to function with full efficiency.
q. Leave Project clean and ready for occupancy.

C. Pest Control: Comply with pest control requirements in Section 015000 "Temporary Facilities and Controls." Prepare written report.

D. Construction Waste Disposal: Comply with waste disposal requirements in Section 015000 "Temporary Facilities and Controls." and Section 017419 "Construction Waste Management and Disposal."

## 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. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be

repaired. Restore damaged construction and permanent facilities used during construction to specified condition.

1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.

    a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.

3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 017700

# SECTION 033000-CAST-IN-PLACE CONCRETE

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section includes cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
   1. Slabs-on-grade.
   2. Foundation.

### 1.2 Related Sections:

A. Division 03 “Concrete Polishing” for requirements for polishing concrete slabs.

B. Division 22 for plumbing and floor drain devices.

### 1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with fly ash; as noted with requirements.

### 1.4 PREINSTALLATION MEETINGS

A. Pre-construction Meeting: Prior to beginning concrete placement, Construction Professional shall schedule meeting with Design Professional, Testing Agency, concrete supplier, concrete placing and finishing foreman and other affected subcontractors. Discuss placing procedures, consistency and setting characteristics of the concrete, acceptability of formwork and reinforcement, acceptable tolerances and finishes, testing, curing and protection. Construction Professional shall be responsible for keeping minutes of meeting and distributing to attending parties.

### 1.5 ACTION SUBMITTALS

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

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
   1. Indicate amounts of mixing water to be withheld for later addition at Project site.

C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement. Shop drawings shall not be duplications of the Contract Documents or plans.

## 1.6 INFORMATION SUBMITTALS

A. Qualification Data: For testing agency.

B. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
   1. Aggregates.

C. Material Certificates: For each of the following, signed by manufacturers:
   1. Cementitious materials.
   2. Admixtures.
   3. Steel reinforcement and accessories.
   4. Curing compounds.
   5. Bonding agents.
   6. Vapor retarders.
   7. Semi-rigid joint filler.

D. Floor surface flatness and levelness measurements to determine compliance with specified tolerances.

E. Field quality-control test and observation reports.

## 1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94 requirements for production facilities and equipment.
   1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency Qualifications: An independent agency, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
   1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.
   2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I

D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.

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

F. Concrete Testing Service: Concrete testing shall be performed by an independent testing agency selected by the Owner. The Construction Professional shall be responsible for all costs associated with retesting of materials and/or installations failing to comply with contract criteria. The testing agency shall invoice the charges for re-test/re-inspections to the Owner separately.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

B. Deliver reinforcement in bundles with waterproof tags. Maintain tags attached until material is incorporated into work.

C. Prevent accumulation of rust or debris on reinforcement during storing. Store off ground and under cover.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Products: provide one of the products specified.
   2. Manufacturers: Provide products by one of the manufacturers specified.

2.2 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.
   1. Plywood, metal, or other approved panel materials.

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.

C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

D. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
   1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

E. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
   1. Furnish ties that, when removed, will leave no holes in the concrete surface.

## 2.3 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615, Grade 60, deformed. Bent bars shall be bent cold.

B. Steel Bar Mats: ASTM A 184, fabricated from ASTM A 615, Grade 60, deformed bars, assembled with clips.

C. Plain-Steel Wire: ASTM A 1064, as drawn.

D. Deformed-Steel Wire: ASTM A 1064.

E. Deformed-Steel Welded Wire Reinforcement: ASTM A 1064, flat sheet.

## 2.4 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615, Grade 60, plain-steel bars, cut bars true to length with ends square and free of burrs.

B. 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," of greater compressive strength than concrete and as follows:
   1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

## 2.5 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
   1. Portland Cement: ASTM C 150, Type I or I/II.
   2. Fly Ash: ASTM C 618, Type F or C. No more than 20% allowed in concrete. Architectural exposed concrete shall not contain fly ash or other pozzolans in its mix.

B. Normal-Weight Aggregates: ASTM C 33, coarse aggregate or better, graded, Class 4M. Provide aggregates from a single source.
   1. Maximum Coarse-Aggregate Size: 1 inch nominal.
   2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Water: ASTM C 94 and potable.

D. Embedded items such as sleeves, straps, washers, angles and plates, shall be of structural steel conforming to ASTM A36. Anchor bolts shall conform to ASTM F1554, Grade 36 (unless noted otherwise in the contract drawings) and shall be regular hexagon type. All embedded items shall be hot-dipped galvanized in accordance with ASTM A123.

E. Headed Concrete Anchors: ASTM A108, install in strict accordance with manufacturer’s recommendations, and in accordance with AWS D1.1.

F. Expansion Bolts: Install in strict accordance with manufacturer’s recommendations.

G. Only anchors evaluated by IAPMO or the ICC Evaluation Service, Inc. (ICC-ES) with a published Evaluation Report shall be approved for use. Anchors that are to be installed in concrete that may become cracked under service loads as noted on the drawings shall be evaluated by ICC-ES according to ACI 355.2/Acceptance Criteria 193 and shall be specifically approved for use in cracked concrete. All anchors shall be approved for resisting seismic and wind loads.

## 2.6 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
   1. Water-Reducing Admixture: ASTM C 494, Type A.
   2. Retarding Admixture: ASTM C 494, Type B.
   3. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
   4. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
   5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494, Type G.
   6. Plasticizing and Retarding Admixture: ASTM C 1017, Type II.
   7. Accelerating Admixture: ASTM C 494, Type C
   8. Air Entrainment Admixture: ASTM C 260

## 2.7 VAPOR RETARDERS

A. Vapor Retarder: See Section 07 2600 of these Specifications.

B. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve. Provide thickness beneath all slabs-on-grade as indicated on Structural Drawings.

## 2.8 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
   1. Products:
      a. Axim Concrete Technologies; Cimfilm.
      b. Burke by Edoco; BurkeFilm.
      c. ChemMasters; Spray-Film.
      d. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Aquafilm.
      e. Dayton Superior Corporation; Sure Film.
      f. Euclid Chemical Company (The); Eucobar.
      g. Kaufman Products, Inc.; Vapor Aid.
      h. Lambert Corporation; Lambco Skin.
      i. L&M Construction Chemicals, Inc.; E-Con.
      j. MBT Protection and Repair, Div. of ChemRex; Confilm.
      k. Meadows, W. R., Inc.; Sealtight Evapre.

l. Metalcrete Industries; Waterhold.
m. Nox-Crete Products Group, Kinsman Corporation; Monofilm.
n. Sika Corporation, Inc.; SikaFilm.
o. Symons Corporation, a Dayton Superior Company; Finishing Aid.
p. Unitex; Pro-Film.
q. US Mix Products Company; US Spec Monofilm ER.
r. Vexcon Chemicals, Inc.; Certi-Vex EnvioAssist.

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

C. Water: Potable, not detrimental to concrete.

D. Clear, Waterborne, Non-Yellowing, Membrane-Forming Curing Compound for areas to received Resilient Tile or Carpet: ASTM C 309, Type 1, Class B, non-dissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.
1. Products:
a. Burke by Edoco; Spartan Cote WB II.
b. ChemMasters; Safe-Cure & Seal 20.
c. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Cure and Seal WB.
d. Dayton Superior Corporation: Safe Cure and Seal (J-18).
e. Euclid Chemical Company (The); Aqua Cure VOX.
f. Kaufman Products, Inc.; Cure & Seal 309 Emulsion.
g. Lambert Corporation; Glazecote Sealer-20.
h. L&M Construction Chemicals, Inc.; Dress & Seal WB.
i. Meadows, W. R., Inc.; Vocomp-20.
j. Metalcrete Industries; Metcure.
k. Nox-Crete Products Group, Kinsman Corporation: Cure & Seal 150E.
l. Symons Corporation, a Dayton Superior Company; Cure & Seal 18 Percent E.
m. Tamms Industries, Inc.; Clearseal WB 150.
n. Unitex; Hydro Seal.
o. US Mix Products Company; US Spec Hydrasheen 15 percent.
p. Vexcon Chemicals, Inc.; Starseal 309.

E. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound to receive no further finish: ASTM C 1315, Type 1, Class A.
1. Products:
a. Burke by Edoco; Cureseal 1315 WB.
b. ChemMasters; Polyseal WB.
c. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Sealcure 1315 WB.
d. Euclid Chemical Company (The); Super Diamond Clear VOX.
e. Kaufman Products, Inc.; Sure Cure 25 Emulsion.
f. Lambert Corporation; UV Safe Seal.
g. L&M Construction Chemicals, Inc.; Lumiseal WB Plus.
h. Meadows, W. R., Inc.; Vocomp-30.
i. Metalcrete Industries; Metcure 30.
j. Symons Corporation, a Dayton Superior Company; Cure & Seal 31 Percent E.

k. Tamms Industries, Inc.; LusterSeal WB 300.
l. Unitex; Hydro Seal 25.
m. US Mix Products Company; US Spec Radiance UV-25.
n. Vexcon Chemicals, Inc.; Vexcon Starseal 1315.

F. Concrete Bonding Agent.
1. Acceptable Products:
a. Anti-Hydro, Anchor-It.
b. Bostik Construction Products, Hydroment 425.
c. The Burke Company, Acrylic Bondcrete.
d. Euclid Chemical Co., Flexcon.
e. Lambert Corp., Acrylbond.
f. L&M Construction Chemicals, Inc., Everbond.
g. Larsen Products Corp, Weld-Crete.
h. Sika Chemical Corp., SikaBond.
i. Sonneborn Building Products, Sonocrete.
j. Unitex, Bonding Agent.
k. W. R. Meadows Co., Intralok.
2. Characteristics: Acrylic latex, non-re-emulsifiable.

G. Epoxy Concrete Bonding Agent.
1. Acceptable Products:
a. Euclid Chemical Co., Euco No. 452 MV Epoxy System.
b. Fosroc Construction Chemicals Co., Celtite 42-47 Hi-Bond.
c. Lambert Corp., Epiweld 580.
d. Sika Corp., Sikadur 32, Hi-Mod.
e. Sonneborn Building Products, Sonobond.
2. Characteristics: Two-component, 100 percent solids, 100 percent reactive, epoxy resin bonding adhesive system; meeting ASTM C881-99, Types I and II, Grade 2, Class C.

H. Semi-Rigid Epoxy Joint Filler: (for exposed polished concrete floors)
1. Acceptable Products:
a. Euclid Chemical Co., Euco 700.
b. Metzger/McGuire Co., Basis of Design - MM-80.
c. W. R. Meadows, Inc., Rezi Weld Flex.
2. Characteristics: Two-component, semi rigid epoxy meeting the requirements of ACI 301.1R and ASTM D 2240.

## 2.9 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

## 2.10 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, Portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4000 psi at 28 days when tested according to ASTM C 109.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
1. Cement Binder: ASTM C 150, Portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109.

## 2.11 TESTING EQUIPMENT

A. Testing agency shall provide supplies, tools and devices as necessary in order to obtain specimens, and perform on-site tests as indicated. Provide no less than the following:
1. Molds for compression test specimens.
2. Slump cones with rod for slump test.
3. Scale and unit weight measure.
4. Concrete thermometer.
5. Air meters.
6. Thermometers.

B. Construction Professional shall provide stable, lockable storage box, thermostatically controlled to maintain temperature between 60 degrees and 80 degrees F. for storage cylinders for first 24 hours after molding. Box shall have minimum capacity of 40 cu. ft. Locate box in a permanent lockable area of approximately 100 sq. ft. Limit access to testing agency personnel and Construction Professional's superintendent.

## 2.12 CONCRETE MIXTURES, GENERAL

A. Construction Professional shall 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.
1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

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

1. Use water-reducing, high-range water-reducing, or plasticizing admixture in concrete, as required, for placement and workability. Concrete slabs placed at air temperatures below 50 degrees F. shall contain the specified non-chloride accelerator. Concrete required to be air-entrained shall include an approved air-entraining admixture.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete and concrete with a water-cementitious materials ratio below 0.45.
4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

## 2.13 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Proportion normal-weight concrete mixture as follows:
1. Minimum Compressive Strength: As indicated within the general notes on the drawings.
2. Maximum Water-Cement Ratio: As indicated within the general notes on the drawings.
3. Slump: Concrete containing the high-range water-reducing admixture (super plasticizer) shall have a maximum slump of 8 inches unless otherwise approved by the Design Professional. The concrete shall arrive at the job site at a slump of 2 inches to 3 inches, be verified, the high-range water-reducing admixture added to increase the slump to the approved level. All other concrete shall have a maximum slump of 5 inches. Measure slump at point of placement
4. Air Content: 4.5 percent for exterior slabs. Unless noted otherwise, interior concrete, such as, slab-on-grade, shall have air content less than 3 percent. If concrete pump is used, air content shall be adjusted due to loss of air in the nozzle. See general notes on the drawings for more information.
5. The following exposure category classifications shall be per ACI 318 (for Interior Concrete).
   a. Anticipated exposure class for freezing and thawing = F0.
   b. Anticipated exposure classes for contact with sulfate = S0.
   c. Anticipated exposure classes for Permeability = P0.
   d. Anticipated exposure classes for corrosion protection of reinforcement = C0.
6. The following exposure category classifications shall be per Chapter 4 of ACI 318-11 (for Foundations):
   a. Anticipated exposure class for freezing and thawing = F1.
   b. Anticipated exposure classes for contact with sulfate = S0.
   c. Anticipated exposure classes for Permeability = P0.
   Anticipated exposure classes for corrosion protection of reinforcement = C1.

B. Mixture Proportions:
1. Mix designs shall be in accordance with ACI 301 except as noted in section 3.17.C.9. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both. Field test data submitted shall be for the actual mixture design to be used.
2. Proportioning Studies for Normal Weight: Trial design batches, mixture proportioning studies, and testing requirements for various classes and types of concrete specified shall be the responsibility of the Construction Professional. Mixture proportions shall be based on compressive strength as determined by test specimens fabricated in accordance with ASTM C192 and tested in accordance with ASTM C 39. Samples of all materials used in

mixture proportioning studies shall be the same as those proposed for use in the project and shall be accompanied by the manufacturer's or producer's test reports indicating compliance with these specifications. Trial mixtures having proportions, consistencies, and air content suitable for the work shall be made based on methodology described in ACI 211.1. Laboratory trial mixtures shall be designed for maximum permitted slump and air content. Separate sets of trial mixture studies shall be made for each combination of cementitious materials and each combination of admixtures proposed for use. No combination of either shall be used until proven by such studies, except that, if approved in writing and otherwise permitted by these specifications, an accelerator or a retarder may be used without separate trial mixture study. Separate trial mixture studies shall also be made for concrete for any conveying or placing method proposed which requires special properties and for concrete to be placed in unusually difficult placing locations. The temperature of concrete in each trial batch shall be reported. For each water-cement ratio, at least three test cylinders for each test age shall be made and cured in accordance with ASTM C 192. They shall be tested at 7 and 28 days in accordance with ASTM C 39. From these test results, a curve shall be plotted showing the relationship between 7 day and 28 day strengths. Each mixture shall be designed to promote easy and suitable concrete placement, consolidation and finishing, and to prevent segregation and excessive bleeding.

3. Average Compressive Strength Required for Mixtures: The mixture proportions selected during mixture design studies shall produce a required average compressive strength (f'cr) exceeding the specified compressive strength (f'c) by the amount indicated below. This required average compressive strength, f'cr, will not be a required acceptance criteria during concrete production. However, whenever the daily average compressive strength at 28 days drops below f'cr during concrete production, or daily average 7-day strength drops below a strength correlated with the 28-day f'cr, the mixture shall be adjusted, as approved, to bring the daily average back up to f'cr. During production, the required f'cr shall be adjusted, as appropriate, based on the standard deviation being attained on the job.
4. Computations from Test Records: Where a concrete production facility has test records, a standard deviation shall be established in accordance with the applicable provisions of ACI 214.3R. Test records from which a standard deviation is calculated shall represent materials, quality control procedures, and conditions the same as those proposed to be used; shall represent concrete produced to meet a specified strength or strengths (f'c) within 1,000 psi of that specified for proposed work; and shall consist of at least 30 consecutive tests. A strength test shall be the average of the strengths of two cylinders made from the same sample of concrete and tested at 28 days. Required average compressive strength f'cr used as the basis for selection of concrete proportions shall be the larger of the equations that follow using the standard deviation as determined above:

   f'cr = f'c + 1.34S where units are in psi
   f'cr = f'c + 2.33S - 500 where units are in psi
   Where S = standard deviation

   Where a concrete production facility does not have test records meeting the requirements above but does have a record based on 15 to 29 consecutive tests, a standard deviation shall be established as the product of the calculated standard deviation and a modification factor from the following table:

| NUMBER OF TESTS | MODIFICATION FACTOR FOR STANDARD DEVIATION |
|---|---|
| 15 | 1.16 |
| 20 | 1.08 |
| 25 | 1.03 |
| 30 or more | 1.00 |

5. Computations without Previous Test Records: When a concrete production facility does not have sufficient field strength test records for calculation of the standard deviation, the required average strength f'cr shall be determined as follows:
   a. If the specified compressive strength f'c is less than 3,000 psi,

      f'cr = f'c + 1000 psi

   b. If the specified compressive strength f'c is 3,000 to 5,000 psi,

      f'cr = f'c + 1,200 psi

   c. If the specified compressive strength f'c is over 5,000 psi,

      f'cr = f'c + 1,400 psi

2.14 FABRICATING REINFORCEMENT

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

2.15 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, and furnish batch ticket information.
   1. When air temperature is between 85 and 90ºF, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90ºF, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK

A. Construction Professional shall hire professional engineer who is registered in the State that the project is located to design the formwork and shores. This design shall be adequate to support all vertical, lateral, static and dynamic loads and construction loads that might be applied until the structure can support such loads.

B. The Construction Professional shall 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.

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

D. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
   1. Class B, 1/4 inch for smooth-formed finished surfaces.

E. Construct forms tight enough to prevent loss of concrete mortar.

F. 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, where indicated
   2. Do not use rust-stained steel form-facing material.

G. 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.

H. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

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

J. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

K. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

L. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

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

N. No horizontal longitudinal conduits, piping, sleeves or any other MEP item shall be placed within concrete footings, concrete slab, or concrete beams.

## 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.
   1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."

## 3.3 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50ºF 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.

1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. 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.

C. 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 Design Professional.

## 3.4 VAPOR RETARDERS

A. Plastic Vapor Retarders: Place, protect, and repair vapor retarders according to ASTM E 1643 and manufacturer's written instructions.
1. Lap joints 6 inches and seal with manufacturer's recommended tape.

## 3.5 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
2. Provide concrete cover over reinforcement in accordance with ACI 301 and ACI 318.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

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.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least two meshes spacing, minimum 12” overlap per ACI 318, Section 12.7. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

## 3.6 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 Design Professional.
1. Roughen joining surface to 1/4" amplitude before casting new concrete against the existing concrete.

2. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
3. Space vertical joints in walls as indicated.
4. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction/Control 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. Sawed Joints (slab-on-grade): Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

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, 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 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Division 7 Section "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. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

## 3.7 CONCRETE PLACEMENT

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

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Design Professional or unless mixing water has been withheld at batch plant for later addition at project site. Amount added at job site shall not exceed amount withheld at plant. Amount that was withheld at batch plant shall be indicated on delivery ticket.
1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

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. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.

3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
4. Transport and place pumped concrete in accordance with ACI 304. Do not use aluminum pipes to transport concrete.
5. Ensure reinforcement, inserts, water stops, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.

D. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
6. Do not place conduits or piping in elevated slabs.
7. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions.
8. Use epoxy bonding system for bonding to damp surfaces, for structural load-bearing applications, and where curing under humid conditions is required.
9. Use latex bonding agent only for non-load-bearing applications.
10. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and use approved chemical adhesive to secure steel dowels to existing concrete, unless steel dowels are at construction joints and dowels are to provide movement in concrete.

E. 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 average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

F. Hot-Weather Placement: Comply with ACI 305 and as follows:
1. Maintain concrete temperature below 90 deg F at time of placement. 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 Construction Professional's option.

2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

## 3.8 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.
   1. Apply to concrete surfaces exposed to public view.

C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:
   1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

## 3.9 FINISHING FLOORS AND SLABS

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

B. 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.
   1. Apply float finish to surfaces indicated to receive trowel finish.

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 (except where designated to receive a non-slip broom finish) 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 for carpeted areas: F(F) 25; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and of levelness, F(L) 15. F(L) values above apply to slabs-on-grade
   b. Specified overall values of flatness for thin-set flooring, resilient flooring, and all other areas: F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade. For elevated composite steel slabs, F(L) values do not need to be taken unless Construction Professional chooses to shore slab to allow F(L) measurements to be taken. F(L) values above apply to slabs-on-grade.
   c. Measure F(F) in accordance with ASTM E1155, within 48 hours after slab installation; report composite overall values and local values for each measured section.
   d. Correct the slab surface if composite overall value is less than specified and if local value is less than two-thirds of specified value or less than F(F) 13.
   e. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process
   f. The concrete on the elevated slabs shall be laser screeded level during construction to provide a maximum elevation change of 1/8 inch per 10 ft of slab length in any direction. The maximum allowed additional concrete thickness to be added on top of the uniform thickness stated on the plans shall be 1.25 inches. Provide survey elevation of the bottom of the erected beams and girders prior to pouring and after pouring elevated slabs with a minimum of one beam per bay and at every girder. Survey points to be at beam and girder ends and mid-spans.

D. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.
   1. Comply with flatness and levelness tolerances for trowel finished floor surfaces.

E. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.
   1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Design Professional before application.

## 3.10 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel-finish concrete surfaces

3.11 CONCRETE PROTECTING AND CURING

A. General: Immediately after placement, protect freshly placed concrete from premature drying and excessive cold or hot temperatures and mechanical injury per ACI 308R. Comply with ACI 306.1 for cold-weather protection and ACI 305 for hot-weather protection during curing. Do not permit traffic over unprotected concrete floor surface until fully cured.

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

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

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 with the following materials:
      a. Water.
      b. Continuous water-fog spray.
   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.
   4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated 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.

3.12 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.

B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

3.13 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
   1. Defer joint filling until concrete has aged at least one month(s). Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install semi-rigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.14 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Definition of "defective concrete" is concrete not conforming to required lines, details, dimensions, tolerances or specified requirements. Repair and patch defective areas when approved by Design Professional. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Design Professional for each individual area. Remove and replace concrete that cannot be repaired and patched to Design Professional's approval. If equipment is placed on concrete slab and slab becomes damaged, Construction Professional will replace damaged portion of slab as directed by Design Professional. Repair or replacement of defective concrete will be determined by the Design Professional. The cost of additional testing shall be borne by Construction Professional when defective concrete is identified.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part Portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. 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 1/2 inch in any dimension in solid concrete, but not less than 1 inch 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 Design Professional.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
7. Repair random cracks and single holes one inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Design Professional’s approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Design Professional's approval.

## 3.15 FIELD QUALITY CONTROL

A. Testing and Inspecting: The Owner shall engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

B. Duties: Testing Agency shall perform the following functions:
   1. Confirm that verified mix designs for concrete classes specified are being used.
   2. Check concrete materials for compliance with specifications.
   3. Sample concrete at project site and prepare compression test specimens, tests for slump, air content and unit weight as required by specifications.
   4. Place concrete test specimens in designated location after casting.
   5. Transport test specimens to laboratory and perform tests according to specifications.
   6. Notify Design Professional immediately of any test specimens that do not meet design compressive strength at 28 days or 2/3 of design strength at seven days.
   7. Verification of use of required design mixture.
   8. Verify concrete placement, including conveying and depositing.
   9. Verify curing procedures and maintenance of curing temperature.
   10. Verify steel reinforcement placement.
   11. Verify headed bolts and studs size, number and location.
   12. Complete field test data sheet for each set of concrete specimens. Completed data sheet shall show the following information: Name and location of project, laboratory number, date, plant, truck number, time batched, time sampled, air temperature, concrete temperature, inspector, mix design number, required strength, unit weight, air content, slump, location of placement, seven day and 28-day strengths, and addition of water to mix.
   13. Verify floor flatness/floor levelness for compliance with specifications.
   14. Verify size, spacing and welds used for attaching metal studs and headed bolts at composite framing.
   15. Refer to the Schedule of Special Inspections Services in Section 01 4001d for Special Inspections required for the concrete portion of this project.

C. Concrete Tests: 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 less than 25 cubic yards, plus one set for each additional 50 cubic yard 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; 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 173, pressure method, for light-weight concrete and 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; one test hourly when air temperature is 40ºF and below and when 80ºF and above, and one test for each composite sample.
   5. Compression Test Specimens: ASTM C 31.

a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.

6. Compressive-Strength Tests: ASTM C 39; test one laboratory-cured one set of two specimens at seven days and one set of two specimens at 28 days, with last cylinder held in reserve.
   a. 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. Whenever this criteria is not met, core tests shall be taken in those areas with questionable concrete, as directed by the Design Professional.
7. Core Tests: Core tests, at Construction Professional's expense, may be required whenever concrete fails to meet the "Evaluation and Acceptance of Concrete" criteria. Cores shall be taken under the direction of Design Professional. Criteria for acceptance of cores shall be as described in ACI 318, Section 5.6.5. Additional core tests, at Construction Professional's expense, may be required by Design Professional whenever other requirements of these specifications are not complied with.
8. Load tests: Perform, at Construction Professional's expense, when core testing is inconclusive or impracticable. Evaluate load test in accordance with ACI 318 and 301.
9. Strength of each concrete mixture will be satisfactory if it meets the specified 28 day compressive strength. Each test cylinder needs to meet the required f'c compressive strength. An average of three tests will NOT be allowed to be a determining factor in determining the acceptability of the concrete. Acceptable concrete has achieved the specified 28 day compressive strength. If this does not occur, then it will be in non-compliance.
10. Test results shall be reported in writing to Design Professional, Georgia State Financing and Investment Commission, concrete manufacturer, and Construction Professional 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.
11. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Design Professional but will not be used as sole basis for approval or rejection of concrete.
12. 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 Design Professional. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by Design Professional.
13. Additional testing and inspecting, at Construction Professional's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
14. Correct deficiencies in the Work that test reports and observations indicate does not comply with the Contract Documents.

D. Measure floor and slab flatness and levelness according to ASTM E 1155 within 48 hours of finishing.

E. Observation of Reinforcement.
   1. The Construction Professional shall provide the Design Professional's Testing Laboratory and the Design Professional with minimum 48-hour notice of readiness for observation of reinforcement.
   2. All reinforcement shall be made readily available for observation prior to formwork cover-up and/or concrete placement.
   3. The Construction Professional shall have copies of POSITIVELY APPROVED submittal data bearing the Design Professional's approval action stamp (see Section 013300 Article 1.4 criteria) made available for reference at the times of scheduled reinforcement observations.
   4. The Construction Professional and the Owner’s Testing Laboratory representative shall jointly inspect the placement and positioning of all reinforcement to verify that the installations are in accordance with the designs and details as shown on the Construction Documents and the specifications for the reinforced concrete and the Contract Documents for the remainder of the reinforcement in accordance with Article 3.15 paragraph B criteria of this Section.
   5. At the completion of the observation of the areas of reinforcement readied for formwork cover-up and/or concrete placement, the Testing Laboratory shall provide the Construction Professional with a legible hand-written report of the installed areas; report shall indicate specific areas observed. The Testing Laboratory shall follow-up with an official typewritten report within seven calendar days thereafter.
   6. All reinforcement and/or related formwork in these areas shall be reviewed and accepted by the Design Professional prior to formwork cover-up and/or footing concrete placement.
   7. The Construction Professional shall be responsible for all costs associated with re-observations of reinforcement to attain full approval by the Testing Laboratory and the Design Professional. *The Testing Agency shall invoice the charges for re-tests/re-inspections to the Owner separately.*

END OF SECTION 033000

# SECTION 033543 - POLISHED CONCRETE FINISHING

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including General and Supplemental Conditions and General Requirements, apply to the work specified in this Section.

### 1.2 SUMMARY

A. Section Includes:
   1. Polishing of concrete floors to achieve designated finish appearance.

B. Related Sections:
   1. Division 03 “Concrete” for requirements for concrete slabs.

### 1.3 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer with demonstrated success with projects incorporating application techniques required by this Section. Work of this section to be performed by an installer who has specialized in installation of work similar to that required for this project. Installer shall be trained and approved by the concrete hardening and sealing material manufacturer.
   1. Experience: Company with not less than 5 years of experience in performing specified work similar in design, products, and extent to scope of this Project; with a record of successful in-service performance; and with sufficient production capability, facilities, and personnel to produce required Work.

B. Reference Standard: Definition D100.0 from Concrete Polishing Association of America (CPAA).

C. Refer to drawings for slopes and any elevation changes in the concrete surface.

D. Coordinate polishing after concrete pour and finishing in accordance with the polishing contractor’s requirements to assure the concrete has not over cured.

E. Coordinate installation of concrete masonry unit and gypsum board walls with the polishing operation to assure polishing reaches the edges of rooms.

### 1.4 SUBMITTALS

A. Samples: Polished concrete samples indicating the proposed finished surface gloss level and aggregate exposure level. Samples do not have to match final poured concrete slab or wall matrix, mix or color.

### 1.5 QUALITY CONTROL

A. Mock-up: Provide mock-up demonstrating the range of finish anticipated.

1. Include degree of polishing as directed by Design Professional.
2. Location of mock-up shall be as agreed to by Design Professional.
3. Mock-Up Size:100 sq ft or of sufficient size to demonstrate finishes for each different polished floor finish at location(s) as directed by Architect, and under condition similar to those which will exist during actual placement.
4. Mock-up will be used to judge workmanship, concrete substrate preparation,
5. operation of equipment, material application and sheen.
6. Allow 24 hours for inspection of mock-up before proceeding with work.
7. Use same personnel, including supervisors, which will perform work.
8. Work shall be representative of those to be expected for work.
9. Show maximum variation that will exist in work.
10. Approval will be for compliance with approved submittals, uniformity of color and exposed aggregates, and uniformity of sheen.
11. When accepted, mock-up will demonstrate minimum standard of quality required for this work. Maintain approved mock-up in undisturbed condition as part of finished the completed Work.

B. Damage and Stain Prevention: Take precautions to prevent damage and staining of concrete surfaces to be polished.
1. Prohibit following over concrete surfaces to be polished:
   a. Pipe cutting operations.
   b. Ferrous metals storage.
2. Protect concrete surfaces to be polished from following:
   a. Petroleum, oil, hydraulic fluid, or other liquid dripping from equipment.
   b. Acids and acidic detergents.
   c. Painting activities.

C. Environmental Limitations: Comply with manufacturer

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original mill wrapping. Deliver only after building is enclosed and spaces are temperature and humidity controlled.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Grinding Machines:
1. Bonded Abrasive Elements: Diamond segments (“discs”) as suitable to achieve specified result.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Surfaces:
1. Verify substrates are acceptable for installation of materials. Notify Design Professional, in writing, of unacceptable substrate conditions.

2. Working on unacceptable substrate indicates acceptance of substrate; completed work indicated as unacceptable requires removal of installed materials and subsequent re-installation of new matching substrate materials and repolishing at no additional cost.
3. Confirm acceptability of concrete strength.

## 3.2 PREPARATION

A. Preparation:
1. Remove dirt, oil, grease, mortar and other foreign matter from surfaces to receive floor finish.
2. Fill cracks as indicated in polishing manufacturer's written instructions or in accordance with the Concrete Polishing Association of America (CPAA).

B. Concrete Slab Moisture Testing: Testing Agency to perform anhydrous calcium chloride test per ASTM F 1869, as follows:
1. Perform tests so that each test area does not exceed 200 sq. ft. (18.6 sq. m) and perform not less than 2 tests in each installation area with test areas evenly spaced in installation area.
2. Proceed with installation only after substrates have maximum moisture-vapor- emission rate of 3 lbs of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24
hours or as otherwise indicated in flooring manufacturer's written instructions.
3. Perform alkalinity and adhesion tests recommended in writing by flooring manufacturer or, if none, according to industry standards.

## 3.3 CONCRETE POLISHING

A. Polish concrete utilizing techniques as recommended by Concrete Polishing Association of America (CPAA).

B. Grind concrete utilizing grinding machines as specified above.

C. Aggregate Exposure Level: Class C, "Medium Aggregate" final appearance.
1. Surface Cut Depth: Approximately 1/8 inch.

D. Finished Gloss: Level 2, "Satin."

## 3.4 CLEANING AND PROTECTION

A. Cleaning:
1. Remove debris at completion of installation.
2. Clean all flor surfaces and any adjacent vertical surfaces using appropriate cleaner upon installation completion.
3. Maintain polished concrete floor free of stains, discoloration, dirt, and other foreign material. Sweep polished concrete floor not more than two days before date scheduled for Material Completion inspections.

B. Protection:

1. Install protective kraft paper or similar covering over flooring during remainder of construction.

END OF SECTION 033543

# SECTION 042200 - CONCRETE UNIT MASONRY

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section Includes:

1. Concrete masonry units.
2. Decorative polished concrete masonry units in high moisture area.
3. Mortar and grout.
4. Steel reinforcing bars.
5. Masonry-joint reinforcement.
6. Embedded flashing.
7. 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 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

### 1.5 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: The Owner will engage a qualified independent testing agency to perform preconstruction testing indicated below. The Construction Professional shall be responsible for all costs associated with retesting of materials and/or installations failing to comply with contract criteria. The testing agency shall invoice the charges for re-test/re-inspections to the Owner separately.

1. Concrete Masonry Unit Test: For each type of unit required, according to ASTM C 140 for compressive strength.

2. Mortar Test (Property Specification): For each mix required, according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
3. Grout Test (Compressive Strength): For each mix required, according to ASTM C 1019.
4. Prism Test: For each type of construction required, according to ASTM C 1314.

## 1.6 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For the following:

1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
2. Reinforcing Steel: Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315. Include elevations of reinforced walls. Reinforcement shop drawings shall not be replications of the structural design drawings.
3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

C. Samples for Initial Selection:

1. Decorative CMUs, in the form of small-scale units.
2. Colored mortar.
3. Weep holes/vents.

D. Samples for Verification: For each type and color of the following:

1. Provide verification samples on a 2 ft. x 3 ft. backing panel. Include decorative masonry and mortar colors as specified.
2. Decorative CMU, in the form of small-scale units. Match Architect's Basis of Design.
3. Pigmented and colored-aggregate mortar.
   a. Make Samples using same sand and mortar ingredients to be used on Project
   b. Match Architect's Basis of Design.

## 1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Material Certificates: For each type and size of the following:

1. Masonry units.
   a. Include data on material properties and 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.

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

1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91/C 91M for air content.
2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

D. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to TMS 602/ACI 530.1/ASCE 6.

E. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

## 1.8 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.

B. Sample Panels: Build sample panels to verify selections made under Sample submittals and to demonstrate aesthetic effects. Comply with requirements in Section 014000 "Quality Requirements" for mockups.

1. Build sample panels for typical exterior walls in sizes approximately 60 inches (1500 mm) long by 48 inches (1200 mm) high by full thickness.
2. Build sample panels facing south.
3. Protect approved sample panels from the elements with weather-resistant membrane.
4. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Design Professional in writing.

    a. Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels unless Design Professional specifically approves such deviations in writing.

## 1.9 DELIVERY, STORAGE, AND HANDLING

A. 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.

B. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.

C. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

D. Protect faces of decorative concrete masonry units during delivery, storage and handling. Chipped units in completed work will be removed and replaced.

1.10 FIELD 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 (600 mm) down both sides of walls, and hold cover securely in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.

C. 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 concrete floor surfaces that receive applied topical and polished finishes.
3. Protect sills, ledges, and projections from mortar droppings.
4. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
5. 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.

D. 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 TMS 602/ACI 530.1/ASCE 6.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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.

2.2 PERFORMANCE REQUIREMENTS

A. Provide unit masonry that develops indicated net-area compressive strengths at 28 days.

1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to TMS 602/ACI 530.1/ASCE 6.
2. Determine net-area compressive strength of masonry by testing masonry prisms according to ASTM C 1314.

2.3 UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6 except as modified by requirements in the Contract Documents.

B. Defective Units: Remove and replace defective masonry units that contain chips, cracks, or other defects Do not use units where such defects are exposed in the completed Work.

C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.

1. Where fire-resistance-rated construction is indicated, units shall be listed and labeled by a qualified testing agency acceptable to State Fire Marshal.

2.4 CONCRETE MASONRY UNITS (CMU)

A. Regional Materials: CMUs shall be manufactured within 500 miles of Project site from aggregates and cement that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.

B. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
2. Provide square-edged units for outside corners unless otherwise indicated.

C. CMUs: ASTM C 90.

1. For concealed, non-visual masonry units provide units that meet the following requirements:

   a. Density Classification: Light weight.
   b. Size (Width): As indicated. Manufactured to dimensions 3/8 inch (10 mm) less-than-nominal dimensions.
   c. Exposed Faces: Provide color and texture matching the range represented by Design Professional's sample.
   d. Faces to Receive Plaster: Where units are indicated to receive a direct application of plaster, provide textured-face units made with gap-graded aggregates.

D. DECORATIVE CMUs: ASTM C90. (Polished)

1. Basis-of-Design: Provide the following system by the manufacturer indicated or other systems by other acceptable manufacturer's list with systems that achieve the system description, product attributes and characteristics including in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification.
   a. Basis of Design Decorative CMU Manufacturer: Cemex Architectural Polished Masonry.
      1) Locations, Colors and Aggregate Matrix:
         a) Color shall be integral through body.
         b) Base CMU Course inside Bathrooms: Black Beauty, Cemex 4471.
         c) CMU Walls Above Base Course inside Bathrooms: Pure White, Cemex 080.
2. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2,000 psi.
      1) Density Classification: Lightweight.
      2) Size: 7-5/8 inches x 7-5/8 inches x 16 inch.
3. Other Acceptable Manufacturers:
   a. Best Block.
   b. Oldcastle Masonry.
   c. Echelon Masonry.

## 2.5 MASONRY LINTELS

A. Masonry Lintels: Built-in-place masonry lintels made from bond beam CMUs matching adjacent CMUs in color, texture, and density classification, with reinforcing bars placed as indicated and filled with coarse grout.

## 2.6 MORTAR AND GROUT MATERIALS

A. Regional Materials: Aggregate for mortar and grout, cement, and lime shall be extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.

B. Portland Cement: ASTM C 150/C 150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

1. Alkali content shall not be more than 0.1 percent when tested according to ASTM C 114.

C. Hydrated Lime: ASTM C 207, Type S.

D. Portland Cement-Lime Mix: Packaged blend of Portland cement and hydrated lime containing no other ingredients.

E. Mortar Cement: ASTM C 1329/C 1329M

F. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979/C 979M. Use only pigments with a record of satisfactory performance in masonry mortar.

G. Colored Cement Products: Packaged blend made from masonry cement and mortar pigments, all complying with specified requirements, and containing no other ingredients.

1. Colored Portland Cement-Aggregate Mortar:

2. Basis-of-Design: Provide the following system by the manufacturer indicated or other systems by other acceptable manufacturer's list with systems that achieve the system description, product attributes and characteristics including in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification.
   a. Basis of Design Decorative Colored Portland Cement-Aggregate Mortar Manufacturer: Coosa Masonry Cements.
      1) Locations, Colors and Aggregate Matrix:
         a) Color shall be integral through body.
         b) Vertical Joints Between Base Polished CMU Course inside Bathrooms: Coosa Premium Dark.
         c) Horizontal Joint Between The Bottom Of Base CMU Course And Concrete Floor Shall Be: Premium Dark.
         d) Vertical and Horizontal Joints Between Polished CMU Walls Above Base Course inside Bathrooms Shall Be: Coosa Old Lime Putty.
         e) Horizontal Joints Between the Top of the Base CMU Course and Wall CMU Shall Be: Coosa Old Lime Putty.

   b. Products: Provide one of the following:
      1) Cemex S.A.B. de C.V.; Richcolor Masonry Cement.
      2) Holcim (US) Inc.; Rainbow Mortamix Custom Color Masonry Cement.

3) Lafarge North America Inc.; U.S. Cement Custom Color Masonry Cement.
4) National Cement Company, Inc.; Coosa Masonry Cement.
5) Lehigh Hanson; HeidelbergCement

H. Aggregate for Mortar: ASTM C 144.

1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
3. White-Mortar Aggregates: Natural white sand or crushed white stone.
4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

I. Aggregate for Grout: ASTM C 404.

J. 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.

1. Products: Provide one of the following:
   a. Euclid Chemical Company (The); Accelguard 80.
   b. Grace Construction Products, W. R. Grace & Co. - Conn.; Morset.
   c. Sonneborn Products, BASF Aktiengesellschaft; Trimix-NCA.

K. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent from same manufacturer.
1. Products: Provide one of the following:
   a. ACM Chemistries; RainBloc for Mortar.
   b. BASF Aktiengesellschaft; Rheopel Mortar Admixture.
   c. Grace Construction Products, W. R. Grace & Co. - Conn.; Dry-Block Mortar Admixture.

L. Water: Potable.

## 2.7 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.

B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

1. Products: Provide one of the following:
   a. Dayton Superior Corporation, Dur-O-Wal Division; D/A 810, D/A 812 or D/A 817.
   b. Heckmann Building Products Inc.; No. 376 Rebar Positioner.
   c. Hohmann & Barnard, Inc.; #RB or #RB-Twin Rebar Positioner.
   d. Wire-Bond; O-Ring or Double O-Ring Rebar Positioner.

C. Masonry-Joint Reinforcement, General: Ladder type complying with ASTM A 951/A 951M.

1. Interior Walls: Hot-dip galvanized carbon steel.
2. Exterior Walls: Hot-dip galvanized carbon steel.
3. Wire Size for Side Rods: 0.148-inch diameter.
4. Wire Size for Cross Rods: 0.148-inch diameter.
5. Spacing of Cross Rods: Not more than 16 inches o.c.
6. Provide in lengths of not less than 10 feet**,** with prefabricated corner and tee units.

D. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.
1. Ladder type with 1 side rod at each face shell of hollow masonry units more than 4 inches wide, plus 1 side rod or 2 side rods at each wythe of masonry 4 inches wide or less.
2. Tab type, either ladder or truss design, with 1 side rod at each face shell of backing wythe and with rectangular tabs sized to extend at least halfway through facing wythe but with at least 5/8-inch cover on outside face.
3. Adjustable (two-piece) type, either ladder or truss design, with one side rod at each face shell of backing wythe and with separate adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches. Size ties to extend at least halfway through facing wythe but with at least 5/8-inch cover on outside face. Ties have hooks or clips to engage a continuous horizontal wire in the facing wythe.

E. Masonry Joint Reinforcement for Veneers Anchored with Seismic Masonry-Veneer Anchors: Single 0.187-inch- diameter, hot-dip galvanized, carbon-steel continuous wire.

F. Masonry-Joint Reinforcement for Veneers Anchored with Seismic Masonry-Veneer Anchors: Single 0.187-inch diameter, hot-dip galvanized carbon-steel continuous wire.

## 2.8 TIES AND ANCHORS

A. General: Ties and anchors shall extend at least 1-1/2 inches into masonry 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. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A1064, with ASTM A 153/A 153M, Class B-2 coating.
2. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, with ASTM A 153/A 153M, Class B coating.
3. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

C. Adjustable Anchors for Connecting to Structural Steel Framing: As indicated. Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

2.9 EMBEDDED FLASHING MATERIALS

A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:

1. Stainless Steel: ASTM A 240/A 240M or ASTM A 666, Type 304, 0.016 inch (0.40 mm) thick.
2. Fabricate continuous flashings in sections 96 inches (2400 mm) long minimum, but not exceeding 12 feet (3.7 m). Provide splice plates at joints of formed, smooth metal flashing.
3. Fabricate through-wall metal flashing embedded in masonry from stainless steel with ribs at 3-inch (76-mm) intervals along length of flashing to provide an integral mortar bond.

   a. Products: Provide products from one of the following:
      1) Cheney Flashing Company; Cheney Flashing (Dovetail) or Cheney 3-Way Flashing (Sawtooth).
      2) Keystone Flashing Company, Inc.; Keystone 3-Way Interlocking Thruwall Flashing.
      3) Sandell Manufacturing Co., Inc.; Mechanically Keyed Flashing.

4. Fabricate through-wall flashing with snaplock receiver on exterior face where indicated to receive counterflashing.
5. Fabricate through-wall flashing with drip edge unless otherwise indicated. Fabricate by extending flashing 1/2 inch (13 mm) out from wall, with outer edge bent down 30 degrees and hemmed.
6. Fabricate through-wall flashing with sealant stop unless otherwise indicated. Fabricate by bending metal back on itself 3/4 inch (19 mm) at exterior face of wall and down into joint 1/4 inch (6 mm) to form a stop for retaining sealant backer rod.
7. Fabricate metal expansion-joint strips from stainless steel to shapes indicated.
8. Solder metal items at corners.

B. Flexible Flashing: Use the following unless otherwise indicated:

1. Rubberized-Asphalt Flashing: Composite flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than **0.040 inch (1.02 mm)**.

   a. Products: Provide one of the following:
      1) Carlisle Coatings & Waterproofing; CCW-705-TWF Thru-Wall Flashing.
      2) Fiberweb, Clark Hammerbeam Corp.; Aquaflash 500.
      3) Grace Construction Products, W. R. Grace & Co. - Conn.; Perm-A-Barrier Wall Flashing.
      4) Hohmann & Barnard, Inc.; Textroflash.
      5) W. R. Meadows, Inc.; Air-Shield Thru-Wall Flashing.
   b. Accessories: Provide preformed corners, end dams, other special shapes, and seaming materials produced by flashing manufacturer.

2. Elastomeric Thermoplastic Flashing: Composite flashing product consisting of a polyester-reinforced ethylene interpolymer alloy.

    a. Products: Provide one of the following:
        1) DuPont; Thru-Wall Flashing.
        2) Hohmann & Barnard, Inc.; Flex-Flash.
        3) Hyload, Inc.; Hyload Cloaked Flashing System.
        4) Mortar Net USA, Ltd.; Total Flash.

3. EPDM Flashing: Sheet flashing product made from ethylene-propylene-diene terpolymer, complying with ASTM D 4637/D 4637M, 0.040 inch (1.02 mm) thick.

    a. Products: Provide one of the following:
        1) Carlisle Coatings & Waterproofing; Pre-Kleened EPDM Thru-Wall Flashing.
        2) Firestone Specialty Products; FlashGuard.
        3) Heckmann Building Products Inc.; No. 81 EPDM Thru-Wall Flashing.
        4) Hohmann & Barnard, Inc.; Epra-Max EPDM Thru-Wall Flashing.
        5) Sandell Manufacturing Co., Inc.; EPDM Flashing.

C. Application: Unless otherwise indicated, use the following:

1. Where flashing is indicated to receive counterflashing, use metal flashing.
2. Where flashing is indicated to be turned down at or beyond the wall face, use metal flashing.
3. Where flashing is partly exposed and is indicated to terminate at the wall face, use metal flashing with a drip edge.
4. Where flashing is fully concealed, use metal flashing or flexible flashing.

D. Solder and Sealants for Sheet Metal Flashings: As specified in Section 076200 "Sheet Metal Flashing and Trim."

E. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

F. Termination Bars for Flexible Flashing: Aluminum or Stainless steel bars 0.075 inch by 1 inch (1.90 mm by 25 mm).

## 2.10 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.

B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 or PVC, complying with ASTM D 2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

C. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D 226/D 226M, Type I (No. 15 asphalt felt).

## 2.11 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Use Portland cement lime or mortar cement mortar unless otherwise indicated.
3. For exterior masonry, use Portland cement lime or mortar cement mortar.
4. For reinforced masonry, use Portland cement lime or mortar cement mortar.
5. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. 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.

C. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.

1. For masonry below grade or in contact with earth, use Type S.
2. For reinforced masonry, use Type S.
3. For mortar parge coats, use Type S.
4. For exterior, above-grade, load-bearing and nonload-bearing walls; for interior nonload-bearing partitions; and for other applications where another type is not indicated, use Type S.

D. Pigmented Mortar: Use colored cement.

1. Pigments shall not exceed 10 percent of portland cement by weight.
2. Pigments shall not exceed 5 percent of masonry cement by weight.
3. Mix to match Design Professional's sample.
4. Application: Use pigmented mortar for exposed mortar joints with the following units:
   a. Cast-stone trim units.

E. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.

1. Mix to match Design Professional's sample.
2. Application: Use colored-aggregate mortar for exposed mortar joints with the following units:
   a. Cast-stone trim units.

F. 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 TMS 602/ACI 530.1/ASCE 6 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 2000 psi.
3. Provide grout with a slump of 8 to 11 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 the Work.
2. Verify that foundations are within tolerances specified.
3. Verify that reinforcing dowels are properly placed.
4. Verify that substrates are free of substances that would impair mortar bond.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION, GENERAL

A. Build chases and recesses to accommodate items specified in this and other Sections.

B. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.

C. 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 1/4 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 (12-mm) 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.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch.

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 head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
4. 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 or other bond pattern indicated on Drawings; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs. All CMU shall be laid in a running bond pattern.

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4 inches. Bond and interlock each course of each wythe at corners. Do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

G. 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.

H. Fill cores in hollow CMUs under lintels, posts, and similar items to the foundation.

I. Build nonload-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.

1. Install compressible filler in joint between top of partition and underside of structure above.
2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch clearance between end of anchor rod and end of tube. Space anchors 48 inches o.c. unless otherwise indicated.
3. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 078443 "Joint Firestopping."

## 3.5 MORTAR BEDDING AND JOINTING

A. Lay hollow CMUs as follows:

1. Bed face shells in mortar and make head joints of depth equal to bed joints.
2. Bed webs fully bedded in mortar in all courses of piers, columns, and pilasters.
3. Bed webs fully bedded in mortar in grouted masonry, including starting course on footings.
4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.

B. Lay solid CMUs with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Set cast-stone trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.

1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
2. Wet joint surfaces thoroughly before applying mortar.
3. Rake out mortar joints for pointing with sealant.

D. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

E. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

F. Cut joints flush where indicated to receive waterproofing unless otherwise indicated.

## 3.6 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,

F. returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

## 3.7 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

A. Anchor masonry to structural steel and concrete, where masonry abuts or faces structural steel or concrete, to comply with the following:

1. Provide an open space not less than indicated on the Drawings between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
3. Space anchors as indicated.

## 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.

B. Form control joints in concrete masonry as follows:
   1. Install preformed control-joint gaskets designed to fit standard sash block.

## 3.9 LINTELS

A. Provide masonry lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.

B. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

## 3.10 FLASHING

A. General: Install embedded flashing at ledges and other obstructions to downward flow of water in wall where indicated.

B. Install flashing as follows unless otherwise indicated:

   1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
   2. At lintels, extend flashing a minimum of 6 inches (150 mm) into masonry at each end. At heads and sills, extend flashing 6 inches (150 mm) at ends and turn up not less than 2 inches (50 mm) to form end dams.
   3. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches (38 mm) or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.
   4. Install metal drip edges and sealant stops with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.
   5. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch (13 mm) back from outside face of wall, and adhere flexible flashing to top of metal drip edge.
   6. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch (13 mm) back from outside face of wall, and adhere flexible flashing to top of metal flashing termination.

7. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.

C. Install single-wythe CMU flashing system in bed joints of CMU walls where indicated to comply with manufacturer's written instructions. Install CMU cell pans with upturned edges located below face shells and webs of CMUs above and with weep spouts aligned with face of wall. Install CMU web covers so that they cover upturned edges of CMU cell pans at CMU webs and extend from face shell to face shell.

D. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

## 3.11 REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.

1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in TMS 602/ACI 530.1/ASCE 6.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Comply with requirements in TMS 602/ACI 530.1/ASCE 6 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Limit height of vertical grout pours to not more than 60 inches.

## 3.12 FIELD QUALITY CONTROL

A. Protect faces of decorative concrete masonry units. Chipped units in completed work will be removed and replaced.

B. Testing and Inspecting: The Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Construction Professional's expense. Testing Agency shall invoice charges for re-tests/re-inspecting to the Owner separately.

C. Inspections: Special inspections according to Level B inspections in accordance with the “International Building Code” and the schedule of special inspections

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.

D. Testing Prior to Construction: One set of tests.

E. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.

F. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.

G. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.

H. Mortar Test (Property Specification): For each mix provided, according to ASTM C 780. Test mortar for mortar air content and compressive strength.

I. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.

J. Prism Test: For each type of construction provided, according to ASTM C 1314 at 7 days and at 28 days.

## 3.13 PARGING

A. Parge exterior faces of below-grade masonry walls, where indicated, in two uniform coats to a total thickness of 3/4 inch. Dampen wall before applying first coat, and scarify first coat to ensure full bond to subsequent coat.

B. Use a steel-trowel finish to produce a smooth, flat, dense surface with a maximum surface variation of 1/8 inch per foot. Form a wash at top of parging and a cove at bottom.

C. Damp-cure parging for at least 24 hours and protect parging until cured.

## 3.14 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 Design Professional'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 applicable cleaning methods indicated in NCMA TEK 8-4A.

## 3.15 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Construction Professional'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 (100 mm) 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 (450 mm) of finished grade.

C. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.

D. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off property.

END OF SECTION 042200

# SECTION 042113.22 – THIN BRICK MASONRY VENEER

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Thin clay face brick units.

### 1.2 ALLOWANCES

A. Face brick is part of the Face Brick Allowance.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Verification: For each type and color of brick and colored mortar.

### 1.4 SUBMITTALS

A. Material Certificates: For each type and size of product.

B. Selection Samples: For each product specified, two complete samples of brick to reflect the full range of color, shades and surface texture of brick specified.

C. Verification Samples: For each product specified, two samples of four brick each, representing actual product, color, and texture.

### 1.5 QUALITY ASSURANCE

A. Sample Panels: Build sample panels to verify selections made under Sample submittals and to demonstrate aesthetic effects. Comply with requirements in Section 014000 "Quality Requirements" for mockups.

1. Build sample panels for [**each type of exposed unit masonry construction**] [**typical exterior wall**] [**typical interior wall**] [**typical exterior and interior walls**] in sizes approximately [**48 inches (1200 mm)**] [**60 inches (1500 mm)**] <**Insert dimension**> long by [**36 inches (900 mm)**] [**48 inches (1200 mm)**] <**Insert dimension**> high[ **by full thickness**].

1.6 FIELD CONDITIONS

A. 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 TMS 602/ACI 530.1/ASCE 6.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

B. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

1.7 MOCKUP

A. Construct mockup at location indicated or directed, and as follows:
1. Size: 4 foot by 4 foot (1.2 m by 1.2 m).
2. Include all unit types and sizes to be used, and mortar joint treatment.

B. The approved sample panel shall be a standard of workmanship for the Work.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver products of this section on pallets, with individual faces protected; keep dry.

B. Store in protected area or under cover on level ground; keep dry. Do not double-stack pallets.

PART 2 - PRODUCTS

2.1 UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6, except as modified by requirements in the Contract Documents.

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

2.2 THIN BRICK AND ACCESSORIES

A. Thin Brick: 1/2 inch thick face brick, and as follows:

1. Dimensional Tolerances: Plus 0 inch or minus 1/16 inch for any dimension 8 inches or less and plus 0 inch or minus 3/32 inch for any dimension more than 8 inches.
2. Out-of-Square Tolerance: Plus or minus 1/16 inch.
3. Warpage Tolerance: Plus 0 inch or minus 1/16 inch.
4. Variation of Shape from Specified Angle: Plus or minus one degree.
5. Modulus of Rupture: Not less than 250 psi when tested according to ASTM C67.
6. Tensile Bond Strength: Not less than 150 psi when tested before and after freeze-thaw test according to ASTM E488 as modified: Adhere a steel plate with a welded rod on a single thin-brick face with epoxy for each test.
7. 24-Hour Cold-Water Absorption: Not more than 6 percent when tested according to ASTM C67.
8. Freeze-Thaw Resistance: No detectable disintegration or separation after 300 freezing-and-thawing cycles when tested according to ASTM C666/C666M, Method B.
9. Chemical Resistance: Tested according to ASTM C650 and rated "not affected."
10. Efflorescence: Tested according to ASTM C67 and rated "not effloresced."
11. Surface Coating: Thin brick with colors or textures applied as coatings shall withstand 50 cycles of freezing and thawing; ASTM C67 with no observable difference in applied finish when viewed from 10 feet.
12. Back Surface Texture: Scored, combed, wire roughened, ribbed, keybacked, or dovetailed.

B. Basis-of-Design Product specification: 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 illustrate and establish 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. Basis of Design: Cherokee Brick; Belfast Gray GA.

2. Additional Acceptable Brick Manufacturers include but are not limited to the following:
   a. Cherokee Brick.
   b. Acme Brick.
   c. Hanson Brick.
   d. General Shale

C. Pointing Grout: Packaged, polymer-modified, sanded grout complying with ANSI A118.7.

## 2.3 MORTAR MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

B. Hydrated Lime: ASTM C207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

D. Masonry Cement: ASTM C91/C91M.

E. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C979/C979M. Use only pigments with a record of satisfactory performance in masonry mortar.

F. Colored Cement Products: Packaged blend made from Portland cement and hydrated lime and mortar pigments, all complying with specified requirements, and containing no other ingredients.

G. Aggregate for Mortar: ASTM C144.

1. White-Mortar Aggregates: Natural white sand or crushed white stone.
2. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

H. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C494/C494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

I. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with concrete bricks containing integral water repellent from same manufacturer.

J. Water: Potable.

K. Flexible Flashing: Use one of the following unless otherwise indicated:

1. Elastomeric Thermoplastic Flashing: Composite flashing product consisting of a polyester-reinforced ethylene interpolymer alloy.

2. EPDM Flashing: Sheet flashing product made from ethylene-propylene-diene terpolymer, complying with ASTM D4637/D4637M, 0.040 inch (1.02 mm) thick.

L. Solder and Sealants for Sheet Metal Flashings: As specified in Section 076200 "Sheet Metal Flashing and Trim."

M. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

## 2.4 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

## 2.5 MORTAR MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Use Portland cement-lime or masonry cement mortar unless otherwise indicated.
3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. 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.

C. Pigmented Mortar: Use colored cement product[ or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.

1. Pigments shall not exceed 10 percent of Portland cement by weight.
2. Pigments shall not exceed 5 percent of masonry cement or mortar cement by weight.
3. Application: Use pigmented mortar for exposed mortar joints.

D. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.

1. Mix to match Architect's sample.
2. Application: Use colored aggregate mortar for exposed mortar joints.

# PART 3 - EXECUTION

## 3.1 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.

B. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.

C. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested according to ASTM C67. Allow units to absorb water so they are damp but not wet at time of laying.

## 3.2 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation, do not vary by more than plus or minus 3/16 inch.

B. Joints:

1. Do not vary from thickness indicated by more than plus or minus 1/8 inch.
2. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8**.**

## 3.3 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 (100-mm) horizontal face dimensions at corners or jambs.

C. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

## 3.4 MORTAR BEDDING AND JOINTING

A. Lay masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

B. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

## 3.5 FIELD QUALITY CONTROL

## 3.6 REPAIRING, POINTING, AND CLEANING

A. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

B. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes.

2. Protect adjacent stone and nonmasonry surfaces from contact with cleaner.
3. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
4. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
5. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

## 3.7 MASONRY WASTE DISPOSAL

A. 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. Do not dispose of masonry waste as fill within 18 inches (450 mm) of finished grade.

B. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042613

# PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

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

## 1.2 SUMMARY

A. This Section includes stone veneer in the following applications:

1. Stone veneer on proposed seatwalls near restroom.

## 1.3 SUBMITTALS

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

1. For stone varieties proposed for use on Project, include data on physical properties required by referenced ASTM standards.

B. Stone Samples for Verification: For each color, grade, finish, and variety of stone required.

C. Colored Mortar Samples for Verification: For each color required. Label Samples to indicate types and amounts of pigments used.

D. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, sources of supply, and other information as required to identify materials used. Include mix proportions for mortar and source of aggregates.

1. Submittal is for information only. Neither receipt of list nor approval of mockups constitutes approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.

E. Qualification Data: For Installer.

## 1.4 QUALITY ASSURANCE

A. Installer Qualifications: An installer who employs experienced stone masons and stone fitters who are skilled in installing stone veneer assemblies similar in material, design, and extent to those indicated for this Project and whose projects have a record of successful in-service performance.

B. Source Limitations for Stone: Obtain each variety of stone, regardless of finish, from a single quarry with resources to provide materials of consistent quality in appearance and physical properties.

1. Obtain each variety of stone from a single quarry, whether specified in this Section or in another Section of the Specifications.

C. Source Limitations for Mortar Materials: Obtain ingredients of a uniform quality for each mortar component from a single manufacturer and each aggregate from one source or producer.

D. Mockups: Build mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution.

1. Build mockups for each type of stone assembly in sizes approximately 48 inches (1200 mm) long by 48 inches (1200 mm) high by full thickness, including face and backup.

2. Protect accepted mockups from the elements with weather-resistant membrane.
3. Approval of mockups is for color, texture, and blending of stone; relationship of mortar and sealant colors to stone colors; tooling of joints; and aesthetic qualities of workmanship.

a. Approval of mockups is also for other material and construction qualities specifically approved by Owner's representative 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 Owner's representative in writing.

4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

B. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

C. Deliver preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.

D. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.6 PROJECT CONDITIONS

A. Protection of Stone Assemblies: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed stone veneer assemblies when construction is not in progress.

1. Extend cover a minimum of 24 inches (600 mm) down both sides and hold cover securely in place.

B. Stain Prevention: Immediately remove mortar and soil to prevent them from staining the face of stone veneer assemblies.

1. Protect base of walls from rain-splashed mud and mortar splatter by coverings spread on the ground and over the wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and 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 end of each day to prevent rain from splashing mortar and dirt on completed stone veneer assemblies.

C. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace stone veneer assemblies damaged by frost or freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602 and Section 2104.3 of the Uniform Building Code.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.

D. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 STONE SOURCES

A. Varieties: Subject to compliance with requirements, provide stone of the following variety and from the following source:

1. Stone Type: Tennessee Fieldstone. Provide mock up for approval. Shall match existing stone work in Heritage Park amphitheater on site.

2. Color: Consistent variations of light brown.

3. Shape: random pattern

## 2.2 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified.

## 2.3 STONE

A. Owner's representative to approve samples for variety, color range, finish, and other stone characteristics relating to aesthetic effects.

B. Stone Standard: ASTM C 568.

## 2.4 MORTAR MATERIALS

A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

1. Low-Alkali Cement: Not more than 0.60 percent total alkali when tested according to ASTM C 114.

B. For pigmented mortar, use a colored cement formulation as required to produce color indicated or, if not indicated, as selected from manufacturer's standard formulations.

1. Pigments shall be composed of natural or synthetic iron oxides, compounded for use in mortar mixes, and with a record of satisfactory performance in stone masonry mortars.
2. Pigments shall not exceed 10 percent of portland cement by weight.
3. For colored-aggregate mortar, use natural color or white cement as necessary to produce required mortar color.

C. Mortar Pigments: Natural or synthetic iron oxides, compounded for use in mortar mixes and with a record of satisfactory performance in stone masonry mortars.

D. Water: Potable.

E. Products:

1. Colored Portland Cement-Lime Mix:

a. Blue Circle Cement; Eaglebond.
b. Glen-Gery Corporation; Color Mortar Blend.
c. Holnam, Inc.; Rainbow Mortamix Custom Color Cement/Lime.
d. Lafarge Corporation; Centurion Colorbond PL.
e. Lehigh Portland Cement Co.; Lehigh Custom Color Portland/Lime.

f. Riverton Corporation (The); Riverton Portland Cement Lime Custom Color.
g. Or approved equal.

2. Cold-Weather Admixture:

a. Euclid Chemical Co.; Accelguard 80.
b. Grace, W. R. & Co., Construction Products Division; Morset.
c. Sonneborn, Div. of ChemRex, Inc.; Trimix-NCA.
d. Or approved equal.

## 2.5 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene urethane or PVC.

B. Cavity Drainage Stone: Washed gravel or washed crushed stone complying with ASTM C 33, Size No. 6.

## 2.6 MASONRY CLEANERS

A. Job-Mixed Detergent Solution: Solution of 1/2-cup (0.14-L) dry-measure tetrasodium polyphosphate and 1/2-cup (0.14-L) dry-measure laundry detergent dissolved in 1 gal. (4 L) of water.

## 2.7 STONE FABRICATION

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

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

C. Dress joints (bed and vertical) straight and at right angle to face, unless otherwise indicated.

D. Finish exposed faces and edges of stone to comply with requirements indicated for finish and to match approved samples and mockups.

1. Finish: Rough face.

a. Finish exposed ends of copings same as front and back faces.

E. Carefully inspect stone at quarry or fabrication plant for compliance with requirements for appearance, material, and fabrication. Replace defective units before shipment.

## 2.8 MORTAR MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

1. Do not use calcium chloride.
2. Add cold-weather admixture (if used) at same rate for all mortar, regardless of weather conditions, to ensure that mortar color is consistent.
3. Mixing Pointing Mortar: Thoroughly mix cementitious and aggregate materials together before adding water. Then mix again, adding only enough water to produce a damp, unworkable mix that will retain its form when pressed into a ball. Maintain mortar in this dampened condition for one to two hours. Add remaining water in small portions until mortar reaches desired consistency. Use mortar within 30 minutes of final mixing; do not retemper or use partially hardened material.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in the form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Stone Masonry: Comply with ASTM C 270, Proportion Specification.

D. Pigmented Mortar: Select and proportion pigments with other ingredients to produce color required.

1. Mix to match Owner’s representative's approved sample.
2. Pigments shall not exceed 10 percent of portland cement by weight.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Examine surfaces indicated to receive stone assemblies, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

A. Advise installers of other work about specific requirements for placement of reinforcement, veneer anchors, flashing, and similar items to be built into stone veneer assemblies.

B. Clean dirty or stained stone surfaces by removing soil, stains, and foreign materials before setting. Clean stone by thoroughly scrubbing with fiber brushes and then drenching with clear

water. Use only mild cleaning compounds that contain no caustic or harsh materials or abrasives.

## 3.3 SETTING OF STONE ASSEMBLIES, GENERAL

A. Sort stone before it is placed in wall to remove stone that does not comply with requirements relating to aesthetic effects, physical properties, or fabrication, or that is otherwise unsuitable for intended use.

B. Arrange stones for good fit in ashlar pattern with joint widths within tolerances indicated. Insert small stones into spaces between larger stones as needed to produce joints as uniform in width as practical.

C. Arrange stones with color and size variations uniformly dispersed for an evenly blended appearance.

D. Set stone to comply with requirements indicated on Drawings. Install veneer anchors, supports, fasteners, and other attachments indicated or necessary to secure stone veneer assemblies in place. Set stone accurately in locations indicated with edges and faces aligned according to established relationships and indicated tolerances.

E. Maintain uniform joint widths except for variations due to different stone sizes and where minor variations are required to maintain bond alignment, if any. Lay walls with 3/8 inch (10 mm) joints.

F. Provide expansion, control, and pressure-relieving joints of widths and at locations indicated.

1. Keep expansion and pressure-relieving joints free of mortar and other rigid materials.

## 3.4 CONSTRUCTION TOLERANCES

A. Variation from Plumb: For vertical lines and surfaces, do not exceed 3/8 inch in 20 feet (10 mm in 6 m) or more. For external corners, expansion joints, control joints, and other conspicuous lines, do not exceed 1/2 inch in 40 feet (13 mm in 12 m) or more.

B. Variation from Level: For bed joints and lines of exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines, do not exceed 1/2 inch in 40 feet (13 mm in 12 m) or more.

C. Variation of Linear Building Line: For position shown in plan, do not exceed 3/4 inch in 40 feet (19 mm in 12 m) or more.

D. Measure variation from level, plumb, and position shown in plan as variation of the average plane of the face of each stone from level, plumb, or dimensioned plane.

E. Variation in Mortar-Joint Thickness: Do not vary from joint size range indicated.

F. Variation in Plane between Adjacent Stones: Do not exceed one-half of tolerance specified for thickness of stone.

G. Variation in Plane on Face of Individual Stone: Do not exceed one-half of tolerance specified for thickness of stone.

## 3.5 POINTING

A. Prepare stone-joint surfaces for pointing with mortar by removing dust and mortar particles. Where setting mortar was removed to depths greater than surrounding areas, apply pointing mortar in layers not more than 3/8 inch (10 mm) deep until a uniform depth is formed.

B. Point stone joints by placing and compacting pointing mortar in layers not more than 3/8 inch (10 mm) deep. Compact each layer thoroughly and allow to become thumbprint hard before applying next layer.

C. Tool joints, when pointing mortar is thumbprint hard, with a smooth jointing tool to produce the following joint profile:

1. Joint Profile: Raked, ½” deep.

## 3.6 ADJUSTING AND CLEANING

A. Remove and replace stone assemblies of the following description:

1. Broken, chipped, stained, or otherwise damaged stone. Stone may be repaired if methods and results are approved by Owner’s representative.
2. Defective joints.
3. Stone assemblies not matching approved samples and mockups.
4. Stone assemblies not complying with other requirements indicated.

B. Replace in a manner that result in stone assemblies' matching approved samples and mockups, complying with other requirements, and showing no evidence of replacement.

C. In-Progress Cleaning: Clean stone assemblies as work progresses. Remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean stone assemblies as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on mockup; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before cleaning stone veneer assemblies.
3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.

4. Wet wall surfaces with water before applying cleaner; remove cleaner promptly by rinsing thoroughly with clear water.
5. Clean stone veneer assemblies by bucket and brush hand-cleaning method described in BIA Technical Note No. 20 Revised II, using job-mixed detergent solution.
6. Clean stone veneer assemblies with proprietary acidic cleaner applied according to manufacturer's written instructions.

## 3.7 EXCESS MATERIALS AND WASTE

A. Excess Stone: To be removed from site by contractor.

B. Excess Masonry Waste: Remove excess clean masonry waste, and other waste, and legally dispose of off Owner's property.

END OF SECTION 044300

# PART 1 - SECTION 051200- STRUCTURAL STEEL GENERAL

## 1.1 RELATED DOCUMENTS

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

## 1.2 SUMMARY

A. This Section includes the following:
   1. Structural steel.
   2. Grout.

## 1.3 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC's "Code of Standard Practice for Steel Buildings and Bridges," that support design loads.

## 1.4 PERFORMANCE REQUIREMENTS

A. Connections: Provide details of all connections in the Contract Documents that are not specifically detailed to be selected or completed by structural-steel fabricator to withstand ASD-service loads indicated and comply with other information and restrictions indicated.
   1. Engineering Responsibility: Fabricator's responsibilities include using a qualified professional engineer, who is registered in the State where the project is located, to prepare structural analysis data for structural-steel connections.

## 1.5 ACTION SUBMITTALS

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

B. 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.
   4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
   5. For structural-steel connections indicated to comply with design loads, include structural shop drawings signed and sealed by the qualified professional engineer, registered in the State in which the project is located, responsible for their preparation. As an alternate, the Fabricator’s Engineer shall submit a signed and sealed cover letter with the shop drawings that substantiates the design information and confirms in writing that the shop and erection drawings produced by the Fabricator properly incorporates her/his design.
   6. Structural steel frame shop drawings for the project shall be submitted to the Design Professional for review and approval action in phases/sequences of maximum 50,000 square foot plan area in minimum two-week intervals.

C. Qualification Data: For Installer and fabricator.

D. Mill Test Reports: Signed by manufacturers certifying that the following products comply with requirements. Submit for record purposes only and retain at job site.
   1. Structural steel including chemical and physical properties.
   2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
   3. Tension-control, high-strength bolt-nut-washer assemblies.
   4. Shear stud connectors.
   5. Nonshrink grout.

E. Source quality-control test reports.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who complies with all AISC quality criteria. Company specializing in performing the work of this section with minimum 5 years of documented experience.

B. Fabricator Qualifications: A qualified fabricator who complies with all AISC BU quality criteria. Company specializing in performing the work of this section with minimum 5 years of documented experience. The Construction Professional shall submit “Fabricator’s Certificate of Compliance.” Construction Professional shall also provide copies of fabricator’s certification or building code evaluation report and Fabricator’s quality control manual for each approved Fabricator that is exempt from Special Inspections of shop fabrications and implementation procedures in accordance with Section 1704.2.5.2. Testing Agency shall perform at least one fabrication shop visit to verify that the Fabricator meets the requirements for exemption.

C. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."
   1. Certification: Submit welders’ qualifications in accordance with AWS D1.1, current within the previous 12 months, for Design Professional’s information only.

D. Comply with applicable provisions of the following specifications and documents:
   1. AISC's "Code of Standard Practice for Steel Buildings” AISC 360-10
   2. AISC's "Specification for Structural Steel Buildings, 14th Edition."
   3. AISC's "Specification for the Design of Steel Hollow Structural Sections."
   4. AISC's "Specification for Allowable Stress Design of Single-Angle Members."
   5. RCSC's "Specification for Structural Joints Using High Strength Bolts."
   6. AISC’s “Quality Criteria and Inspection Standards.”
   7. American Welding Society (AWS):
      a. AWS D1.1, “Structural Welding Code – Steel.”
      b. AWS B1.10, “Guide for the Non-Destructive Inspection of welds.”
      c. AWS B2.1, “Welding Procedure and Performance Qualification.”
   8. Steel Structures Painting Council (SSPC), “Systems and Specifications,” Latest Edition.
   9. American Society for Non-Destructive Testing (ASNT), standards as referenced herein.

E. Steel Finish for Members Exposed to View: AESS 2 minimum.

F. Finish Painting: Coordinate finish painting requirements with Division 9 Painting Section.

G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

H. Allowable tolerances:
   1. In manufacture: Within limits established by ASTM A6/A6M.
   2. In erection: Complying with AISC “Code of Standard Practice.”

I. Qualifications of welders:
   1. Welders employed on the work shall have passed qualification tests within the past 12 months in the position for which employed, using test procedures covered in the AWS D1.1.
   2. Construction Professional shall require any welder to retake the qualification test when, in the opinion of the Design Professional, the work of the welder creates a reasonable doubt as to the proficiency of the welder.

1.7 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 erosion and deterioration.
   1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.
   2. 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.

1.8 COORDINATION

A. Furnish 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.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A992, Grade 50 ksi

B. Channels, Angles, M, S-Shapes: ASTM A36.

C. Plate and Bar: ASTM A36.

D. Cold-Formed Hollow Structural Sections: ASTM A500 Grade C / ASTM A1085, structural tubing.

E. Steel Pipe: ASTM A 53 GRADE B, Fy = 35 ksi.
   1. Weight Class: As indicated on Drawings.
   2. Finish: Black.

F. Welding Electrodes: Comply with AWS requirements.

## 2.2 BOLTS, CONNECTORS, AND ANCHORS

A. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, heavy hex head steel structural bolts with splined ends; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.
   1. Finish: Plain.

B. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1, Type B.

C. Unheaded Anchor Rods: ASTM F 1554, Grade 36.
   1. Configuration: As shown on Drawings.
   2. Nuts: ASTM A 563 heavy hex carbon steel.
   3. Plate Washers: ASTM A 36 carbon steel-Fabricator shall use plate washers as indicated in Table 14-2, AISC Steel Manual, 14th Edition.
   4. Washers: ASTM F 436 hardened carbon steel.
   5. Finish: Plain.

D. Threaded Rods: ASTM A 36, Grade A, unless otherwise noted on plan
   1. Nuts: ASTM A 563 heavy hex carbon steel.
   2. Washers: ASTM A 36 carbon steel.
   3. Finish: Plain.

E. Clevises, Turnbuckles: ASTM A 108, Grade 1035, cold-finished carbon steel.

F. Eye Bolts and Nuts: ASTM A 108, Grade 1030, cold-finished carbon steel.

G. Sleeve Nuts: ASTM A 108, Grade 1018, cold-finished carbon steel.

## 2.3 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time per manufacturer's product data. Minimum compressive strength = 7000 psi at 28 days.

B. Non-Shrink Grout:
   1. Acceptable products:
      a. Gifford-Hill and Co., Supreme.
      b. L&M Construction Chemicals Co., Crystex.
      c. Master Builders Co., Master Flow 713.
      d. Sonneborn Building Products, Sonogrout.
      e. The Upco Co., Upcon High Flow 261.
      f. U. S. Grout Corp., Five Star Grout.
      g. W. R. Bonsal Co., Type A Construction Grout.
      h. W. R. Meadows, Inc., 588.
   2. Characteristics: High flow, non-metallic, controlled expansive type grout.

## 2.4 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings, AISC 360-10" and AISC's "Specification for Structural Steel Buildings, 14th Edition."
   1. Beams and girders shall be fabricated and installed with natural camber up.
   2. Identify high-strength structural steel according to ASTM A 6 and maintain markings until structural steel has been erected.
   3. Mark and match-mark materials for field assembly. For exposed steel members, mark member so it is not visible in the finished work.
   4. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
   5. Members shall not be spliced, connected, or extended, except as shown on Drawings, without the Design Professional's written consent.
   6. Connections shall be shop welded and field bolted, unless otherwise indicated.
   7. Cut required beam penetrations and reinforce as indicated. For openings shown on the drawings, no change in location will be permitted without Design Professional's written consent.

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.

C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces. Remove burrs and roughness from holes.

D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 1, "Solvent Cleaning" and SSPC-SP 2, "Hand Tool Cleaning."

F. Steel Wall-Opening Framing: Select true and straight members for fabricating steel wall-opening framing to be attached to structural steel. Straighten as required to provide uniform, square, and true members in completed wall framing.

G. Holes: Provide holes required for securing other work to structural steel and for passage of other work through steel framing members.
   1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
   2. Base-Plate Holes: Cut, drill, or punch holes perpendicular to steel surfaces.
   3. Weld threaded nuts to framing and other specialty items indicated to receive other work.
   4. Remove burrs and roughness from holes and fabricated elements.

H. Use seated connections only when they do not interfere with architectural features.

I. Design connections not detailed on the drawings shall be designed under direct supervision of a Professional Engineer who is experienced in design of this work and licensed in the State in which the Project is located. Connections for non-composite beams shall be adequate to provide for the reaction specified on plan.

J. Connections for composite beams shall be adequate to provide for the reaction specified on plan.

## 2.5 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using High Strength Bolts" for type of bolt and type of joint specified.
   1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
   1. Remove backing bars or runoff tabs, back gouge, and grind steel smooth in areas where structural steel is exposed to view.
   2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings, AISC 360-10" for mill material.
   3. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent weld show-through on exposed steel surfaces.
      a. Grind butt welds flush.
      b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.

## 2.6 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.

## 2.7 SOURCE QUALITY CONTROL

A. The Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.
   1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

C. Bolted Connections: Shop-bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using High Strength Bolts."

D. Welded Connections: In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1 and the following inspection procedures:
   1. Ultrasonic Inspection: ASTM E 164.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments, with steel erector present, for compliance with requirements. This survey shall be performed by a licensed Land Surveyor, who is registered in the State that the project is located.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. As erection proceeds, survey final elevations and plan locations of columns, beams, and other major structural steel elements for compliance with requirements and specified tolerances.

D. Construction Professional shall engage land surveyor to perform surveying, who is registered in the State that the project is located.

E. The steel frame survey submittals shall indicate final elevations and plan locations of columns, beams, and other major framing, as well as column plumbness. Indicate discrepancies between actual installation and the Contract Documents.

F. The placement or application of other materials which might obscure or restrain surveyed elements cannot be made until submittal has been approved by the Design Professional and unsatisfactory conditions have been corrected.

G. The Construction Professional shall check all exposed structural steel members upon delivery for twist, kinks, gouges, or other imperfections which may result in rejection of the appearance of the member. Coordinate remedial action with Fabricator prior to erecting steel.

3.2 PREPARATION

A. The structure has not been designed to stand on its own or to support design loads until the work is complete. 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.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC's "Code of Standard Practice for Steel Buildings, AISC 360-10" and "Specification for Structural Steel Buildings—14$^{th}$ Edition."

B. Anchor bolts: Furnish anchor bolts and other connectors for securing structural steel to foundations and other in-place work. Furnish template for presetting bolts and other anchors to accurate locations.

C. Base Plates: Clean concrete surfaces of bond-reducing materials, and roughen surfaces prior to setting base plates. Clean bottom surface of base plates and bearing plates.

1. Set base plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of base plate.
3. Snug-tighten Pretension anchor rods after supported members have been positioned and plumbed. Anchor bolt shall fully engage nut at top of base plate. Do not remove wedges or shims but, if protruding, cut off flush with edge of base plate before packing with grout.
4. Promptly pack grout solidly between bearing surfaces and base 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.
5. Grout solidly between column plates and bearing surfaces, complying with manufacturer's instructions for nonshrink grout. Trowel grouted surfaces smooth, splaying neatly to 45 degrees. Grout shall be placed under all column base plates before any vertical loads are added.

D. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings, AISC 360-10".

E. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be 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.

F. Splice members only where indicated.

G. Remove erection bolts on welded, exposed structural steel; fill holes with plug welds; and grind smooth at exposed surfaces.

H. Do not field cut or alter structural members without approval of Design Professional. Do not use thermal cutting during erection unless approved by Design Professional. Finish thermally cut sections within smoothness limits in AWS D1.1.

I. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

J. Maximum Variation From Plumb: 1/4 inch (6 mm) per level, non-cumulative.

K. Maximum Offset From True Alignment: 1/4 inch (6 mm).

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using High Strength Bolts" for type of bolt and type of joint specified.
1. Joint Type: Snug-tightened as indicated on the Drawings.
2. Use high strength bolts in bearing with the threads included in shear plane as indicated on the drawings.
3. Bolts shall be of length allowing full thread engagement.
4. Enter bolts into holes without damaging the thread.

5. Provide one hardened flat washer under the turned element.
6. Bolt holes shall be standard round holes. Oversize and short-slotted holes are subject to the Design Professional's acceptance. Where oversize or short-slotted holes are accepted for use, provide standard hardened washers for adequate bearing area. Place washers on exposed face of oversize or short-slotted hole.
7. Use no manual torque wrenches for final tightening of high strength bolts.
8. Draw unfinished bolt heads and nuts tight against the work with a wrench not less than 1'-3" long.

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
1. Comply with AISC's "Code of Standard Practice for Steel Buildings, AISC 360-10" and "Specification for Structural Steel Buildings" for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
2. Welding shall be performed by welders currently qualified under AWS standard qualification procedure. Each shop and field welder shall be assigned an identifying symbol or mark, and all welds made by him shall be so identified.
3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings, AISC 360-10" for mill material.
4. Verify that weld sizes, fabrication sequence, and equipment used for exposed structural steel will limit distortions to allowable tolerances. Prevent weld show-through on exposed steel surfaces.
   a. Grind butt welds flush.
   b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.
   c. Field weld components indicated on Shop Drawings

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Field quality control testing of steel shall be performed by an Independent Testing Laboratory selected the Owner. The Construction Professional shall be responsible for all costs associated with re-testing of materials and/or installations failing to comply with Contract criteria. The testing agency shall invoice the charges for re-test/re-inspections to the Owner separately.

B. Bolted Connections: Shop-bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using High Strength Bolts." Test at least 25% of the bolts in each connection.

C. Welded Connections: Visually inspect 100% of field welds according to AWS D1.1.
1. In addition to visual inspection field welds will be tested according to AWS D1.1 and the following inspection procedures:
   a. Ultrasonic Inspection: ASTM E 164 for all full penetration welds and partial penetration column splice welds.
2. Verification of welder's qualifications and welding procedures and materials.
3. Monitoring of fabricator's and erector's quality control programs.

D. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AAWS D1.1 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 on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.

E. Erection: Perform field inspections to verify that erection of the structural steel frame is straight, plumb, square and level. Confirm with written report showing NO EXCEPTIONS to the specified criteria to the area inspected prior to Construction Professional's installation of metal decking for concrete placement on elevated slabs in the area inspected. The entire structural frame shall be inspected and confirmed for compliance with this criteria.

F. Construction Professional's duties relative to testing:
1. Provide Testing Agency access to project site.
2. Notify Testing Agency of schedule for shop and field work.
3. Provide Testing Agency with complete set of shop and erection drawings, material lists, mill reports and cutting lists.
4. Furnish temporary scaffolding and work platforms for testing work.
5. Coordinate with Testing Agency for field testing.
6. Pay costs of additional testing performed beyond scope of that required and for re-testing if initial tests reveal non-conformance with specified requirements.

G. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

H. Record Documents: The Testing Agency shall maintain results of specified tests and shall deliver copies to the Design Professional and Construction Professional.

I. Design Professional's Reviews:
1. The Construction Professional shall provide the Design Professional with minimum 48-hour notice of readiness for observation of the aspects of steel work noted below.
   a. Each level, or portion of level, of steel supporting elevated slabs PRIOR to placement of slab concrete.
   b. Upper level steel areas supporting roof system.
2. The Construction Professional shall have copies of POSITIVELY APPROVED submittal data bearing the Design Professional's approval action stamp (see Spec 01 6000) made available for reference at the times of scheduled inspections.
3. The Construction Professional shall provide necessary lifts, lighting, equipment operators, and other incidentals for the Testing Laboratory and the Design Professional to safely perform the required observations.
4. The Construction Professional and the Owner's Testing Laboratory shall jointly inspect the steel work for compliance with Contract criteria in accordance with the criteria outline elsewhere in this Section.
5. At the completion of inspected areas, the testing laboratory shall provide the Construction Professional with a hand-written report of the inspected areas. Report shall indicate specific areas and aspects of work inspected and approved. The Testing Laboratory shall follow-up with an official typewritten report within seven calendar days thereafter.

6. Each area of inspection shall have been reviewed by the Testing Laboratory prior to observation by the Design Professional. Area shall be reviewed and accepted by the Design Professional prior to installing subsequent slab work and roof system work.
7. The Construction Professional shall be responsible for all costs associated with re-inspections of installations to attain full approval by the Testing Laboratory and the Design Professional. *(The testing agency shall invoice the charges for re-test/re-inspections to the Owner separately.)*

3.6 REPAIRS AND PROTECTION

A. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of painted structural steel.
   1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
   2. For structural steel exposed to weather, provide primer, intermediate, and finish coat of paint in the millages specified.

B. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.

END OF SECTION 05 1200

# SECTION 053100-STEEL DECK

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes the following:
   1. Roof deck.

B. Related Sections include the following:
   1. Section 051200 "Structural Steel"

### 1.2 ACTION SUBMITTALS

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

B. Shop Drawings: Show layout and types of deck panels, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction. Shop drawings shall not be duplications of the Construction Documents or plans.

C. Product Certificates: For each type of steel deck, signed by product manufacturer.

D. Welding certificates.

E. Field quality-control test and inspection reports.

F. 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. Self drilling fasteners.

G. Research/Evaluation Reports: For steel deck.

### 1.3 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency qualified according to ASTM E 329 for testing indicated.

B. Welding: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."

C. Fire-Test-Response Characteristics: Where indicated, provide steel deck units identical to those tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to the State Fire Marshall.
   1. Fire-Resistance Ratings: Indicated by design designations of applicable testing and inspecting agency.

2. Steel deck units shall be identified with appropriate markings of applicable testing and inspecting agency.

D. 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" with Supplement 1, dated 2010.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this Section with minimum 5 years of experience.

B. Deck Manufacturer: Steel Deck Institute member company who is approved to manufacture specified decking.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling. Store metal deck with one end selevated for drainage.

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 ROOF DECK

A. Steel 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. Galvanized and Shop-Primed Steel Sheet: ASTM A 653, Structural Steel (SS), Grade 33, G60 zinc coating
2. Profile Depth: As indicated.
3. Design Uncoated-Steel Thickness: As indicated.
4. Span Condition: Triple span or more.
5. Side Laps: No. 10 screws as noted on Drawings.

B. Do not prime galvanized surfaces, surfaces to receive sprayed-on fireproofing/insulation.

2.2 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Self-Drilling Fasteners: For side lap connections use #10-16 HWH pilot point self-drilling screws for roof deck.

C. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

D. 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.

E. 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.

F. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.

G. Steel Sheet Accessories: Steel sheet of same material, finish and thickness as deck, unless otherwise indicated.

H. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck, with 3-inch-wide flanges and level recessed pans of 1-1/2-inch minimum depth. For drains, cut holes in the field.

I. Galvanizing Repair Paint: ASTM A 780 and SSPC-Paint 20 or DOD-P-21035, with dry film containing a minimum of 94 percent zinc dust by weight.

J. 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.

3.2 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications, approved shop drawings, and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.

B. Locate deck bundles to prevent overloading of supporting members.

C. 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.

D. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

E. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

F. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

G. Install finished deck true to line. Underside of deck shall be true and without defects.

H. Install decking units and accessories in accordance with product data and approved shop drawings.

I. Install deck with corrugations running perpendicular to supports. Lay only as much deck as can be welded during same work period.

J. Following erection, wire-brush welds and similar scars resulting from installation. Touch up using primer of same type as shop primer.

K. Where deck forms a finished ceiling surface, exercise care to prevent misplaced holes, dents or other imperfections in deck. Damaged deck shall be repaired or replaced.

3.3 ROOF-DECK INSTALLATION

A. Fasten roof-deck panels to steel supporting members by screws indicated and as follows: (Fasten deck after supporting members are securely attached.)
   1. Screws: As indicated.
   2. Attachment Spacing: As indicated.
   3. Attach metal roof deck 6 inches on center at roof opening framing.
   4. Do not place or store metal deck on steel members until these steel members are permanently anchored and bridged. Avoid excessive concentrated loads during construction.
   5. Install metal deck with major flat surface on top (normal position). Install metal deck according to approved shop drawings.

B. Side-Lap and Perimeter Edge Fastening: As indicated

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 attachments not more than 12 inches apart with at least one attachment at each corner.

E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Attach to substrate to provide a complete deck installation.
   1. Attach 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.

G. Cut openings in deck for exhaust ducts or fans, plumbing vents and similar projections furnished by other trades.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: The Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. All field welds will be subject to inspection.

C. After five to ten squares of roof deck have been erected, testing laboratory will visually inspect the work for conformance with this Specification. All fastenings, including sidelaps, will be inspected for size, quality and spacing.

D. Deficiencies found during the inspection will be brought to the attention of the Design Professional and the Construction Professional.

E. Demonstrate corrective procedures for deficiencies found to the satisfaction of the testing laboratory before erection of the roof deck is resumed.

F. When the erection of the roof deck is completed, but before placing any roofing materials, the testing laboratory will make a final inspection of the deck installation and submit a final report to the Design Professional stating compliance with the contract documents.

G. Testing agency will report test results promptly and in writing to Construction Professional and Design Professional.

H. Remove and replace work that does not comply with specified requirements.

I. Additional testing and inspecting, at Construction Professional's expense, will be performed to determine compliance of corrected work with specified requirements.

3.5 REPAIRS AND 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 brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.
   1. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.

C. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Material completion.

END OF SECTION 053100

# SECTION 061000 - ROUGH CARPENTRY

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section Includes:
   1. Wood blocking and nailers.
   2. Plywood backing panels.

B. Related Requirements:
   1. Section 313116 "Termite Control" for site application of borate treatment to wood framing.

### 1.3 GENERAL

A. Any blocking in rated walls shall to be fire treated.

B. All blocking at roofs or in exterior walls shall be Pressure Treated.

### 1.4 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

   1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
   2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
   3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
   4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.5 INFORMATIONAL SUBMITTALS

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

1. Wood-preservative-treated wood.
2. Fire-retardant-treated wood.
3. Power-driven fasteners.
4. Post-installed anchors.
5. Metal framing anchors.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

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. For exposed lumber indicated to receive a stained or natural finish, **mark grade stamp on end or back of each piece**.
3. Dress lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber: 15 percent for 2-inch nominal thickness or less; 19 percent for more than 2-inch nominal thickness unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

2. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

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 items indicated on Drawings, and the following:

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, 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 above the ground in crawlspaces or unexcavated areas.
5. Wood floor plates that are installed over concrete slabs-on-grade.

## 2.3 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Treatment shall not promote corrosion of metal fasteners.
2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.

C. Kiln-dry lumber after treatment to maximum moisture content of 19 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.

E. Application: Treat items indicated on Drawings, and the following:
   1. Concealed blocking.
   2. Roof construction.
   3. Plywood backing panels.

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. Cants.
   4. Furring.
   5. Grounds.

B. Dimension Lumber Items: Construction or No. 2 grade lumber of any of the following species:

   1. Hem-fir (north); NLGA.
   2. Mixed southern pine or southern pine; SPIB.
   3. Spruce-pine-fir; NLGA.
   4. Hem-fir; WCLIB or WWPA.
   5. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
   6. Western woods; WCLIB or WWPA.
   7. Northern species; NLGA.
   8. Eastern softwoods; NeLMA.

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 WWPA.

D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

E. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

## 2.5 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: Plywood, DOC PS 1, Exterior, A-C fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch 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. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

D. Lag Bolts: ASME B18.2.1.

E. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.

F. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry assemblies and equal to four times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.

1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.

2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.

## 2.7 METAL FRAMING ANCHORS

A. Manufacturers: Manufacturers offering products that may be incorporated into the Work include the following:
1. Cleveland Steel Specialty Co.
2. KC Metals Products, Inc.
3. Phoenix Metal Products, Inc.
4. Simpson Strong-Tie Co., Inc.
5. USP Structural Connectors.

B. Allowable design loads, as published by manufacturer, shall meet allowable design loads. 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.

C. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 coating designation.

1. Use for interior locations unless otherwise indicated.

D. Hot-Dip, Heavy-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); G185 coating designation; and not less than 0.036 inch thick.

1. Use for wood-preservative-treated lumber and where indicated.

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. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.

C. 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 nailers, blocking, and similar supports to comply with requirements for attaching other construction.

D. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.

E. Install shear wall panels to comply with manufacturer's written instructions.

F. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

G. Install sill sealer gasket to form continuous seal between sill plates and foundation walls.

H. Do not splice structural members between supports unless otherwise indicated.

I. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

J. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:

1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal thickness.
3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. and to solidly fill space below partitions.
4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet o.c.

K. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

L. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

1. Use inorganic boron for items that are continuously protected from liquid water.
2. Use copper naphthenate for items not continuously protected from liquid water.

M. 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.

N. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

## 3.2 WOOD BLOCKING, AND NAILER INSTALLATION

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

D. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

## 3.3 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet enough that moisture content exceeds that specified, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061000

# SECTION 061600 - SHEATHING

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section Includes:

1. Wall sheathing.
2. Parapet.
3. sheathing.
4. Roof sheathing.
5. Sheathing joint and penetration treatment.

B. Related Requirements:

1. Section 072726 "Fluid-Applied Membrane Air Barrier" for Fluid-Applied Membrane barrier applied over wall sheathing.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.

### 1.4 INFORMATIONAL SUBMITTALS

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

1. Fire-retardant-treated plywood.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance Ratings: As tested according to ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

2.2 WOOD PANEL PRODUCTS

A. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.

B. Factory mark panels to indicate compliance with applicable standard.

2.3 FIRE-RETARDANT-TREATED PLYWOOD

A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Use treatment that does not promote corrosion of metal fasteners.
2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.

3. Design Value Adjustment Factors: Treated lumber plywood shall be tested according to ASTM D 5516 and design value adjustment factors shall be calculated according to ASTM D 6305. Span ratings after treatment shall be not less than span ratings specified. For roof sheathing and where high-temperature fire-retardant treatment is indicated, span ratings for temperatures up to 170 deg F shall be not less than span ratings specified.

C. Kiln-dry material after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.

D. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.

E. Application: Treat all plywood unless otherwise indicated.

1. Roof sheathing.

## 2.4 WALL SHEATHING

A. Glass-Mat Gypsum Sheathing: ASTM C 1177/1177M.

1. Products: Provide one of the following:

a. Georgia-Pacific Building Products; Dens-Glass Gold.

b. CertainTeed Corporation; GlasRoc.

c. National Gypsum Company; Gold Bond eXP Extended Exposure Sheathing.

d. United States Gypsum Company; Securock.

2. Type and Thickness: Type X, 5/8 inch thick.

B. Cementitious (Concrete) Backer Board Units: ASTM C 1325, Type A.

1. Manufacturers: Provide products by one of the following:

a. Custom Building Products.

b. National Gypsum.

c. United States Gypsum Company.

2. Thickness: 5/8 inch.

## 2.5 PARAPET SHEATHING

A. Plywood Sheathing: Either DOC PS 1 or DOC PS 2, Exterior, Structural I sheathing.

1. Span Rating: Not less than 16/0.
2. Nominal Thickness: Not less than 1/2 inch.

B. Glass-Mat Gypsum Sheathing: ASTM C 1177/1177M.

1. Manufacturers: Provide products by one of the following:

a. CertainTeed Corporation.

b. Georgia-Pacific Building Products.

c. National Gypsum Company.

d. United States Gypsum Company.

2. Type and Thickness: Type X, 5/8 inch thick.

2.6 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. For roof parapet and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

D. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

E. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached.

1. For steel framing less than 0.0329 inch thick, use screws that comply with ASTM C 1002.
2. For steel framing from 0.033 to 0.112 inch thick, use screws that comply with ASTM C 954.

F. Screws for Fastening Composite Nail Base Insulated Roof Sheathing to Metal Roof Deck: Steel drill screws, in type and length recommended by sheathing manufacturer for thickness of sheathing to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117. Provide washers or plates if recommended by sheathing manufacturer.

2.7 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

A. Sealant for Glass-Mat Gypsum Sheathing: Silicone joint sealant compatible with joint substrates formed by gypsum sheathing and other materials, recommended by sheathing manufacturer and fluid-applied membrane air barrier manufacturer for application indicated

and complying with requirements for elastomeric sealants specified in Section 079200 "Joint Sealants."

B. Sealant for Glass-Mat Gypsum Sheathing: Silicone emulsion sealant complying with ASTM C 834, compatible with sheathing tape and sheathing and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.

1. Sheathing Tape: Self-adhering glass-fiber tape, minimum 2 inches wide, 10 by 10 or 10 by 20 threads/inch, of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing and with a history of successful in-service use.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:

1. Table 2304.9.1, "Fastening Schedule," in the ICC's International Building Code.
2. ICC-ES evaluation report for fastener.

D. Coordinate wall parapet and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

E. Do not bridge building expansion or control joints; cut and space edges of panels to match spacing of structural support elements.

F. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

### 3.2 WOOD STRUCTURAL PANEL INSTALLATION

A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.

B. Fastening Methods: Fasten panels as indicated below:

1. Roof Sheathing:

    a. Screw to cold-formed metal framing.
    b. Space panels 1/8 inch apart at edges and ends.

3.3 GYPSUM SHEATHING INSTALLATION

A. Comply with GA-253 and with manufacturer's written instructions.

    1. Fasten gypsum sheathing to cold-formed metal framing with screws.
    2. Install panels with a 3/8-inch gap where non-load-bearing construction abuts structural elements.
    3. Install panels with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.

B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.

C. Horizontal Installation: Install sheathing with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent panels without forcing. Abut ends over centers of studs, and stagger end joints of adjacent panels not less than one stud spacing. Attach at perimeter and within field of panel to each stud.

    1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of panels.

D. Vertical Installation: Install vertical edges centered over studs. Abut ends and edges with those of adjacent panels. Attach at perimeter and within field of panel to each stud.

    1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of panels.

E. Seal sheathing joints according to sheathing manufacturer's written instructions.

    1. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

3.4 CEMENTITIOUS BACKER UNIT INSTALLATION

A. Install panels and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated.

END OF SECTION 061600

# SECTION 062010 - EXTERIOR AND INTERIOR FINISH WOOD CARPENTRY

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Interior and exterior wood trim.
2. Interior and exterior lumber siding.
3. Interior and exterior lumber soffits and ceilings.

### 1.2 ACTION SUBMITTALS

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

B. Samples: For each exposed product and for each color and texture specified.

### 1.3 QUALITY ASSURANCE

A. Provide products form a single source.

### 1.4 WARRANTY

A. Installers Warranty for Siding, Soffits and Trim: Installer agrees to repair or replace wood that fail in materials (warp, become unattached or rot) for 5 years.

## PART 2 - PRODUCTS

### 2.1 MATERIALS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with applicable rules of any rules-writing agency certified by the American Lumber Standard Committee's (ALSC) Board of Review. Grade lumber by an agency certified by the ALSC's Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of inspection agency, indicating grade, species, moisture content at time of surfacing, and mill.
2. For exposed lumber, mark grade stamp on end or back of each piece.

## 2.2 EXTERIOR TRIM

A. Verify local availability before retaining species and grade in first four subparagraphs below. Some grades in subparagraphs are considered "knotty." Other species and grades are available.

B. Species and Grade: Northern white cedar; NeLMA or NLGA D Select.

C. Maximum moisture content for seasoned or kiln-dried, board-size lumber varies depending on species, grade, and grading agency. See the Evaluations. Pressure-preservative-treated lumber is usually specified to have a maximum moisture content of 19 percent.

D. Maximum Moisture Content: 19 percent with at least 85 percent of shipment at 12 percent or less.

E. Finger Jointing: Not allowed.

F. Face Surface: Surfaced (smooth).

G. Locations: As indicated on the Drawings.

H. Acceptable Alternate Lumber Trim:

1. Wood Species: Cypress.
2. Finish Grade: Select or D Grade.

## 2.3 LUMBER SIDING

A. Species: Northern white cedar; NeLMA or NLGA D Select.

B. Pattern: As indicated on the Drawings.

C. Acceptable Alternate Lumber Trim:

1. Wood Species: Cypress.
2. Finish Grade: Select or D Grade.

## 2.4 LUMBER SOFFITS

A. Provide kiln-dried lumber siding complying with DOC PS 20.

B. Species and Grade: Northern white cedar; NeLMA or NLGA D Select.

C. Pattern: V-edge, smooth-faced tongue and groove, actual face width (coverage) and thickness of 5-1/8 by 23/32 inch (130 by 18 mm).

D. Acceptable Alternate Lumber Trim:

1. Wood Species: Cypress.

2. Finish Grade: Select or D Grade.

## 2.5 MISCELLANEOUS MATERIALS

A. Fasteners for Exterior Finish Carpentry: Provide nails or screws, in sufficient length to penetrate not less than 1-1/2 inches (38 mm) into wood substrate.

1. For face-fastening siding, provide ringed-shank siding nails or hot-dip galvanized-steel siding nails.
2. For pressure-preservative-treated wood, provide stainless steel fasteners.
3. For applications not otherwise indicated, provide stainless steel fasteners.

B. Flashing: Comply with requirements in Section 076200 "Sheet Metal Flashing and Trim" for flashing materials installed in exterior finish carpentry.

1. Horizontal Joint Flashing for Panel Siding: Preformed, stainless steel, Z-shaped flashing.

C. Sealants: Latex, complying with ASTM C834 Type OP, Grade NF and applicable requirements in Section 079200 "Joint Sealants," and recommended by sealant and substrate manufacturers for intended application.

# PART 3 - EXECUTION

## 3.1 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

B. Prime lumber and moldings to be painted, including both faces and edges, unless factory primed.

1. Cut to required lengths and prime ends.
2. Comply with requirements in Section 099113 "Exterior Painting."

## 3.2 INSTALLATION, GENERAL

A. Install exterior finish carpentry level, plumb, true, and aligned with adjacent materials.

1. Use concealed shims where necessary for alignment.
2. Scribe and cut exterior finish carpentry to fit adjoining work.
3. Refinish and seal cuts as recommended by manufacturer.
4. Install to tolerance of 1/8 inch in 96 inches (3 mm in 2438 mm) for level and plumb. Install adjoining exterior finish carpentry with 1/32-inch (0.8-mm) maximum offset for flush installation and 1/16-inch (1.5-mm) maximum offset for reveal installation.
5. Coordinate exterior finish carpentry with materials and systems in or adjacent to it.
6. Provide cutouts for mechanical and electrical items that penetrate exterior finish carpentry.

3.3 INSTALLATION OF STANDING AND RUNNING TRIM

A. Install flat-grain lumber with bark side exposed to weather.

B. Install trim with minimum number of joints as is practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches (610 mm) long, except where necessary.

1. Use scarf joints for end-to-end joints.
2. Stagger end joints in adjacent and related members.

C. Fit exterior joints to exclude water.

1. Cope at returns and miter at corners to produce tight-fitting joints, with full-surface contact throughout length of joint.
2. Plane backs of casings to provide uniform thickness across joints, where necessary for alignment.

D. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.

3.4 INSTALLATION OF SIDING

A. Horizontal Lumber Siding:

1. Apply starter strip along bottom edge of sheathing or sill.
2. Install first course of siding, with lower edge at least 1/8 inch (3 mm) below starter strip and subsequent courses lapped 1 inch (25 mm) over course below.

a. Nail at each stud.
b. Do not allow nails to penetrate more than one thickness of siding.

3. Leave 1/8-inch (3-mm) gap at trim and corners unless otherwise indicated. Install sealant in joint.
4. Butt joints only over framing or blocking, nailing top and bottom on each side and staggering joints in subsequent courses.

B. Flashing: Install metal flashing as indicated on Drawings and as recommended by siding manufacturer.

C. Finish: Apply finish within two weeks of installation.

END OF SECTION 062013

# SECTION 072100 - THERMAL INSULATION

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section Includes:
   1. Polyisocyanurate foam-plastic board.
   2. Glass-fiber blanket.
   3. Glass-fiber board.

B. Related Requirements:

   1. Section 042000 "Unit Masonry" for insulation installed in masonry cells.
   2. Section 061600 "Sheathing" for foam-plastic board sheathing installed directly over wood or steel framing.
   3. Section 092900 "Gypsum Board" for sound attenuation blanket used as acoustic insulation.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

### 1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect foam-plastic board insulation as follows:

   1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
   2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
   3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 POLYISOCYANURATE FOAM-PLASTIC BOARD

A. Polyisocyanurate Board, Foil Faced : ASTM C 1289, foil faced, Type I, Class 1 or 2.

1. Manufacturers: Provide products by one of the following:
   a. Atlas EPS
   b. Atlas Roofing Corporation
   c. Carlisle Coatings & Waterproofing, Inc.
   d. Dow Chemical Company.
   e. Firestone Building Products.
   f. Hunter Panels
   g. Rmax, Inc.
2. Board Thickness: Thickness as required to achieve R-value as noted on drawings.
3. Thermal Resistance (LTTR Value) of: 6 per inch. Retain "Fire Propagation Characteristics" Subparagraph below if required. Tested products are not available from all manufacturers for all types of assemblies.
4. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
5. maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.

2.2 GLASS-FIBER BLANKET

A. Sustainability Requirements: Provide glass-fiber blanket insulation as follows:

1. Free of Formaldehyde: Insulation manufactured with 100 percent acrylic binders and no formaldehyde.
2. Low Emitting: Insulation tested according to ASTM D 5116 and shown to emit less than 0.05-ppm formaldehyde.

B. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

C. Glass-Fiber Blanket, Unfaced : ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

1. Manufacturers: Provide products by one of the following:
   a. CertainTeed Corporation
   b. Carlisle Coatings & Waterproofing, Inc.
   c. Firestone Building Products.

D. Sustainability Requirements: Provide glass-fiber blanket insulation as follows:
1. Free of Formaldehyde: Insulation manufactured with 100 percent acrylic binders and no formaldehyde.

2. Low Emitting: Insulation tested according to ASTM D 5116 and shown to emit less than 0.05-ppm formaldehyde.

## 2.3 INSULATION FASTENERS

A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.
   1. Products: Provide products by one of the following:
      a. AGM Industries, Inc.; Series T TACTOO Insul-Hangers.
      b. Gemco; Spindle Type.
      c. GLT Products; Peel & Press Insulation Hangers
   2. Plate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
   3. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation.

B. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick galvanized-steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches square or in diameter.
   1. Products: Provide products by one of the following :
      a. AGM Industries, Inc.; RC150.
      b. Gemco; Dome Cap.
      c. Midwest Fasteners; WA150
   2. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in the following locations:

      a. Crawl spaces.
      b. Ceiling plenums.
      c. Where indicated.

C. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates without damaging insulation, fasteners, or substrates.
   1. Products: Provide products by one of the following:
      a. AGM Industries, Inc.; TACTOO Adhesive.
      b. Gemco; Tuff Bond Hanger Adhesive.
      c. MIDWEST Fasteners; Hanger Adhesive

## 2.4 ACCESSORIES

A. Insulation for Miscellaneous Voids:

   1. Glass-Fiber Insulation: ASTM C 764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E 84.
   2. Spray Polyurethane Foam Insulation: ASTM C 1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.

B. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

E. Provide continuous insulation throughout all exterior wall cavities and in interior walls indicated and noted on the drawings.

3.3 INSTALLATION OF SLAB INSULATION

A. On vertical slab edge and foundation surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.

1. If not otherwise indicated, extend insulation a minimum of **36 inches** below exterior grade line.

B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

1. If not otherwise indicated, extend insulation a minimum of **36 inches** in from exterior walls.

3.4 INSTALLATION OF CAVITY-WALL INSULATION

A. Foam-Plastic Board Insulation: Install pads of adhesive spaced approximately 24 inches o.c. both ways on inside face and as recommended by manufacturer. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions. Press units firmly against inside substrates.

1. Supplement adhesive attachment of insulation by securing boards with two-piece wall ties designed for this purpose and specified in Section 042000 "Unit Masonry."

3.5 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
4. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.

B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:

1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft..
2. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

3.6 INSTALLATION OF INSULATION IN CEILINGS FOR SOUND ATTENUATION

A. Where glass-fiber blankets are indicated for sound attenuation above ceilings, install blanket insulation over entire ceiling area in thicknesses indicated. Extend insulation 24 inches up either side of partitions.

3.7 INSTALLATION OF INSULATION FOR CONCRETE SUBSTRATES

A. Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors as follows:
1. Fasten insulation anchors to concrete substrates with insulation anchor adhesive according to anchor manufacturer's written instructions. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness, and

application indicated.

2. Apply insulation standoffs to each spindle to create cavity width indicated between concrete substrate and insulation.
3. After adhesive has dried, install board insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation below indicated thickness.
4. Where insulation will not be covered by other building materials, apply capped washers to tips of spindles.

3.10 JOINTS & GAPS

A. The following areas of the building envelope should be sealed, caulked, gasketed or weather-stripped to minimize air leakage and maintain a continuous insulation barrier:
   1. Joints around fenestration and door frames
   2. Junctions between walls and foundations, between walls at building corners, between walls and structural floor or roofs and between walls and roof or wall panels.
   3. Openings at penetrations of utility services through roofs, walls and floors
   4. Site built fenestration and doors
   5. Building assemblies used as ducts or plenums
   6. Joints, seams and penetrations of vapor retarders
   7. All other openings in the building envelope

3.11 PROTECTION

B. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 072100

# SECTION 072600 - VAPOR RETARDERS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section Includes:

1. Under-slab vapor barrier under concrete slabs.
2. Separation filter fabric below dewatering stone course.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete"

### 1.3 REFERENCE STANDARDS

A. The following standards and publications are applicable to the extent referenced in the text.

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

D 412 Standard Test Methods for Rubber Properties in Tension

D 903 Standard Test Method for Peel or Stripping Strength of Adhesive Bonds

D 3767 Standard Practice for Rubber - Measurements of Dimensions

E 96 Standard Test Methods for Water Vapor Transmission of Materials

E 154 Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover

E 1643 Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs

E 1745 Plastic Vapor Retarders Used in Contact with Soil or Granular fill under Concrete Slabs

C. American Concrete Institute (ACI)
ACI 302.1R-96 Addendum Vapor Retarder Location: For slabs with vapor-sensitive floor coverings, locate retarder in direct contact with the slab (not beneath a layer of granular fill).

### 1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.5 PERFORMANCE REQUIREMENTS

A. Prepare substrate in accordance with ACI 302.1R Section 4.1 and manufacturer's written directions.

PART 2 - PRODUCTS

2.1 VAPOR RETARDERS

A. Composite sheet membrane comprising of polyolefin film, and layers of specially formulated synthetic adhesive layers. The membrane shall form an integral and permanent bond to poured concrete to prevent vapor migration at the interface of the membrane and structural concrete. Provide membrane with the following physical properties:

1. Thickness (nominal): 10mil minimum; ACI 302.1R-04
2. Water Vapor Permanence: .0084 perms; ASTM F 1249
3. Tensile Strength: 79.6 lbf/in; ASTM D 882
4. Puncture Resistance: 2326 grams; ASTM D 1709

B. Manufacturers: Provide products from one of the following manufacturers:
1. Stego Industries.
2. Grace Construction Products.
3. W.R. Meadows Company.

2.2 ACCESSORIES

A. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

PART 3 - EXECUTION

3.1 PREPARATION

A. The installer shall examine conditions of substrates and other conditions under which this work is to be performed and notify the Construction Profesional, in writing, of circumstances detrimental to the proper completion of the work. Do not proceed with work until unsatisfactory conditions are corrected

B. Clean substrates of substances that are harmful to vapor retarders, including removing projections capable of puncturing vapor retarders.

## 3.2 INSTALLATION

A. Earth and stone substrates shall be well compacted to produce an even, solid substrate. Remove loose aggregate or sharp protrusions. Concrete substrates shall be smooth or broom finished and monolithic. Remove standing water prior to membrane application.

B. Installation shall be in accordance with manufacturer's instructions and ASTM E 1643–98, including but not limited to, the following:
   1. Apply membrane with film facing the prepared substrate.
   2. Apply succeeding sheets by overlapping the previous sheet 50-mm (2 in.) along marked lap line. End Laps should be staggered to avoid a build up of layers.
   3. Taped Lap Method: Secure and seal the overlaps. Overband the lap with the 100mm (4in) wide tape using lap line for alignment.

C. Penetrations: Apply detailing compound to seal around penetrations.

D. Inspection: Special Inspection Agency shall inspect installation prior to concrete work.

## 3.3 CONCRETE PLACEMENT

A. Place concrete within time limits prescribed by manufacturer. Inspect membrane and repair any damage. Ensure all liner is removed from membrane and tape before concrete placement.

## 3.4 PROTECTION

A. Protect vapor retarders from damage until concealed by permanent construction.

END OF SECTION 072600

# SECTION 072726 - FLUID-APPLIED MEMBRANE AIR BARRIERS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Vapor-permeable, fluid-applied air barriers.

### 1.2 RELATED SECTIONS

A. Coordinate work in this section with the following:

1. 044301-Stone Masonry Veneer.
2. 051200 - Structural Steel Framing.
3. 053100 - Steel Decking
4. 061600 - Sheathing.
5. 062013 - Exterior and Interior Finish Wood Carpentry.
6. 072100 - Thermal Insulation.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings or Manufacturer's Instructions and Details: For air-barrier assemblies.

1. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.

C. Manufacturer's Statement: Provide manufacturer's written statement confirming that the material to be installed is compatible with wall assemblies and substrates.

### 1.4 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Air-Barrier Performance: Air-barrier assembly and seals with adjacent construction shall be capable of performing as a continuous air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

B. Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft. (0.2 L/s x sq. m of surface area at 75 Pa), when tested according to ASTM E2357.

2.2 MEDIUM-BUILD AIR BARRIERS, VAPOR PERMEABLE

A. Medium-Build, Vapor-Permeable Air Barrier: Synthetic polymer material with an installed dry film thickness, according to manufacturer's written instructions, of 17 to 30 mils (0.4 to 0.8 mm) over smooth, void-free substrates.

1. Acceptable Manufacturers:

a. BASF.
b. Grace.
c. Henry Company.
d. Mar-flex Waterproofing & Building Products.
e. Tremco.
f. W.R. Meadows.

2. Physical and Performance Properties:

a. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. (0.02 L/s x sq. m of surface area at 75-Pa) pressure difference; ASTM E2178.
b. Vapor Permeance: Minimum 10 perms (580 ng/Pa x s x sq. m); ASTM E96/E96M, Desiccant Method, Procedure A.
c. Ultimate Elongation: Minimum 200 to 250 percent; ASTM D412, Die C.
d. Adhesion to Substrate: Minimum 16 lbf/sq. in. (110 kPa) when tested according to ASTM D4541.
e. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
f. UV Resistance: Can be exposed to sunlight for 90 days according to manufacturer's written instructions.

2.3 ACCESSORY MATERIALS

A. Requirement: Provide primers, transition strips, termination strips, joint reinforcing fabric and strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic, substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and other accessory materials that are recommended in writing by air-barrier manufacturer to produce a complete air-barrier assembly and that are compatible with primary air-barrier material and adjacent construction to which they may seal.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

A. Clean, prepare, treat, fill, and seal substrate and joints and cracks in substrate according to manufacturer's written instructions and details. Provide clean, dust-free, and dry substrate for air-barrier application.

B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.

C. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching material.

D. Remove excess mortar from masonry ties, shelf angles, and other obstructions.

E. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.

F. Bridge isolation joints, expansion joints and discontinuous wall-to-wall, deck-to-wall, and deck-to-deck joints with air-barrier accessory material that accommodates joint movement according to manufacturer's written instructions and details.

3.2 INSTALLATION

A. Install materials according to air-barrier manufacturer's written instructions and details to form a seal with adjacent construction and ensure continuity of air and water barrier.

1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
2. Install transition strip on roofing membrane or base flashing so that a minimum of 3 inches (75 mm) of coverage is achieved over each substrate.
3. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
4. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.

B. Connect and seal exterior wall air-barrier material continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.

C. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply transition strip so that a minimum of 3 inches (75 mm) of coverage is achieved over each substrate. Maintain 3 inches (75 mm) of full contact over firm bearing to perimeter frames, with not less than 1 inch (25 mm) of full contact.

D. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches (150 mm) beyond repaired areas in strip direction.

E. Medium-Build Air Barriers: Apply continuous unbroken air-barrier material to substrates according to the following thickness. Apply an increased thickness of air-barrier material in full contact around protrusions such as masonry ties.
   1. Vapor-Permeable, Medium-Build Air Barrier: Total dry film thickness as recommended in writing by manufacturer to comply with performance requirements, applied in one equal coat. Apply additional material as needed to achieve void- and pinhole-free surface, but do not exceed thickness on which required vapor permeability is based.

F. Do not cover air barrier until it has been tested and inspected by testing agency.

G. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

## 3.3 FIELD QUALITY CONTROL

A. Testing: The Contractor shall provide mil thickness inspections by measures the mil thickness after application to confirm the minimum thickness is achieved.

B. Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.
   1. Remove and replace deficient air-barrier components for retesting as specified above.

C. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.

D. Prepare test and inspection reports.

## 3.4 CLEANING AND PROTECTION

A. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.

B. Remove masking materials after installation.

END OF SECTION 072726

# SECTION 074113.16 - STANDING-SEAM METAL ROOF PANELS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section includes:

1. Standing-seam metal roof panels.
2. Concealed Fasteners.
3. Related trim and accessories.

B. Related Requirements:

1. 051200 - Structural Steel Framing.
2. 053100 - Steel Decking.
3. 076200 - Sheet Metal Flashing and Trim.

### 1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.

1. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.
2. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
3. Review structural loading limitations of structural members during and after roofing.
4. Review flashings, special details, drainage, penetrations, equipment curbs, and condition of other construction that affect metal panels.
5. Review temporary protection requirements for metal panel systems during and after installation.

C. Samples: For each type of metal panel and trim indicated. 12 inch long samples.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product test reports.

C. Warranties: Sample of special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1. Installer's Field Supervisor: Experienced mechanic supervising work on site whenever work is underway.

B. UL-Certified, Portable Roll-Forming Equipment: UL-certified, portable roll-forming equipment capable of producing metal panels warranted by manufacturer to be the same as factory-formed products. Maintain UL certification of portable roll-forming equipment for duration of work.

1.7 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.8 COORDINATION

A. Coordinate sizes and locations of roof penetrations.

B. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including rupturing, cracking, or puncturing.
b. Deterioration of metals and other materials beyond normal weathering.
2. Warranty Period: Two years from date of Material Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
2. Finish Warranty Period: 10 years from date of Material Completion.

C. Special Weathertightness Warranty: On manufacturer’s standard form, in which manufacturer agrees to repair or replace metal panel assemblies that fail to remain weathertight, including leaks, without monetary limitation within 10 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

A. Energy Performance: Provide roof panels that are listed on the EPA/DOE's ENERGY STAR "Roof Product List" for low-slope roof products.

B. Energy Performance: Provide roof panels according to one of the following when tested according to CRRC-1:
1. Three-year, aged solar reflectance of not less than 0.55 and emissivity of not less than 0.75.

C. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E1592:
1. Wind Loads: As indicated on Drawings.
2. Other Design Loads: As indicated on Drawings.
3. Deflection Limits: For wind loads, no greater than 1/180 of the span.

D. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E1680 at the following test-pressure difference:
1. Test-Pressure Difference: 1.57 lbf/sq. ft.

E. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E1646 or ASTM E331 at the following test-pressure difference:
1. Test-Pressure Difference: 2.86 lbf/sq. ft.

F. Hydrostatic-Head Resistance: No water penetration when tested according to ASTM E2140.

G. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.
   1. Uplift Rating: UL 60.

H. FM Global Listing: Provide metal roof panels and component materials that comply with requirements in FM Global 4471 as part of a panel roofing system and that are listed in FM Global's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Global markings.
   1. Fire/Windstorm Classification: Class 1A-60.
   2. Hail Resistance: MH.

I. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

## 2.2 MANUFACTURERS

A. Basis-of-Design Product specification: 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 illustrate and establish 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.

B. Basis of Design: MBC: SSR-Standing Seam Roof System; BattenLok HS.
   1. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, structural quality, Grade 50, Coating Class AZ50 (Grade 340, Coating Class AZM150), prepainted by the coil-coating process per ASTM A 755/A 755M.
      a. Nominal Coated Thickness: 24 gage.
      b. Panel Surface: Stucco embossed with flat pan.
      c. Exterior Finish: Fluoropolymer two-coat system.
   2. Panel Width: 16 inches (406 mm).
   3. Panel Seam Height: 2 inch (50.8 mm).
   4. Joint Type: Mechanically seamed.

C. Other Acceptable Manufacturers:
   1. VP Buildings, Varco Pruden Buildings.
   2. Morin, a Kingspan Group Company.
   3. Centria International.
   4. Peterson Aluminum Corporation.

## 2.3 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Underlayment: Provide self-adhering, cold-applied, sheet underlayment, a minimum of 30 mils thick, specifically designed to withstand high metal

temperatures beneath metal roofing. Provide primer when recommended by underlayment manufacturer.

1. Thermal Stability: Stable after testing at 220 deg F; ASTM D1970.
2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F; ASTM D1970.

B. Slip Sheet: Manufacturer's recommended slip sheet, of type required for application.

## 2.4 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C645; cold-formed, metallic-coated steel sheet, ASTM A653/A653M, G90 coating designation or ASTM A792/A792M, Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

D. Gutters: Formed from same material as roof panels, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch-long sections, of size and metal thickness according to SMACNA's "Design Professionalural Sheet Metal Manual." Furnish gutter supports spaced a maximum of 36 inches o.c., fabricated from same metal as gutters. Provide wire ball strainers of compatible metal at outlets. Finish gutters to match metal roof panels.

E. Downspouts: Formed from same material as roof panels. Fabricate in 10-foot-long sections, complete with formed elbows and offsets, of size and metal thickness according to SMACNA's "Architectural Sheet Metal Manual." Finish downspouts to match gutters.

F. Panel Clips: Provide panel clip of type specified, at spacing indicated on approved shop drawings.

1. Provide one or two piece clip system compatible with warranty requirements.
   a. Two-Piece: ASTM C 645, with ASTM A 653/A 653M, G90 (Z180) hot-dip galvanized zinc coating, configured for concealment in panel joints, and identical to clips utilized in tests demonstrating compliance with performance requirements.
2. Single-Piece Fixed: ASTM A 653/A 653M, G90 (Z180) hot-dip galvanized zinc coating, configured for concealment in panel joints, and identical to clips utilized in tests demonstrating compliance with performance requirements.

G. Panel Sealants: Provide sealant types recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

## 2.5 FABRICATION

A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.

C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

D. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
   1. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
   2. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
      a. Size: As recommended by SMACNA's "Design Architectural Sheet Metal Manual" or metal panel manufacturer for application, but not less than thickness of metal being secured.

## 2.6 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. 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 same piece are unacceptable. 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.

C. Steel Panels and Accessories

   1. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
      a. Color - Basis of Design: MBCI Signature 300; Slate Gray.
   2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.

1. Examine primary and secondary roof framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer.
2. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roof panel manufacturer.
   a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C754 and metal panel manufacturer's written recommendations.

3.3 UNDERLAYMENT INSTALLATION

A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.

1. Apply over the entire roof surface.
2. Apply over the roof area indicated below:
   a. Roof perimeter for a distance up from eaves of 36inches minimum beyond interior wall line.
   b. Valleys, from lowest point to highest point, for a distance on each side of 24inches minimum. Overlap ends of sheets not less than 6 inches.
   c. Rake edges for a distance of 18 inches.
   d. Hips and ridges for a distance on each side of 12 inches.
   e. Roof-to-wall intersections for a distance from wall of 18 inches.

B. Flashings: Install flashings to cover underlayment to comply with requirements specified in Section 076200 "Sheet Metal Flashing and Trim."

3.4 METAL PANEL INSTALLATION

A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving metal panels.
2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air or water-resistive barriers and flashings that are concealed by metal panels are installed.
3. Install screw fasteners in predrilled holes.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Install flashing and trim as metal panel work proceeds.
6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:

1. Steel Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.
2. Aluminum Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.
3. Copper Panels: Use copper, stainless-steel, or hardware-bronze fasteners.
4. Stainless-Steel Panels: Use stainless-steel fasteners.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

D. Lap-Seam Metal Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.

E. Horizontal-Seam (Bermuda-Type) Metal Roof Panels: Fasten metal roof panels to supports with concealed clips at each horizontal-seam joint at location, spacing, and with fasteners recommended by manufacturer. Start at eave and work upward toward ridge.
1. Install clips to supports with self-drilling fasteners.

F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal panel manufacturer; or, if not indicated, provide types recommended in writing by metal panel manufacturer.

G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Design Professionalural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level. Install work with laps, joints, and seams that are permanently watertight.

H. Gutters: Join sections with riveted and soldered or lapped and sealed joints. Attach gutters to eave with gutter hangers spaced not more than 36 inches o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.

I. Downspouts: Join sections with telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c. in between.
   1. Provide elbows and plastic pipe extensions at base of downspouts to direct water away from building.

J. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to metal roof panels as recommended by manufacturer.

## 3.5 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align metal panel units within installed tolerance of 1/4 inch in 20 feet on slope and location lines and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

## 3.6 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Water-Spray Test: After installation, test area of assembly as directed by Design Professional for water penetration according to AAMA 501.2.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect completed metal panel installation, including accessories. Report results in writing.

D. Remove and replace applications where tests and inspections indicate that they do not comply with specified requirements.

## 3.7 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

B. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074113.16

# SECTION 079200 - JOINT SEALANTS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Nonstaining silicone joint sealants.
2. Mildew-resistant joint sealants.
3. Latex joint sealants.

B. Related Requirements:

1. Section 07 2726 "Fluid-Applied Membrane Air Barrier" for sealing joints in sound-rated construction.

### 1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

### 1.3 ACTION SUBMITTALS

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

### 1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each kind of joint sealant, for tests performed by a qualified testing agency.

### 1.5 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

B. Product Testing: Test joint sealants using a qualified testing agency.

1. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.

C. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

1.6 FIELD 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.

1.7 WARRANTY

A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Ten years from date of Substantial Completion.

C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:

1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
2. Disintegration of joint substrates from causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

A. Compatibility: Provide joint sealants, backings, 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. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the following:

1. Architectural sealants shall have a VOC content of 250 g/L or less.
2. Sealants and sealant primers for nonporous substrates shall have a VOC content of 250 g/L or less.
3. Sealants and sealant primers for nonporous substrates shall have a VOC content of 775 g/L or less.

C. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

## 2.2 NONSTAINING SILICONE JOINT SEALANTS

A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C 1248.

B. Silicone, Nonstaining, S, NS, 50, NT: Nonstaining, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.

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

   a. Dow Corning Corporation.
   b. Pecora Corporation.
   c. Tremco Incorporated.

## 2.3 MILDEW-RESISTANT JOINT SEALANTS

A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.

B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.

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

   a. Dow Corning Corporation; Dow Corning® 786 Silicone Sealant.
   b. Pecora Corporation; Pecora 860.
   c. Tremco Incorporated; Tremsil 200.

## 2.4 LATEX JOINT SEALANTS

A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

2.5 JOINT-SEALANT BACKING

A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

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

a. Alcot Plastics Ltd.
b. BASF Corporation; Construction Systems.
c. Construction Foam Products; a division of Nomaco, Inc.

B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.6 MISCELLANEOUS MATERIALS

A. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

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 of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected and/or that installation of sealants constitutes acceptance from the installer of acceptable substrate conditions.

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 and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

    a. Masonry.

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

    a. Metal.
    b. Glass.
    c. Porcelain enamel.
    d. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by 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. 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 sealant backings of kind indicated to support 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 sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place 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.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below 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 sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.
4. Provide flush joint profile at locations indicated on Drawings according to Figure 8B in ASTM C 1193.
5. Provide recessed joint configuration of recess depth and at locations indicated on Drawings according to Figure 8C in ASTM C 1193.

G. Repair all joints with visible defects including any signs of visible voids, bubbles, debris, or other foreign materials in sealant.

## 3.4 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:

1. Extent of Testing: Test completed and cured sealant joints as follows:

a. Perform 10 tests for the first 1000 feet of joint length for each kind of sealant and joint substrate.
b. Perform one test for each 1000 feet of joint length thereafter or one test per each floor per elevation.

2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.

a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

3. Inspect tested joints and report on the following:

a. Whether sealants filled joint cavities and are free of voids.

b. Whether sealant dimensions and configurations comply with specified requirements.
c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.

4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.
5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

B. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

## 3.5 CLEANING

A. Clean off excess 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.

## 3.6 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, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

## 3.7 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

a. Control and expansion joints in unit masonry.
b. Joints between metal panels.

c. Perimeter joints between materials listed above and frames of doors, windows, and louvers.
d. Control and expansion joints in and other.
e. Other joints as indicated on Drawings.

2. Joint Sealant: Silicone, nonstaining, S, NS, 50, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

B. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

a. Tile control and expansion joints.

2. Joint Sealant: Urethane, S, NS, 25, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

C. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

a. Joints between plumbing fixtures and adjoining walls, floors, and counters.

2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

D. Joint-Sealant Application: Concealed mastics.

1. Joint Locations:

a. Aluminum thresholds.
b. Sill plates.

2. Joint Sealant: Butyl-rubber based.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION 079200

# SECTION 08 1113 - HOLLOW METAL DOORS AND FRAMES

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section includes:

1. Exterior standard steel doors and frames for high moisture restrooms that will be washed down.

B. Related Requirements:

1. Section 087100 "Door Hardware" for door hardware for hollow-metal doors.

### 1.2 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

### 1.3 COORDINATION

A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

### 1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

### 1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, temperature-rise ratings, and finishes.

B. Shop Drawings: Include the following:

1. Elevations of each door type.
2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.

3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
7. Details of anchorages, joints, field splices, and connections.
8. Details of accessories.
9. Details of moldings, removable stops, and glazing.

C. Product Schedule: For hollow-metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule on the Drawings.

1.6 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency.

B. Oversize Construction Certification: For assemblies required to be fire-rated and exceeding limitations of labeled assemblies.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal doors and frames palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

1. Provide additional protection to prevent damage to factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow-metal doors and frames vertically under cover at Project site with head up. Place on minimum 4-inch-high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Provide products by one of the following:
1. Ceco Door; ASSA ABLOY.
2. Curries Company; ASSA ABLOY.
3. Republic Doors and Frames.
4. Steelcraft; an Allegion brand.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings and temperature-rise limits indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

1. Smoke- and Draft-Control Assemblies: Provide assemblies with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.
2. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F above ambient after 30 minutes of standard fire-test exposure.

B. Fire-Rated, Borrowed-Lite Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.

C. Thermally Rated Door Assemblies: Provide door assemblies with U-factor of not more than 0.50 deg Btu/F x h x sq. ft. when tested according to ASTM C 518.

2.3 INTERIOR STANDARD STEEL DOORS AND FRAMES

A. Construct hollow-metal doors and frames to comply with standards indicated for materials,

2.4 EXTERIOR STANDARD STEEL DOORS AND FRAMES

A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Heavy-Duty Doors and Frames: SDI A250.8, Level 2; SDI A250.4, Level B.

1. Doors:

a. Type: As indicated in the Door and Frame Schedule on the Drawings.
b. Thickness: 1-3/4 inches.
c. Face: Metallic-coated steel sheet, minimum thickness of 0.042 inch, with minimum A60coating.
d. Edge Construction: Model 2, Seamless.
e. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets. Seal joints against water penetration.
f. Bottom Edges: Close bottom edges of doors with end closures or channels of same material as face sheets. Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape.
g. Core: Manufacturer's standard - insulated.

h. Fire-Rated Core: Manufacturer's standard vertical steel stiffener with insulation core for fire-rated doors.

2. Frames:

a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A60coating.
b. Construction: Full profile welded.

3. Exposed Finish: Prime.

2.5 BORROWED LITES

A. Fabricate of uncoated steel sheet, minimum thickness of 0.053 inch.

B. Construction: Full profile welded.

C. Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as metal as frames.

D. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.

2.6 HOLLOW-METAL PANELS

A. Provide hollow-metal panels of same materials, construction, and finish as adjacent door assemblies.

2.7 FRAME ANCHORS

A. Jamb Anchors:

1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches of frame height above 7 feet.
3. Postinstalled Expansion Anchor: Minimum 3/8-inch-diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.

B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.

C. Floor Anchors for Concrete Slabs with Underlayment: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at top of underlayment.

D. Material: ASTM A 879/A 879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M; hot-dip galvanized according to ASTM A 153/A 153M, Class B.

2.8 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.

D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

E. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

F. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

G. Glazing: Comply with requirements in Section 088000 "Glazing."

2.9 FABRICATION

A. Door Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.

B. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.

1. Sidelite and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by welding.
2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.

3. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.

    a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
    b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

4. Terminated Stops: Terminate stops 6 inches above finish floor with a 90-degree angle cut, and close open end of stop with steel sheet closure. Cover opening in extension of frame with welded-steel filler plate, with welds ground smooth and flush with frame.

C. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.

1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.

D. Glazed Lites: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with mitered hairline joints.

1. Provide stops and moldings flush with face of door, and with square stops unless otherwise indicated.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames. Provide loose stops and moldings on inside of hollow-metal doors and frames.
4. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.
5. Provide stops for installation with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

## 2.10 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.

B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.2 INSTALLATION

A. General: Install hollow-metal doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.

B. Hollow-Metal Frames: Comply with SDI A250.11.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.

    a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
    b. Install frames with removable stops located on secure side of opening.

2. Fire-Rated Openings: Install frames according to NFPA 80.
3. Floor Anchors: Secure with postinstalled expansion anchors.

    a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

4. Solidly pack mineral-fiber insulation inside frames.
5. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout or mortar.
6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
7. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:

    a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.

c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

C. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.

1. Non-Fire-Rated Steel Doors: Comply with SDI A250.8.
2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
3. Smoke-Control Doors: Install doors according to NFPA 105.

D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.

## 3.3 CLEANING AND TOUCHUP

A. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

B. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

C. Factory-Finish Touchup: Clean abraded areas and repair with same material used for factory finish according to manufacturer's written instructions.

D. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 081113

# SECTION 087100 – DOOR HARDWARE

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes commercial door hardware for the following:

1. Swinging doors.
2. Sliding doors.
3. Other doors to the extent indicated.

B. Door hardware includes, but is not necessarily limited to, the following:

1. Mechanical door hardware.
2. Electromechanical door hardware.
3. Cylinders specified for doors in other sections.

C. Related Sections:

1. Division 08 Section “Door Hardware Schedule”.
2. Division 08 Section “Hollow Metal Doors and Frames”.
3. Division 08 Section “Access Control Hardware”.

D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ICC/IBC - International Building Code.
3. NFPA 70 - National Electrical Code.
4. NFPA 80 - Fire Doors and Windows.
5. NFPA 101 - Life Safety Code.
6. NFPA 105 - Installation of Smoke Door Assemblies.
7. State Building Codes, Local Amendments.

E. Standards: All hardware specified herein shall comply with the following industry standards:

1. ANSI/BHMA Certified Product Standards - A156 Series
2. UL10C – Positive Pressure Fire Tests of Door Assemblies

1.3 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."

2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.

3. Content: Include the following information:

a. Type, style, function, size, label, hand, and finish of each door hardware item.
b. Manufacturer of each item.
c. Fastenings and other pertinent information.
d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
e. Explanation of abbreviations, symbols, and codes contained in schedule.
f. Mounting locations for door hardware.
g. Door and frame sizes and materials.
h. Warranty information for each product.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Shop Drawings: Details of electrified access control hardware indicating the following:

1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access

control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:

a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
b. Complete (risers, point-to-point) access control system block wiring diagrams.
c. Wiring instructions for each electronic component scheduled herein.

2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.

D. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.

E. Informational Submittals:

1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

F. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Submittals.

## 1.4 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during

the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

D. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.

1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.

2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.

E. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.

F. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:

1. Function of building, purpose of each area and degree of security required.
2. Plans for existing and future key system expansion.
3. Requirements for key control storage and software.
4. Installation of permanent keys, cylinder cores and software.
5. Address and requirements for delivery of keys.

G. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.

1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
3. Review sequence of operation narratives for each unique access controlled opening.
4. Review and finalize construction schedule and verify availability of materials.
5. Review the required inspecting, testing, commissioning, and demonstration procedures

H. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

## 1.5 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

## 1.6 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.

C. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

## 1.7 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.
2. Faulty operation of the hardware.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
4. Electrical component defects and failures within the systems operation.

C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.

D. Special Warranty Periods:
1. Seven years for heavy duty cylindrical (bored) locks and latches.
2. Twenty five years for manual surface door closer bodies.
3. Two years for electromechanical door hardware.

1.8 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.

B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:

1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.

C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 HANGING DEVICES

A. Hinges: ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.

1. Quantity: Provide the following hinge quantity:

a. Two Hinges: For doors with heights up to 60 inches.
b. Three Hinges: For doors with heights 61 to 90 inches.

c. Four Hinges: For doors with heights 91 to 120 inches.
d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.

2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:

a. Widths up to 3’0”: 4-1/2” standard or heavy weight as specified.
b. Sizes from 3’1” to 4’0”: 5” standard or heavy weight as specified.

3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:

a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.

4. Hinge Options: Comply with the following:

a. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.

5. Manufacturers:

a. Bommer Industries (BO) - LB Series.
b. Hager Companies (HA) - CB Series.
c. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - TA Series.

B. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 certified continuous geared hinge. with minimum 0.120-inch thick extruded 6060 T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.

1. Manufacturers:

a. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK).
b. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).

C. Sliding and Folding Door Hardware: Hardware is to be of type and design as specified and should comply with ANSI/BHMA A156.14.

1. Sliding Bi-Passing Pocket Door Hardware: Provide complete sets consisting of track, hangers, stops, bumpers, floor channel, guides, and accessories indicated.

2. Cascading: Provide a bi-parting or single direction telescoping system as required with a minimum 200 lb. per door capacity.

3. Bi-folding Door Hardware: Rated for door panels weighing up to 125 lb.

4. Pocket Sliding Door Hardware: Rated for doors weighing up to 200 lb.

5. Manufacturers:

    a. Hager Companies (HA).
    b. Johnson Hardware (JO).
    c. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).

## 2.3 DOOR OPERATING TRIM

A. Door Push Plates and Pulls: ANSI/BHMA A156.6 certified door pushes and pulls of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.

1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
4. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.

5. Manufacturers:

    a. Hiawatha, Inc. (HI).
    b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
    c. Trimco (TC).

## 2.4 CYLINDERS AND KEYING

A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.

B. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as locksets and exit devices, unless otherwise indicated.

C. Cylinders: Original manufacturer cylinders complying with the following:

1. Mortise Type: Threaded cylinders with rings and cams to suit hardware application.

2. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
3. Bored-Lock Type: Cylinders with tailpieces to suit locks.
4. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
5. Keyway: Manufacturer’s Standard.

D. Keying System: Each type of lock and cylinders to be factory keyed.

1. Conduct specified "Keying Conference" to define and document keying system instructions and requirements.
2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
3. New System: Key locks to a new key system as directed by the Owner.

E. Key Quantity: Provide the following minimum number of keys:

1. Change Keys per Cylinder: Two (2)
2. Master Keys (per Master Key Level/Group): Five (5).
3. Construction Keys (where required): Ten (10).

F. Construction Keying: Provide construction master keyed cylinders.

G. Key Registration List (Bitting List):

1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
2. Provide transcript list in writing or electronic file as directed by the Owner.

H. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150% of the number of locks required for the project.

1. Manufacturers:

a. Lund Equipment (LU).
b. MMF Industries (MM).
c. Telkee (TK).

I. Key Control Software: Provide one network version of "Key Wizard" branded key management software package that includes one year of technical support and upgrades to software at no charge. Provide factory key system formatted for importing into “Key Wizard” software.

## 2.5 MECHANICAL LOCKS AND LATCHING DEVICES

A. Cylindrical Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.2, Series 4000, Grade 1 certified.

1. Furnish with solid cast levers, standard 2 3/4” backset, and 1/2" (3/4" at rated paired openings) throw brass or stainless steel latchbolt.

2. Locks are to be non-handed and fully field reversible.

3. Extended cycle test: Locks to have been cycle tested in ordinance with ANSI/BHMA 156.2 requirements to 2 million cycles.

4. Manufacturers:

    a. Corbin Russwin Hardware (RU) – CL3300 Series.
    b. Sargent Manufacturing (SA) – 10 Line.

2.6 AUXILIARY LOCKS

A. Cylindrical Deadlocks: ANSI/BHMA A156.36, Grade 1, cylindrical type deadlocks to fit standard ANSI 161 preparation and 1 3/8" to 1 3/4" thickness doors. Provide tapered collars to resist vandalism and 1" throw solid steel bolt with hardened steel roller pins. Deadlocks to be products of the same source manufacturer and keyway as other locksets.

1. Manufacturers:

    a. Corbin Russwin Hardware (RU) - DL3200 Series.
    b. Sargent Manufacturing (SA) - 480 Series.

2.7 LOCK AND LATCH STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

B. Standards: Comply with the following:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
4. Dustproof Strikes: BHMA A156.16.

## 2.8 ELECTROMAGNETIC LOCKING DEVICES

A. Surface Electromagnetic Locks (Heavy Duty): Electromagnetic locks to be surface mounted type conforming to ANSI A156.23, Grade 1 with minimum holding force strength of 1,200 pounds. Locks to be capable of either 12 or 24 voltage and be UL listed for use on fire rated door assemblies. Electronics are to be fully sealed against tampering and allow exterior weatherproof applications. As indicated in Hardware Sets, provide specified mounting brackets and housings. Power supply to be by the same manufacturer as the lock with combined products having a lifetime replacement warranty.

1. Manufacturers:

   a. Securitron (SU) – M62 Series.
   b. Securitron (SU) – M68 Series.

## 2.9 DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:

1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers including installation and adjusting information on inside of cover.

2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.

3. Cycle Testing: Provide closers which have surpassed 15 million cycles in a test witnessed and verified by UL.

4. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the physically handicapped, provide units complying with ANSI ICC/A117.1.

5. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.

6. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.

7. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully

operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.

1. Manufacturers:

    a. Corbin Russwin Hardware (RU) - DC6000 Series.
    b. Sargent Manufacturing (SA) - 351 Series.
    c. Norton Door Controls (NO) - 7500 Series.
    d. Yale Locks and Hardware (YA) - 4400 Series.

## 2.10 SURFACE MOUNTED CLOSER HOLDERS

A. Electromagnetic Door Holders: Certified ANSI A156.15 electromagnetic door holder/releases with a minimum 20 to 40 pounds holding power and single coil construction able to accommodate.12VDC, 24VAC, 24VDC and 120VAC. Coils to be independently wound, employing an integral fuse and armatures to include a positive release button.

1. Manufacturers:

    a. Rixson (RF) - 980/990 Series.
    b. Sargent Manufacturing (SA) - 1560 Series.

## 2.11 ARCHITECTURAL TRIM

A. Door Protective Trim

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.

2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1” LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.

3. Where plates are applied to fire rated doors with the top of the plate more than 16” above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer’s catalog and template book for specific requirements for size and applications.

4. Protection Plates: ANSI/BHMA A156.6 certified protection plates (kick, armor, or mop), fabricated from the following:

    a. Stainless Steel: 300 grade, 050-inch thick.

5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.

6. Manufacturers:

    a. Hiawatha, Inc. (HI).
    b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
    c. Trimco (TC).

## 2.12 DOOR STOPS AND HOLDERS

A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.

B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.

1. Manufacturers:

    a. Hiawatha, Inc. (HI).
    b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
    c. Trimco (TC).

## 2.13 ARCHITECTURAL SEALS

A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.

1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.

C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.

1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NPFA 252, Standard Methods of Fire Tests of Door Assemblies.

D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.

E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

F. Manufacturers:

1. National Guard Products (NG).
2. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).
3. Reese Enterprises, Inc. (RE).

2.14 ELECTRONIC ACCESSORIES

A. Key Switches: Key switches furnished standard with stainless steel single gang face plate with a 12/24VDC bi-color LED indicator. Integral backing bracket permits integration with any 1 1/4" or 1 1/2" mortise type cylinder. Key switches available as momentary or maintained action and in narrow face plate options.

1. Manufacturers:

a. Security Door Controls (SD) - 800 Series.
b. Securitron (SU) - MK Series.

B. Push-Button Switches: Industrial grade momentary or alternate contact, back-lighted push buttons with stainless-steel switch enclosures. 12/24 VDC bi-color illumination suitable for either flush or surface mounting.

1. Manufacturers:

a. Security Door Controls (SD) - 400 Series.
b. Securitron (SU) - PB Series.

C. Request-to-Exit Motion Sensor: Request-to-Exit Sensors motion detectors specifically designed for detecting exiting through a door from the secure area to a non-secure area. Include built-in timers (up to 60 second adjustable timing), door monitor with sounder alert, internal vertical pointability coverage, 12VDC or 24VDC power and selectable relay trigger with fail safe/fail secure modes.

1. Manufacturers:

a. Security Door Controls (SD) - MD-31D Series.
b. Securitron (SU) - XMS Series.

2.15 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.16 FINISHES

A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware

C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.

B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.

1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.

B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.

C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

## 3.4 FIELD QUALITY CONTROL

A. Field Inspection: Supplier will perform a final inspection of installed door hardware and state in report whether work complies with or deviates from requirements, including whether door hardware is properly installed, operating and adjusted.

## 3.5 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

## 3.6 CLEANING AND PROTECTION

A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

B. Clean adjacent surfaces soiled by door hardware installation.

C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

## 3.7 DEMONSTRATION

A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

## 3.8 DOOR HARDWARE SETS

A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

B. The supplier is responsible for handing and sizing all products and providing the correct option for the appropriate door type and material where more than one is presented in the hardware sets. Quantities listed are for each pair of doors, or for each single door.

C. Manufacturer’s Abbreviations:
1. MK - McKinney
2. PE - Pemko
3. RU - Corbin Russwin
4. SU - Securitron
5. RO - Rockwood
6. NO - Norton
7. RF - Rixson
8. OT - OTHER

**<u>Hardware Sets</u>**

**Set: 1.0**
Doors: 100
Description: Janitor

| | | | | |
|---|---|---|---|---|
| 3 | Hinge (heavy weight) | TA2314 NRP | US32D | MK |
| 1 | Storeroom Lock | CL3357 AZD | 626 | RU |
| 1 | Surface Closer | 351 CPS | EN | SA |
| 1 | Kick Plate | K1050 10" CSK BEV | US32D | RO |
| 1 | Threshold | 271A x Length Required x MSES25SS | | PE |
| 1 | Gasketing | 303AS (Head & Jambs) | | PE |
| 1 | Rain Guard | 346C x Width of Frame Head | | PE |
| 1 | Sweep | 3452CNB x Length Required | | PE |

**Set: 2.0**
Doors: 101, 102, 103, 104, 105, 106
Description: Toilet

| | | | | |
|---|---|---|---|---|
| 3 | Hinge | TA2314 NRP | US32D | MK |
| 1 | Privacy Lock | ML2060 ASA M19V | 626 | RU |
| 1 | Surface Closer | 351 UO | EN | NO |
| 1 | Wall Stop or Floor Stop | 409/440 | 630 | RO |
| 1 | Kick Plate | K1050 10" CSK BEV | US32D | RO |
| 1 | Threshold | 271A x Length Required x MSES25SS | | PE |
| 1 | Gasketing | 303AS (Head & Jambs) | | PE |
| 1 | Rain Guard | 346C x Width of Frame Head | | PE |
| 1 | Sweep | 3452CNB x Length Required | | PE |
| 1 | Coat Hook | RM802 | US26D | RO |

END OF SECTION 087100

# SECTION 089119 - FIXED LOUVERS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Fixed, formed-metal louvers.

B. Related Sections:

1. 042200 - Concrete Unit Masonry.
2. 062013 - Exterior and Interior Finish Wood Carpentry.
3. 092400 - Cement Plastering.

### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.

B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.

1. Show weep paths, gaskets, flashing, sealant, and other means of preventing water intrusion.
2. Show mullion profiles and locations.

C. Samples: For each type of metal finish required.

### 1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on evaluation of comprehensive tests performed according to AMCA 500-L by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver and showing compliance with performance requirements specified.

### 1.4 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain louvers from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

2.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver-blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.

1. Wind Loads: Determine loads based on pressures as indicated on Drawings.

B. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

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

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

D. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

2.3 FIXED, EXTRUDED-ALUMINUM LOUVERS

A. Horizontal Louvers:

1. Manufacturers: Subject to compliance with requirements, Provide products by one of the following:
   a. Airolite Company, LLC.
   b. All-Lite Architectural Products.
   c. Cesco Products; a division of Mestek, Inc.
   d. Greenheck Fan Corporation.
   e. Ruskin Company; Tomkins PLC.

2. Louver Depth: Refer to Drawings.
3. Frame and Blade Nominal Thickness: Not less than 0.052 inch for blades and 0.040 inch for frames.
4. Mullion Type: Exposed.
5. Color: Match adjacent wall color. Confirm with Architect.

6. Louver Performance Ratings:

    a. Free Area: Not less than area shown on drawings.
    b. Point of Beginning Water Penetration: Not less than 1000 fpm.
    c. Air Performance: Not more than 0.10-inch wg static pressure drop at free-area velocity.
    d. Air Performance: Not more than 0.15-inch wg> static pressure drop at 950-fpm free-area.

7. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

## 2.4 LOUVER SCREENS

A. General: Provide insect screen at each exterior louver.

    1. Screen Location for Fixed Louvers: Interior face.
    2. Screening Type: Insect screening.

B. Secure screen frames to louver frames with machine screws with heads finished to match louver, spaced a maximum of 6 inches from each corner and at 12 inches o.c.

## 2.5 MATERIALS

A. Galvanized-Steel Sheet: ASTM A 653/A 653M, G60 zinc coating, mill phosphatized.

B. Fasteners: Use types and sizes to suit unit installation conditions.

    1. Use hex-head or Phillips pan-head tamper-resistant screws for exposed fasteners unless otherwise indicated.
    2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
    3. For fastening galvanized steel, use hot-dip-galvanized steel or 300 series stainless-steel fasteners.
    4. For fastening stainless steel, use 300 series stainless-steel fasteners.
    5. For color-finished louvers, use fasteners with heads that match color of louvers.

C. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed for masonry, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.6 FABRICATION

A. Factory assemble louvers to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.

C. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

1. Frame Type: Exterior flange unless otherwise indicated.

D. Include supports, anchorages, and accessories required for complete assembly.

E. Provide subsills made of same material as louvers for recessed louvers.

F. Join frame members to each other and to fixed louver blades with fillet welds concealed from view unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Form closely fitted joints with exposed connections accurately located and secured.

D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

E. Protect unpainted galvanized and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.

F. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 079200 "Joint Sealants" for sealants applied during louver installation.

## 3.4 ADJUSTING AND CLEANING

A. Clean exposed louver surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.

B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.

C. Restore louvers damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Design Professional, remove damaged units and replace with new units.

1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 089119

# SECTION 092400 - CEMENT PLASTERING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Exterior 3-coat
2. Vertical plasterwork (stucco).

### 1.2 RELATED SECTIONS:

A. Coordinate with other work under related sections;

1. 042200 - Concrete Unit Masonry.
2. 044301-Stone Masonry Veneer.
3. 061000 - rough carpentry.
4. 061600 - Sheathing.
5. 062013 - Exterior and Interior Finish Wood Carpentry.
6. 072100 - Thermal Insulation.
7. 072726 - Fluid-Applied Membrane Air Barriers.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: 12 inch x 12 inch for each type color and texture specified.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance Ratings: Where indicated, provide cement plaster assemblies identical to those of assemblies tested for fire resistance according to ASTM E119 by a qualified testing agency.

### 2.2 SYSTEM DESCRIPTION

A. Three coat stucco is applied in three layers. 3/8-inch thick scratch coat, 3/8-inch thick brown coat, and approximate 1/8-inch thick finish coat applied over an approved weather-resistive barrier and metal lath either by hand using a trowel or by machine application.

1. Basis-of-Design: Provide the following system by the manufacturer indicated or other systems by other acceptable manufacturer's list with systems that achieve the system description, product attributes and characteristics including in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification.

    a. Basis of Design Manufacturer: Omega Products International.

        1) System: Diamond Wall Three Coat System. Factory prepared blend of Portland cement, chopped fibers, and other manufacturer's system ingredients field mixed with sand and water
        2) Scratch and Brown Coat: Diamond Wall Sanded:
            a) Factory prepared blend of Portland cement complying with C150, sand, chopped fibers, and other system ingredients.

## 2.3 WATER RESISTIVE BARRIER

A. Basis of Design: AkroGuard: Acrylic-based, vapor-permeable water-resistive/air barrier coating manufactured by Omega Products International, Inc.

B. Alternative Water Resistive Barriers:

1. Open Framing and non-Wood-based Sheathing:
    a. One layer of D Kraft building paper complying with UBC Standard 14-1.
    b. One layer of asphalt-saturated felt complying with ASTM D226 Type I.
    c. Equivalent material recognized in a current evaluation report as complying with the ICC-ES Acceptance Criteria for Water-resistive Barriers (AC38) acceptable to the cement plastering system manufacturer and meets the warranty requirements.

**2.** Over Wood-based Sheathing:

    a. Two layers of D Kraft building paper complying with UBC Standard 14-1.
    b. Two layers of asphalt-saturated felt complying with ASTM D226 Type I.
    c. Equivalent material recognized in a current evaluation report as complying with the ICC-ES Acceptance Criteria for Water-resistive Barriers (AC38) acceptable to the cement plastering system manufacturer and meets the warranty requirements.

## 2.4 METAL LATH

A. Provide one of the following lath selections acceptable to the cement plastering system manufacturer and meets the warranty requirements.

B. Expanded-Metal Lath: ASTM C847, cold-rolled carbon-steel sheet with ASTM A653/A653M, G60 (Z180), hot-dip galvanized-zinc coating.

1. Diamond-Mesh Lath: Flat, 2.5 lb/sq. yd. (1.4 kg/sq. m).
2. Flat-Rib Lath: Rib depth of not more than 1/8 inch (3 mm), 2.75 lb/sq. yd. (1.5 kg/sq. m).

3. 3/8-Inch (10-mm) Rib Lath: [3.4 lb/sq. yd. (1.8 kg/sq. m)] [4 lb/sq. yd. (2.2 kg/sq. m)].

C. Wire-Fabric Lath:

1. Welded-Wire Lath: ASTM C933; self-furring, [1.4 lb/sq. yd. (0.8 kg/sq. m)] [1.95 lb/sq. yd. (1.1 kg/sq. m)].
2. Woven-Wire Lath: ASTM C1032; self-furring, with stiffener wire backing, 1.4 lb/sq. yd. (0.8 kg/sq. m).

## 2.5 SHEATHING

A. Refer to Section 061600 - Sheathing.

## 2.6 ACCESORIES

A. General: Comply with ASTM C1063, and coordinate depth of trim and accessories with thicknesses and number of plaster coats required.

B. Metal Accessories:

1. Provide metal accessories acceptable to the cement plastering system manufacturer and meets the warranty requirements.
   a. Caulking: Acrylic latex complying with ASTM C834.
   b. Vapor Retarder: A vapor retarder complying with the International Energy Conservation Code (IECC) Section 402.5 or 502.5 or IRC Section R318.1vided.
   c. Flashing: Flashing complying with UBC Section 1404.2, IBC Section 1405.3 or IRC Section R703.8, as applicable, must be provided.
   d. Fasteners: Nails, staples, or screws used to rigidly secure lath and associated accessories shall be corrosion-resistant and meet the minimum requirements of ASTM C1063.
   e. Zinc and Zinc-Coated (Galvanized) Accessories: The following accessories shall be fabricated from zinc.
      1. Corner Aid: Minimum 26-gauge thick; expanded flanges shaped to permit complete embedding in plaster; minimum 2 in. wide; Square-edge style; use unless otherwise indicated.
      2. Strip Mesh: Metal Lath, 3.4 lb/yd$^2$ expanded metal; 6 in. wide x 18 in. long.
      3. Vent Screed: Minimum 26-gauge thick; thickness governed by plaster thickness; minimum 4-inch (102 mm) width, double “V” profile, with perforated expanse between “V’s” of longest possible lengths.
      4. Casing Bead: Minimum 26-gauge thick; thickness governed by plaster thickness; maximum possible lengths; expanded metal flanges, with square edges.

5. Drip Screed: Minimum 26-gauge thick, depth governed by plaster thickness, minimum 3-1/2 in. high flange, maximum possible lengths.
6. Control and Expansion Joints: Depth to conform to plaster thickness; use maximum practical lengths.
   a. Control Joints: One-piece-type, folded pair of unperforated screeds in double V configuration; removable protective tape on plaster face of control joint.
   b. Expansion Joints: [Pair of casing beads with sealant between.

B. Plastic Trim: Fabricated from high-impact PVC.
1. Cornerbeads: With perforated flanges. Square-edge style; use unless otherwise indicated.
2. Casing Beads: With perforated flanges in depth required to suit plaster bases indicated and flange length required to suit applications indicated.
3. Control Joints: One-piece-type, folded pair of unperforated screeds in V, etc. configuration; removable protective tape on plaster face of control joint.
4. Expansion Joints: Pair of casing beads with sealant between.

## 2.6 CRACK ISOLATION SYSTEM

A. Mesh: Where required by the cement stucco system manufacturer, provide alkali resistant woven glass fiber fabric.

## 2.7 MISCELLANOUS MATERIALS

A. Water for Mixing and Finishing Plaster: Potable and free of substances capable of affecting plaster set or of damaging plaster, lath, or accessories.

B. Fiber for Base Coat: Alkaline-resistant glass or polypropylene fibers, 1/2 inch (13 mm) long, free of contaminants, manufactured for use in cement plaster.

C. Bonding Compound: ASTM C932.

D. Fasteners for Attaching Metal Lath to Substrates: ASTM C1063.

E. Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, not less than 0.0475-inch (1.21-mm) diameter unless otherwise indicated.

F. Sound-Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

2.8 PLASTER MATERIALS

A. Portland Cement: ASTM C150/C150M, **Type I**.

B. Masonry Cement: ASTM C91, Type N.

C. Color: Match Basis of Design: Omega Products International – Color Tek #005878 Color # 35.

D. Finish: Omega Products International – Fine Sand

E. Plastic Cement: ASTM C1328.

F. Lime: ASTM C206, Type S; or ASTM C207, Type S.

G. Sand Aggregate: ASTM C897.

H. Perlite Aggregate: ASTM C35.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Prepare smooth, solid substrates for plaster according to ASTM C926.

B. Fire-Resistance-Rated Assemblies: Install components according to requirements for design designations from listing organization and publication indicated on Drawings.

C. Sound-Attenuation Blankets: Where required, install blankets before installing lath unless blankets are readily installed after lath has been installed on one side.

3.2 INSTALLING METAL LATH

A. Metal Lath: Install according to ASTM C1063.

3.3 INSTALLING ACCESSORIES

A. Install according to ASTM C1063 and at locations indicated on Drawings.

B. Reinforcement for External (Outside) Corners:

1. Install lath-type, external-corner reinforcement cornerbead at exterior locations.
2. Install cornerbead at interior locations.

C. Control Joints: Locate as indicated on Drawings.

## 3.4 PLASTER APPLICATION

A. General: Comply with ASTM C926.

B. Bonding Compound: Apply on unit masonry and concrete substrates for direct application of plaster.

C. Walls; Base-Coat Mixes for Use over Metal Lath: For scratch and brown coats, for three-coat plasterwork with 3/4-inch (19-mm) total thickness, as follows:

1. Portland cement mixes.
2. Masonry cement mixes.
3. Portland and masonry cement mixes.
4. Plastic cement mixes.
5. Portland and plastic cement mixes.

D. Plaster Finish Coats:

1. Apply per manufacturer's written requirements.
2. Apply to provide Basis of Design color and finish indicated.

E. Concealed Exterior Plasterwork: Where plaster application is used as a base for adhered finishes, omit finish coat.

## 3.5 CLEANING

A. Cleaning: Remove any and all materials used, overspray from adjacent surfaces, and all protective masking

## 3.5 PROTECTION

A. Protect applied material from inclement weather until dry and prevent it from freezing for a minimum of 24-hours after set and/or until dry. Refer to manufacturer's product data sheet for additional requirements.

## 3.6 PLASTER REPAIRS

A. Repair or replace work to eliminate cracks, dents, blisters, buckles, crazing and check cracking, dry outs, efflorescence, sweat outs, and similar defects and where bond to substrate has failed.

END OF SECTION 092400

# SECTION 099113 - EXTERIOR PAINTING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section includes surface preparation and the application of paint systems on exterior substrates. Including but not limited to the following exterior substrates:

1. Concrete.
2. Galvanized metal.
3. Aluminum (not anodized or otherwise coated).

B. Related Requirements:

1. Section 051200 "Structural Steel Framing for shop priming of metal substrates.
2. Section 055000 "Metal Fabrications" for shop priming metal fabrications.
3. Section 099600 “High-Performance Coatings” for exposed structural steel.

### 1.2 DEFINITIONS

A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.

B. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

C. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.

D. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.

E. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.

F. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
2. Indicate VOC content.

B. Samples for Verification of visually exposed surfaces only: For each type of paint system and each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches square.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

C. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.4 QUALITY ASSURANCE

A. Galvanized metal primers shall be compatible with the galvanized process and galvanizing material on metal substrate. Clean galvanized substrates prior to applying primers as recommended by primer manufacturer's written recommendations.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.6 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, available products from the following manufacturers that may be incorporated into the Work include but are not limited to products listed in the Exterior Painting Schedule for the paint category indicated.

1. PPG Architectural Coatings -Design Basis
2. Sherwin-Williams Company
3. Benjamin Moore
4. Valspar Corporation

2.2 PAINT, GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists.

B. Primer, galvanized, Water Based: MPI #134.

C. Water-Based Paints:
   1. Light Industrial Coating, Exterior, Water Based, (Gloss Level 6): MPI #164.
   2. Light Industrial Coating, Exterior, Water Based, (Gloss Level 5): MPI #163.

D. Solvent Based Paints:
   1. Alkyd, Exterior Gloss (Gloss Level 6): MPI #9

E. Material Compatibility:

   1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
   2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

F. Provide materials with low VOC content and limits compliant with local and state VOC limits.

G. Colors: Match Architect's samples.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

   1. Concrete: 12 percent.
   2. Fiber-Cement Board: 12 percent.
   3. Masonry (Clay and CMUs): 12 percent.
   4. Wood: 15 percent.
   5. Portland Cement Plaster: 12 percent.
   6. Gypsum Board: 12 percent.

C. Portland Cement Plaster Substrates: Verify that plaster is fully cured.

D. Exterior Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

E. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

F. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.

F. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:
1. SSPC-SP 3.

G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

I. Aluminum Substrates: Remove loose surface oxidation.

J. Wood Substrates:

1. Scrape and clean knots. Before applying primer, apply coat of knot sealer recommended in writing by topcoat manufacturer for exterior use in paint system indicated.
2. Sand surfaces that will be exposed to view, and dust off.
3. Prime edges, ends, faces, undersides, and backsides of wood.
4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

K. Plastic Trim Fabrication Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

## 3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
4. Paint entire exposed surface of window frames and sashes.
5. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
6. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

## 3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Architect may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.

1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

## 3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

## 3.6 EXTERIOR PAINTING SCHEDULE

A. Galvanized-Metal Substrates:

1. Water-Based Light Industrial Coating System:

a. Prime Coat: Primer, galvanized, water based, MPI #134 unless specified otherwise elsewhere. Basis of Design - PPG Paints 90-912 Pitt Tech Plus Int./Ext. DTM Industrial Acrylic Primer.
b. Intermediate Coat: Light industrial coating, exterior water based, matching topcoat.
c. Topcoat: Light industrial coating exterior water based, semi-gloss (Gloss Level 5), MPI #163. Basis of Design - PPG Paints 90-1210 Pitt-Tech Plus Int/Ext Semi-Gloss DTM Industrial Enamel.

B. Stainless-Steel Substrates:
1. Water-Based Light Industrial Coating System:
a. Prime Coat: Primer, quick dry, for aluminum, MPI #95.
b. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.
c. Topcoat: Light industrial coating exterior water based semi-gloss (Gloss Level 5), MPI #163. Basis of Design - PPG Paints 90-1210 Pitt-Tech Plus Int/Ext Semi-Gloss DTM Industrial Enamel.

C. Concrete Masonry Units:
1. Elastomeric Coating MPI EXT 4.2D:
a. Prime Coat: Primer, as recommended by the manufacturer. Basis of Design - PPG Paints 4-100XI Perma-Crete Concrete Block & Masonry Surfacer/Filler.
b. Intermediate Coat: Elastomeric Coating MPI # 113. Basis of Design - PPG Paints 4-110 Perma-Crete Pitt Flex Smooth Elastomeric Coating.
c. Topcoat: Elastomeric Coating MPI # 113 Basis of Design - PPG Paints 4-110 Perma-Crete Pitt Flex Smooth Elastomeric Coating.

D. Concrete:
   1. Elastomeric Coating MPI EXT 4.2D:
      a. Prime Coat: Primer, as recommended by the manufacturer. PPG Paints 4-603 Perma-Crete 4-603 Interior Exterior Acrylic Alkali Resistant Primer.
      b. Intermediate Coat: Elastomeric Coating MPI # 113. Basis of Design - PPG Paints 4-110 Perma-Crete Pitt Flex Smooth Elastomeric Coating.
      c. Topcoat: Elastomeric Coating MPI # 113. Basis of Design - PPG Paints 4-110 Perma-Crete Pitt Flex Smooth Elastomeric Coating.

END OF SECTION 099113

# SECTION 099600 - HIGH-PERFORMANCE COATINGS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section includes surface preparation and the application of high-performance coating systems on the following substrates:

1. Exterior Substrates:
   a. Exposed steel.

2. Interior Substrates:
   a. Exposed steel.

B. Section Cross-Reference:

1. 051200 - Structural Steel Framing

### 1.2 DEFINITIONS

A. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D523.

B. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D523.

C. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D523.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.

### 1.4 QUALITY ASSURANCE

A. Mockups: Apply mockups of each coating system indicated to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each coating system.

2. Final approval of color selections will be based on mockups.

   a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:

1. Tnemec Inc.
2. PPG Paints.
3. Sherwin-Williams Co.

2.2 HIGH-PERFORMANCE COATINGS, GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."

B. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
3. Products shall be of same manufacturer for each coat in a coating system.

C. Colors: Match standing seam metal roof color.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

C. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

## 3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and coating systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce coating systems indicated.

## 3.3 APPLICATION

A. Apply high-performance coatings according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."

B. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

C. Steel Substrates:

1. Epoxy System; 3-coat with matt finish:

END OF SECTION 099600

# SECTION 101423.16 - ROOM-IDENTIFICATION PANEL SIGNAGE (AT RESTROOMS)

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Exterior solid signage system for room identification.

B. References:

A. Federal Register Part III, Department of Justice, Office of the Attorney General, 28 CFR Part 35: Nondiscrimination on the Basis of Disability in state and local Government Services.

### 1.3 ALLOWANCE

A. Provide interior signage and room-identification signs for each room shown on the plans.

### 1.4 DEFINITIONS

A. Accessible: In accordance with the accessibility standard

B. Braille: Grade 2 Braille including 189 part-word or whole word contractions in addition to Grade 1 Braille 63 characters. Tactile is required whenever braille is required.

C. Non-tactile: Letters and numbers on signs with width-to-height ratio between 3:5 and 1:1 and stroke width ratio between 1:5 and 1:10 using upper case "X" to calculate ratios. Use type styles with medium weight; upper and lower case lettering are permitted; serif typestyles are permitted.

D. Symbols: Symbol itself is not required to be tactile but equivalent verbal description is required both in tactile letters and braille.

E. Tactile: 1/32 inch (0.80 mm) raised capital letters without serifs at least 5/8 inch (16 mm) height and not more than 2 inches (51 mm) height based on upper case "X". Braille is required whenever tactile is required

1.5 COORDINATION

A. Furnish templates for placement of sign-anchorage devices embedded in permanent construction by other installers.

B. Furnish templates for placement of electrical service embedded in permanent construction by other installers.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For room-identification signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.

C. Samples for Verification: For type of sign assembly showing components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:

1. Room-Identification Signs: Full-size Sample.
2. Variable Component Materials: Full-size Sample of each base material, character (letter, number, and graphic element) in each exposed color and finish not included in Samples above.

D. Product Schedule: For room-identification signs. Coordinate room name designations indicated on Drawings with the Onwer.

1.7 SYSTEM DESCRIPTION

A. Signage under this section is intended to include items for identification, direction, control, and information of building where installed as complete integrated system from a single manufacturer

B. ADA design requirements:
1. Signage requiring tactile graphics:
a. Wall mounted signs designating permanent rooms and spaces such as, room numbers and restroom, department, office, and fire exit identifications.
b. Individually applied characters are strictly prohibited.
2. Signage not requiring tactile graphics but which are required to comply to other ADA requirements include signs providing direction to or information about function of space such as, directional signs (signs with arrow), informational signs (operating hours,

policies, etc.), regulatory signs (no smoking, do not enter), and ceiling and projected wall mount signs.

C. Comply with 2010 ADA standards, chapter 7-section 703.

1. Tactile graphics signs mounting requirements:

a. Single doors: Mount 60 inches (1524 mm) to sign centerline above finish floor and on wall adjacent to latch side of door.

b. Openings: Mount 60 inches (1524 mm) to sign centerline above finish floor adjacent opening.

c. No wall space adjacent latch side of door, opening, or double doors: Mount 60 inches (1524 mm) to sign centerline above finish floor on nearest adjacent wall.

1.8 CLOSEOUT SUBMITTALS

A. Maintenance Data: For signs to include in maintenance manuals.

B. Maintenance data and cleaning requirements for exterior surfaces.

C. Furnish instructions or one complete software package in Owner selected format for PC type computer for updating signs inserts by Owner.

D. Maintenance data and cleaning requirements for exterior surfaces.

1.11 QUALITY ASSURANCE

A. Manufacturer Qualifications:
1. Work required under this section from manufacturer regularly engaged in work of this type and scope for a minimum of 5 years.
2. Maintain computer link between schedule input and computerized typography production

B. Installer Qualifications: Trained and authorized by manufacturer for installations of required scope and product.

1.12 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

B. Schedule system installation after room finishes and fixtures have been completed.

1.13 DELIVERY, STORAGE, AND HANDLING

A. Package signs to prevent damage during shipment, handling, storage and installation. Products are to remain in their original packaging (unless otherwise specified) until removal is necessary for installation.

B. If installation site is not ready for signage upon delivery, store signs in a dry, air-conditioned environment.

C. Handle signage in accordance with manufacturer's instructions.

D. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.14 WARRANTY

A. When warranties are required, verify with Owner's counsel that warranties stated in this article are not less than remedies available to Owner under prevailing local laws.

B. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the follow

a. Deterioration of finishes beyond normal weathering.
b. Deterioration of embedded graphic image.
c. Separation or delamination of sheet materials and components.

2. Warranty Period: Five years from date of Material Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

**A.** Accessibility Standard: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities for shower and dressing compartments designated as accessible, and Georgia Accessibility Code 120-3-20 (.01-.08).

2.2 SYSTEM REQUIREMENTS ROOM-IDENTIFICATION SIGNS

A. General

1. Sign system shall feature modular solutions for all required sign types, including but not limited to wall mounted personnel signs, work station personnel signs, primary room identification, directories, directional, overhead signs, projection wall signs,

free standing signs, restroom signs, regulatory and information signs, stair signs and changeable slide conference room signs.

2. Signs within the system shall feature the same family of components and convey a uniform look throughout.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. APCO Signs.
2. ASI Signage.
3. Innerface Architectural Signage, Inc.
4. Inpro Corporation.

## 2.3 FEATURES

A. Typography: As selected from manufacturer’s standards.

B. Colors and Finishes: As selected from manufacturer’s standards.

1. Comply with 200 ADA standards, Chapter 7 – section 703, Sign system shall comply with all current and applicable ADA regulations, including requirements regarding which sign types require Braille/tactile features, character heights, color contrast and installation locations and mounting heights within the facility.

## 2.4 SIGN MATERIALS

A. Braille / Tactile Components: PETG-backed photopolymer with raised characters and Braille of minimum 1/32 inch (0.8 mm) depth/thickness. Braille/tactile plaques shall contain a minimum of 40% recycled content.

B. Acrylic Sheet: ASTM D4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).

## 2.5 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:

1. Use concealed fasteners and anchors.
2. For exterior exposure, furnish nonferrous-metal devices unless otherwise indicated.

## 2.6 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

B. Shop assembly:
   1. Fabricate units to configurations indicated on reviewed shop drawings.
   2. Provide copy on inserts, and covers required on reviewed shop drawings and in accord with ADA requirements.
   3. Provide additional blank paper as specified.
   4. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
   5. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
   6. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
   7. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.

C. Signs with Changeable Message Capability: Fabricate signs to allow insertion of changeable messages as follows:
   1. For slide-in changeable inserts, fabricate slot without burrs or constrictions that inhibit function. Furnish initial changeable insert. Subsequent changeable inserts are by Owner. Furnish two blank inserts for each sign for Owner's use.
   2. For frame to hold changeable sign panel, fabricate frame without burrs or constrictions that inhibit function. Furnish initial sign panel. Subsequent changeable sign panels are by Owner.

## 2.7 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 not acceptable. 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 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Design Professional of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. General: Install products in accordance with manufacturer's instructions, in locations and with mounting methods as specified in sign and location drawings.

B. Square, plumb and level all installed products.

C. Install all signage in accordance with 2010 ADA standards and any applicable state standards.

D. Upon completion of the work, sign installer shall remove any unused products, materials, packaging and debris from the installation site.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Install signs so they do not protrude or obstruct according to the accessibility standard.
3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.

3.4 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films as signs are installed.

B. Clean all exposed surface not more than 48 hours prior to Date of Material Completion in accordance with manufacturer's written cleaning instructions.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

D. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

3.5 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Material Completion.

END OF SECTION 101423.13

# SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Public-use washroom accessories.
2. Warm-air dryers.
3. Childcare accessories.
4. Underlavatory guards.

B. Substrate: Refer to Drawings, substrate is polished concrete masonry unit wall for this project.

C. Related Requirements:

1. 042200 - Concrete Unit Masonry.

### 1.2 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
3. Include electrical characteristics, if any.

4. Approved full-size Samples will be returned and may be used in the Work.

B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated.
2. Identify accessories using designations indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For manufacturer's special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For accessories to include in maintenance manuals.

1.6 WARRANTY

A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, visible silver spoilage defects.
2. Warranty Period: 15 years from date of Material Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE 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.

2.2 PUBLIC-USE WASHROOM ACCESSORIES

A. Source Limitations: Obtain public-use washroom accessories from single source from single manufacturer.

2.3 ACCESSORIES

A. Basis-of-Design Product specification: 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 illustrate and establish 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.

B. Stainless Steel Finish: Brushed.

C. Acceptable Manufacturers:

1. Bradley Corporation.
2. Bobrick.
3. American Specialties.

4. AJW Architectural Products.
5. Tubular Specialties.

D. Schedule of Accessories – Basis of Design:

| Accessory | Model | Manufacturer |
|---|---|---|
| Grab Bars:<br>18"<br>36’”<br>42” | <br>8120-00118<br>8120-00136<br>8120-001428 | Bradley Corporation |
| Verge Lav/Washbasin; Terreon Solid Surface; Color - Glacier | LVAD1 | Bradley Corporation |
| Sensor Faucet | 775B305 | American Standard |
| 10 Year PWRX Battery Kit | PK00WRK | American Standard |
| Toilet Tissue Dispenser Jumbo | 5426-11 | Bradley Corporation |
| Seat Cover Dispenser | 5A40-11 | Bradley Corporation |
| Napkin Disposal | 4A10-11 | Bradley Corporation |
| Soap Dispenser Automatic | 6A01-11 | Bradley Corporation |
| Hand Dryer | 2923-2874 | Bradley Corporation |
| Mirror | 780-2436 | Bradley Corporation |
| Baby Changing Station | 962-11 | Bradley Corporation |

## 2.4 UNDERLAVATORY GUARDS

A. Under Lavatory Guard:

1. Coordinate with Plumbing sections.
2. Description: Insulating pipe covering for supply and drain piping assemblies that prevents direct contact with and burns from piping; allow service access without removing coverings.
3. Material and Finish: Antimicrobial, molded plastic, white.

## 2.5 MATERIALS

A. Stainless Steel: ASTM A666, Type 304, 0.031-inch minimum nominal thickness unless otherwise indicated.

B. Brass: ASTM B19, flat products; ASTM B16/B16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B30, castings.

C. Steel Sheet: ASTM A1008/A1008M, Designation CS (cold rolled, commercial steel), 0.036-inch minimum nominal thickness.

D. Galvanized-Steel Sheet: ASTM A653/A653M, with G60 hot-dip zinc coating.

E. Galvanized-Steel Mounting Devices: ASTM A153/A153M, hot-dip galvanized after fabrication.

F. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.

G. Chrome Plating: ASTM B456, Service Condition Number SC 2 (moderate service).

H. Mirrors: ASTM C1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.6 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to ASTM F446.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written instructions.

END OF SECTION 102800

# PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

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

## 1.2 SUMMARY

A. This Section includes the following:

1. Site Furnishings.
   a. Provide for the purchase and on site delivery of all furnishings listed or shown on the drawings.
   b. Provide all labor, tools and materials for the installation of these furnishings.

## 1.3 SUBMITTALS

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

B. Maintenance Data: For site furnishings to include in maintenance manuals.

C. Manufacturer warranty, and assembly instructions, specifications, etc., for all factory products.

## 1.4 COORDINATION

A. Contractor shall be responsible for verifying all dimensions and required hardware of furnishings prior to installation.

## 1.5 QUALITY ASSURANCE

A. All pre-packed items shall remain in their original containers until such time when the actual installations will take place. Said items shall be stored as necessary to prevent damage and shall be in new condition at the time of installation.

B. Source Limitations: Obtain each type of site furnishing through one source from a single manufacturer.

PART 2 - PRODUCTS

2.1 PRODUCTS

A. Contractor shall refer to drawings for specified Basis-of-Design products and locations of all site furnishings. All items are subject to compliance with requirements and are to be installed per manufacturer's recommendations. Any equivalent products are subject to the approval of the Owner and/or Design professional.

2.2 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: Weld connections continuously. Weld solid members with full-length, full-penetration welds and 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.

C. Pipes and Tubes: Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of handrail and railing components.

D. Preservative-Treated Wood Components: Complete fabrication of treated items before treatment if possible. If cut after treatment, apply field treatment complying with AWPA M4 to cut surfaces.

E. Exposed Surfaces: Polished, sanded, or otherwise finished; all surfaces smooth, free of burrs, barbs, splinters, and sharpness; all edges and ends rolled, rounded, or capped.

F. Factory Assembly: Assemble components in the factory to greatest extent possible to minimize field assembly. Clearly mark units for assembly in the field.

2.3 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. 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.

2.4 ALUMINUM FINISHES

A. 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.

2.5 STEEL AND GALVANIZED STEEL FINISHES

A. 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.

B. PVC Finish: Manufacturer's standard, UV-light stabilized, mold-resistant, slip-resistant, matte-textured, dipped or sprayed-on, PVC-plastisol finish, with flame retardant added; complying with coating manufacturer's written instructions for pretreatment, application, and minimum dry film thickness.

2.6 IRON FINISHES

A. 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.

2.7 STAINLESS-STEEL FINISHES

A. Remove tool and die marks and stretch lines or blend into finish.

B. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

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. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Complete field assembly of site furnishings where required.

B. Unless otherwise indicated, install site furnishings after landscaping and paving have been completed.

C. Install site furnishings level, plumb, true, and securely anchored and positioned at locations indicated on Drawings.

D. All furnishings shall be located where shown on the drawings or where directed by the Owner/ Design professional in the field.

E. Contractor shall use actual furnishings to establish all dimensions, clearances, etc.

F. All items shall be installed plumb and level.

G. All factory items shall be installed in full accordance with the manufacturer's recommendation or as approved by the Owner/ Design professional.

H. All furnishings shall be guaranteed against factory and assemblage defects. Delays caused by rejection of defective items, and/or additional shipping costs shall not warrant an extension of the contract time or an increase in the contract sum.

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.

END OF SECTION 129300

# SECTION 220517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Sleeves.
2. Sleeve-seal systems.
3. Grout.

### 1.2 ACTION SUBMITTALS

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

## PART 2 - PRODUCTS

### 2.1 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

D. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

E. Galvanized-Steel-Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

### 2.2 SLEEVE-SEAL SYSTEMS

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

1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. Metraflex Company (The).
4. Pipeline Seal and Insulator, Inc.

5. Proco Products, Inc.

B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Carbon steel.
3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating of length required to secure pressure plates to sealing elements.

## 2.3 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

# PART 3 - EXECUTION

## 3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.

2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.

2. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200 "Joint Sealants."

E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials.

## 3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

## 3.3 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls above Grade:

   a. Piping Smaller Than NPS 6: Cast-iron wall sleeves, Galvanized-steel wall sleeves, or Galvanized-steel-pipe sleeves.
   b. Piping NPS 6 and Larger: Cast-iron wall sleeves, Galvanized-steel wall sleeves, or Galvanized-steel-pipe sleeves.

2. Exterior Concrete Walls below Grade:

   a. Piping Smaller Than NPS 6: Cast-iron wall sleeves with sleeve-seal system, Galvanized-steel wall sleeves with sleeve-seal system, or Galvanized-steel-pipe sleeves with sleeve-seal system.

      1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.

   b. Piping NPS 6 and Larger: Cast-iron wall sleeves with sleeve-seal system, Galvanized-steel wall sleeves with sleeve-seal system, or Galvanized-steel-pipe sleeves with sleeve-seal system.

      1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs-on-Grade:

    a. Piping Smaller Than NPS 6: Cast-iron wall sleeves with sleeve-seal system, Galvanized-steel wall sleeves with sleeve-seal system, or Galvanized-steel-pipe sleeves with sleeve-seal system.

        1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.

    b. Piping NPS 6 and Larger: Cast-iron wall sleeves with sleeve-seal system, Galvanized-steel wall sleeves with sleeve-seal system, Galvanized-steel-pipe sleeves with sleeve-seal system, or Galvanized-steel-pipe sleeves.

        1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.

4. Concrete Slabs above Grade:

    a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves or PVC-pipe sleeves.
    b. Piping NPS 6 and Larger: Galvanized-steel-pipe sleeves or PVC-pipe sleeves.

5. Interior Partitions:

    a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
    b. Piping NPS 6 and Larger: Galvanized-steel-sheet sleeves

END OF SECTION 220517

# SECTION 312000 - EARTH MOVING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Excavating and filling for rough grading the Site.
2. Preparing subgrades for slabs-on-grade, walks pavements, turf and grasses, and plants.
3. Excavating and backfilling for buildings and structures.
4. Drainage course for concrete slabs-on-grade.
5. Subbase course for concrete walks and pavements.
6. Subbase course and base course for asphalt paving.
7. Excavating and backfilling trenches for utilities and pits for buried utility structures.

### 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. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Design professional. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Design professional. Unauthorized excavation, as well as remedial work directed by Design professional, shall be without additional compensation.

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

H. 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.

I. 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 cement concrete pavement or a cement concrete or hot-mix asphalt walk.

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 PREINSTALLATION MEETINGS

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

1.4 INFORMATIONAL SUBMITTALS

A. Material test reports.

1.5 FIELD CONDITIONS

A. Utility Locator Service: Notify utility locator service for area where Project is located before beginning earth-moving operations.

B. Do not commence earth-moving operations until plant-protection measures specified in Section 015639 "Temporary Tree and Plant Protection" are in place.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D2487 and Groups A-1, A-2-4, A-2-5, and A-3 according to AASHTO M 145, or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D2487 and Groups A-2-6, A-2-7, A-4, A-5, A-6, and A-7 according to AASHTO M 145, or a combination of these groups.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.

F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200) sieve.

G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.

H. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and zero to 5 percent passing a No. 8 sieve.

## 2.2 ACCESSORIES

A. Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility; colored to comply with local practice or requirements of authorities having jurisdiction.

B. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches mm) 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 to comply with local practice or requirements of authorities having jurisdiction.

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 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

3.3 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, 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. Pile Foundations: Stop excavations 6 to 12 inches above bottom of pile cap before piles are placed. After piles have been driven, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.
3. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.

B. Excavations at Edges of Tree- and Plant-Protection Zones:

1. Excavate by hand or with an air spade to indicated lines, cross sections, elevations, and subgrades. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.

2. Cut and protect roots according to requirements in Section 015639 "Temporary Tree and Plant Protection."

## 3.4 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

## 3.5 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated.

C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

D. Trenches in Tree- and Plant-Protection Zones:

1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.
3. Cut and protect roots according to requirements in Section 015639 "Temporary Tree and Plant Protection."

## 3.6 SUBGRADE INSPECTION

A. Proof-roll subgrade below the building slabs and pavements with a pneumatic-tired dump truck to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

B. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

C. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Design professional, without additional compensation.

D. Notify Testing Agent when excavations have reached required subgrade.

E. If Testing Agent determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

## 3.7 UNAUTHORIZED EXCAVATION

A. 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, with 28-day compressive strength of 2500 psi may be used when approved by Design professional.

1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Design professional.

## 3.8 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory 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.

## 3.9 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Section 033000 "Cast-in-Place Concrete."

D. Trenches under Roadways: Provide 4-inch thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase course. Concrete is specified in Section 033000 "Cast-in-Place Concrete."

E. Initial Backfill: Place and compact initial backfill of subbase material, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the pipe or conduit.

1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

F. Final Backfill: Place and compact final backfill of satisfactory soil to final subgrade elevation.

G. Warning Tape: Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

## 3.10 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.
2. Under walks and pavements, use satisfactory soil material.
3. Under steps and ramps, use Engineered fill.
4. Under building slabs, use Engineered fill.
5. Under footings and foundations, use Engineered fill.

## 3.11 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill soil 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.

## 3.12 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D698:

1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 92 percent.
3. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 85 percent.

4. For utility trenches, compact each layer of initial and final backfill soil material at 85 percent.

## 3.13 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to elevations required to achieve indicated finish elevations, within the following subgrade tolerances:

1. Turf or Unpaved Areas: Plus or minus 1 inch.
2. Walks: Plus or minus 1 inch.
3. Pavements: Plus or minus 1/2 inch.

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch (when tested with a 10-foot straightedge.

## 3.14 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:

1. Shape subbase course and base course to required crown elevations and cross-slope grades.
2. Place subbase course and base 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.
3. Compact subbase course and base 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 D698 and ASTM D1557.

## 3.15 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

A. Place drainage course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:

1. Place drainage 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.
2. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D698.

## 3.16 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform inspections:

B. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.

C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

D. 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 Design professional.

E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

## 3.17 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

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 greatest extent possible.

## 3.18 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 312000

# SECTION 313219 - GEOTEXTILE FOR SOIL STABILIZATION AND LAYER SEPARATION

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section includes:
   1. Geotextile to stabilize and reinforce an aggregate cover material (subbase, base, riprap, etc).
   2. Geotextile for subsurface drainage filtration.

B. Related Requirements:
   1. Section 015723 “Temporary Storm Water Pollution Control”
   2. Section 312000 “Earth Moving”
   3. Section 312313 “Concrete Paving”
   4. Section 334200 “Stormwater Conveyance”
   5. Section 334600 “Subdrainage”

### 1.2 DEFINITIONS

A. Minimum Average Roll Value (MARV): Property value calculated as typical minus two standard deviations. Statistically, it yields a 97.7 percent degree of confidence that any sample taken during quality assurance testing will exceed value reported.

### 1.3 SUBMITTALS

A. Submit the following:
   1. Certification: The contractor shall provide to the Engineer a certificate stating the name of the manufacturer, product name, style number, and chemical composition of the filaments or yarns and other pertinent information to fully describe the geotextile. The Certification shall state that the furnished geotextile meets MARV requirements of the specification as evaluated under the Manufacturer's quality control program. The Certification shall be attested to by a person having legal authority to bind the Manufacturer. Certifications from Private Label distributors will not be accepted.
   2. If an alternate product is submitted full scale performance testing performed by an Independent testing agency shall be provided.
   3. Coefficient of Interaction (CI) test results performed by a lab with GRI accreditation should be provided to confirm conformance to the specified value.
   4. Manufacturer’s installation Guidelines shall be provided.
   5. One 1’ x 1’sample shall be provided.
   6. Quality Standards: The contractor shall provide to the Engineer the Manufacturer’s Quality Control Plan along with their current GAI-LAP and ISO 9001:2015 certificates.
   7. Alternate products must be submitted 15 days prior to bid date to engineer and should include information on five similar projects in size and scope.

## 1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications:
   1. The geotextile Manufacturer shall have all the following credentials:
      a. Geosynthetic Accreditation Institute (GAI)- Laboratory Accreditation Program (LAP)
      b. ISO 9001:2015 Quality Management System

B. The geotextile manufacturer shall have a GAI-LAP accredited laboratory at the location production capable of performing the ASTM tests as outlined in the specification.

## 1.5 DELIVERY, STORAGE, AND HANDLING

A. Geotextile labeling, shipment, and storage shall follow ASTM D4873. Product labels shall be color-coded to specifically identify each product and clearly show the Manufacturer's name, style name, and roll number.

B. Each geotextile roll shall be wrapped with a material that will protect the geotextile from damage due to shipment, water, sunlight, and contaminants.

C. During storage, geotextile rolls shall be elevated off the ground and adequately covered to protect them from the following: site construction damage, precipitation, extended ultraviolet radiation including sunlight, chemicals that are strong acids or strong bases, flames including welding sparks, excess temperatures, and any other environmental conditions that may damage the physical property values of the geotextile.

# PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

A. TenCate™ Geosynthetics Americas
365 South Holland Drive
Pendergrass, GA, USA 30567
1-800-685-9990
1-706-693-2226
1-706-693-4400, fax
www.tencategeo.us

B. US Fabrics Inc.
3904 Virginia Avenue
Cincinnati, OH USA 45227
1-800-518-2290
1-513-271-4420, fax
www.usfabricsinc.com

C. Or approved equivalent.

## 2.2 MATERIALS

A. Geotextile

1. The geotextile shall be woven from high-tenacity long-chain synthetic polymers composed of at least 95 percent by weight of polyolefins or polyesters. They shall form a stable network such that the filaments or yarns retain their dimensional stability relative to each other, including selvages.
2. The geotextile shall meet the requirements of Table 1. All numeric values in Table 1 except AOS represent MARV in the specified direction. Values for AOS represent maximum average roll values.

**TABLE 1 – GEOTEXTILE FOR SOIL STABILIZATION AND LAYER SEPARATION**

| Mechanical Properties | Test Method | Unit | Minimum Average Roll Value | |
|---|---|---|---|---|
| | | | MD | CD |
| Grab Tensile Strength | ASTM D4632 | lbs (N) | 250 (1113) | 250 (1113) |
| Grab Tensile Elongation | ASTM D4632 | % | 50 | 50 |
| Trapezoid Tear Strength | ASTM D4533 | lbs (N) | 100 (445) | 100 (445) |
| CBR Puncture Strength | ASTM D6241 | lbs (N) | 700 (3115) | |
| | | | Maximum Opening Size | |
| Apparent Opening Size (AOS) | ASTM D4751 | U.S. Sieve (mm) | 100 (0.15) | |
| | | | Minimum Roll Value | |
| Permittivity | ASTM D4491 | $sec^{-1}$ | 0.8 | |
| Flow Rate | ASTM D4491 | $gal/min/ft^2$ ($l/min/m^2$) | 75 (3056) | |
| | | | Minimum Test Value | |
| UV Resistance (at 500 hours) | ASTM D4355 | % strength retained | 70 | |

| Physical Properties | Unit | Roll Size |
|---|---|---|
| Roll Dimensions (width x length) | ft (m) | 15 x 300 (4.57 x 91.4) |
| Roll Area | $yd^2$ ($m^2$) | 500 (418) |

3. Approved geotextiles are as follows:
   a. Mirafi® 1100N
   b. US 250NW

## 2.3 QUALITY CONTROL

A. Manufacturing Quality Control: Testing shall be performed at an on-site laboratory accredited by GAI-LAP for tests required for the geotextile, at frequency meeting or exceeding ASTM D4354.

B. Manufacturer's certifications and testing of quality assurance samples obtained using Procedure B of ASTM D4354. A lot size for conformance or quality assurance sampling shall be the shipment quantity of the given product or a truckload of the given product, whichever is smaller.

PART 3 - EXECUTION

3.1 Follow Manufacturer's Installation guidelines provided in the submittal.

END OF SECTION 313219

# SECTION 321313 - CONCRETE PAVING

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section Includes Concrete Paving. Including the Following:
   1. Curbs and gutters
   2. Sidewalks

B. Related Requirements:

   1. Section 033000 "Cast-in-Place Concrete" for general building applications of concrete.
   2. Section 321373 "Concrete Paving Joint Sealants" for joint sealants in expansion and contraction joints within concrete paving and in joints between concrete paving and asphalt paving or adjacent construction.

### 1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash, slag cement, and other pozzolans.

B. W/C Ratio: The ratio by weight of water to cementitious materials.

### 1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at site.

   1. Review methods and procedures related to concrete paving the following:

      a. Concrete mixture design.
      b. Quality control of concrete materials and concrete paving construction practices.
      c. To be determined.

   2. Require representatives of each entity directly concerned with concrete paving to attend, including the following:

      a. Contractor's superintendent.
      b. Independent testing agency responsible for concrete design mixtures.

c. Ready-mix concrete manufacturer.
d. Concrete paving Subcontractor.
e. Manufacturer's representative of stamped concrete paving system used for stamped detectable warnings.

## 1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. To be determined.

Samples for Initial Selection: For each type of product, ingredient, or admixture requiring color selection.

C. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

## 1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: To be determined.

B. Material Certificates: For the following, from manufacturer:

1. Cementitious materials.
2. Steel reinforcement and reinforcement accessories.
3. Fiber reinforcement.
4. Admixtures.
5. Curing compounds.
6. Applied finish materials.
7. Bonding agent or epoxy adhesive.
8. Joint fillers.

C. Material Test Reports: For each of the following:

1. Aggregates: to be determined.

D. Field quality-control reports.

## 1.7 QUALITY ASSURANCE

A. Stamped Detectable Warning Installer Qualifications: An employer of workers trained and approved by manufacturer of stamped concrete paving systems.

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

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").

C. Testing Agency Qualifications: Qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

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. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockups of full-thickness sections of concrete paving to demonstrate typical joints; surface finish, texture, and color; curing; and standard of workmanship.
2. Build mockups of concrete paving in the location and of the size indicated or, if not indicated, build mockups where directed by Design Professional and not less than 96 inches (2400 mm) by 96 inches (2400 mm).
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Design Professional specifically approves such deviations in writing.
4. Approved mockups may become part of the completed Work if undisturbed at time of Material completion.

## 1.8 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified independent testing agency to perform preconstruction testing on concrete paving mixtures.

## 1.9 FIELD CONDITIONS

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

B. Cold-Weather Concrete Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:

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 design mixtures.

C. Hot-Weather Concrete Placement: Comply with ACI 301 (ACI 301M) and as follows when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover steel reinforcement with water-soaked burlap, so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

## PART 2 - PRODUCTS

### 2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with ACI 301 (ACI 301M) unless otherwise indicated.

### 2.2 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.

1. Use flexible or uniformly curved forms for curves with a radius of 100 feet (30.5 m) or less. Do not use notched and bent forms.

B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

### 2.3 STEEL REINFORCEMENT

A. Plain-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, fabricated from galvanized-steel wire into flat sheets.

B. Deformed-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, flat sheet.

C. Epoxy-Coated Welded-Wire Reinforcement: ASTM A 884/A 884M, Class A, plain steel.

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

E. Galvanized Reinforcing Bars: ASTM A 767/A 767M, Class II zinc coated, hot-dip galvanized after fabrication and bending; with ASTM A 615/A 615M, Grade 60 (Grade 420) deformed bars.

F. Epoxy-Coated Reinforcing Bars: ASTM A 775/A 775M or ASTM A 934/A 934M; with ASTM A 615/A 615M, Grade 60 (Grade 420) deformed bars.

G. Steel Bar Mats: ASTM A 184/A 184M; with ASTM A 615/A 615M, Grade 60 (Grade 420) deformed bars; assembled with clips.

H. Plain-Steel Wire: ASTM A 1064/A 1064M, galvanized.

I. Deformed-Steel Wire: ASTM A 1064/A 1064M.

J. Epoxy-Coated-Steel Wire: ASTM A 884/A 884M, Class A; coated.

K. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420) plain-steel bars; zinc coated (galvanized) after fabrication according to ASTM A 767/A 767M, Class I coating. Cut bars true to length with ends square and free of burrs.

L. Epoxy-Coated, Joint Dowel Bars: ASTM A 775/A 775M; with ASTM A 615/A 615M, Grade 60 (Grade 420) plain-steel bars.

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

N. Hook Bolts: ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6), internally and externally threaded. Design hook-bolt joint assembly to hold coupling against paving form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.

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

1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.
2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.

P. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating, compatible with epoxy coating on reinforcement.

Q. Zinc Repair Material: ASTM A 780/A 780M.

## 2.4 CONCRETE MATERIALS

A. To be determined.

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

1. Portland Cement: ASTM C 150/C 150M, gray or white portland cement Type I, Type II, Type I/II, Type III, or Type V.
2. Fly Ash: ASTM C 618, Class C or Class F.
3. Slag Cement: ASTM C 989/C 989M, Grade 100 or 120.
4. Blended Hydraulic Cement: ASTM C 595/C 595M, Type IS, portland blast-furnace slag orType IP, portland-pozzolan or Type IL, Portland-limestone orType IT ternary blended cement.

C. Normal-Weight Aggregates: ASTM C 33/C 33M, Class 4S or Class 4M or Class 1N, , uniformly graded. Provide aggregates from a single source with documented service-record data of at least 10 years' satisfactory service in similar paving applications and service conditions using similar aggregates and cementitious materials.

1. Maximum Coarse-Aggregate Size: 1 inch (25 mm) nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Air-Entraining Admixture: ASTM C 260/C 260M.

E. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.

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

F. Water: Potable and complying with ASTM C 94/C 94M.

## 2.5 FIBER REINFORCEMENT

A. Synthetic Fiber: Monofilament polypropylene fibers engineered and designed for use in decorative concrete paving, complying with ASTM C 1116/C 1116M, Type III, 1/2 to 1-1/2 inches (13 to 38 mm) long.

1. To be determined.

B. Synthetic Fiber: Fibrillated polypropylene fibers engineered and designed for use in decorative concrete paving, complying with ASTM C 1116/C 1116M, Type III, 1/2 to 1-1/2 inches (13 to 38 mm) long.

## 2.6 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) dry or cotton mats.

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

C. Water: Potable.

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

1. To be determined.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

1. To be determined.

F. White, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 2, Class B, dissipating.

1. To be determined.

## 2.7 RELATED MATERIALS

A. Joint Fillers: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork in preformed strips.

B. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.

C. Bonding Agent: ASTM C 1059/C 1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Epoxy-Bonding Adhesive: ASTM C 881/C 881M, two-component epoxy resin capable of humid curing and bonding to damp surfaces; of class suitable for application temperature, of grade complying with requirements, and of the following types:

1. Types I and II, nonload bearing or Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

## 2.8 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301 (ACI 301M), for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.

1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.

2. When automatic machine placement is used, determine design mixtures and obtain laboratory test results that comply with or exceed requirements.

B. Cementitious Materials: Use fly ash, pozzolan, slag cement, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent. Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash or Pozzolan: 25 percent.
2. Slag Cement: 50 percent.
3. Combined Fly Ash or Pozzolan, and Slag Cement: 50 percent, with fly ash or pozzolan not exceeding 25 percent.

C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:

1. Air Content: [To be determined] percent plus or minus 1-1/2 percent for 1-1/2-inch (38-mm) nominal maximum aggregate size.
2. Air Content: [To be determined] percent plus or minus 1-1/2 percent for 1-inch (25-mm) nominal maximum aggregate size.
3. Air Content: [To be determined] percent plus or minus 1-1/2 percent for 3/4-inch (19-mm) nominal maximum aggregate size.

D. Limit water-soluble, chloride-ion content in hardened concrete to [0.15] [0.30] percent by weight of cement.

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

1. Use water-reducing admixture, high-range, water-reducing admixture, high-range, water-reducing and retarding admixture, or plasticizing and retarding admixture in concrete as required for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

F. Synthetic Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than 1.0 lb/cu. yd. (0.60 kg/cu. m) or 1.5 lb/cu. yd. (0.90 kg/cu. m).

G. Concrete Mixtures: Normal-weight concrete.

1. Compressive Strength (28 Days): 4500 psi (31 MPa) or 4000 psi (27.6 MPa) or 3500 psi (24.1 MPa) or 3000 psi (20.7 MPa).
2. Maximum W/C Ratio at Point of Placement: 0.45 or 0.50.
3. Slump Limit: 4 inches (100 mm) or 5 inches (125 mm) or 8 inches (200 mm), plus or minus 1 inch (25 mm).
4. To be determined.

## 2.9 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M. Furnish batch certificates for each batch discharged and used in the Work.

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

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For concrete batches of 1 cu. yd. (0.76 cu. m) or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For concrete batches larger than 1 cu. yd. (0.76 cu. m), increase mixing time by 15 seconds for each additional 1 cu. yd. (0.76 cu. m).
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixing time, quantity, and amount of water added.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proof-roll prepared subbase surface below concrete paving to identify soft pockets and areas of excess yielding.

1. Completely proof-roll subbase in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 mph (5 km/h).
2. Proof-roll with a pneumatic-tired and loaded, 10-wheel, tandem-axle dump truck weighing not less than 15 tons (13.6 tonnes).
3. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch (13 mm) according to requirements in Section 312000 "Earth Moving."

C. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

## 3.3 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides 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.

## 3.4 STEEL REINFORCEMENT INSTALLATION

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

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

D. Install welded-wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

E. Zinc-Coated Reinforcement: Use galvanized-steel wire ties to fasten zinc-coated reinforcement. Repair cut and damaged zinc coatings with zinc repair material.

F. Epoxy-Coated Reinforcement: Use epoxy-coated steel wire ties to fasten epoxy-coated reinforcement. Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963/D 3963M.

G. 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 of adjacent mats.

## 3.5 JOINTS

A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated. Provide joint types as indicated on drawings.

1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.

1. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.
2. Provide tie bars at sides of paving strips where indicated.
3. Butt Joints: Use bonding agent epoxy-bonding adhesive at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
4. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys unless otherwise indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
5. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.

1. Locate expansion joints at intervals of 50 feet (15.25 m) unless otherwise indicated.
2. Extend joint fillers full width and depth of joint.
3. Terminate joint filler not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) below finished surface if joint sealant is indicated.
4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
6. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows.

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch (6-mm) or 3/8-inch (10-mm) radius. Repeat grooving of contraction joints after applying surface finishes.[ Eliminate grooving-tool marks on concrete surfaces.]

   a. Tolerance: Ensure that grooved joints are within 3 inches (75 mm) either way from centers of dowels.

2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.

   a. Tolerance: Ensure that sawed joints are within 3 inches (75 mm) either way from centers of dowels.

3. Doweled Contraction Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch (6-mm) or 3/8-inch (10-mm) radius. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

## 3.6 CONCRETE PLACEMENT

A. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in.

B. Remove snow, ice, or frost from subbase surface and steel reinforcement before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

D. Comply with ACI 301 (ACI 301M) requirements for measuring, mixing, transporting, and placing concrete.

E. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.

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 according to ACI 301 (ACI 301M) by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.

1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.

H. Screed paving surface with a straightedge and strike off.

I. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleedwater appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

J. Curbs and Gutters: Use design mixture for automatic machine placement. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing.

K. Slip-Form Paving: Use design mixture for automatic machine placement. Produce paving to required thickness, lines, grades, finish, and jointing.

1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of slip-form paving machine during operations.

## 3.7 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleedwater sheen has disappeared and 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-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface, perpendicular to line of traffic, to provide a uniform, fine-line texture.

## 3.8 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306.1 for cold-weather protection.

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

D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

a. Water.
b. Continuous water-fog spray.
c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Immediately repair any holes or tears occurring during installation or 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 PAVING TOLERANCES

A. Comply with tolerances in ACI 117 (ACI 117M) and as follows:

1. Elevation: 3/4 inch (19 mm).
2. Thickness: Plus 3/8 inch (10 mm), minus 1/4 inch (6 mm).
3. Surface: Gap below 10-feet- (3-m-) long; unleveled straightedge not to exceed 1/2 inch (13 mm).
4. Alignment of Tie-Bar End Relative to Line Perpendicular to Paving Edge: 1/2 inch per 12 inches (13 mm per 300 mm) of tie bar.
5. Lateral Alignment and Spacing of Dowels: 1 inch (25 mm).
6. Vertical Alignment of Dowels: 1/4 inch (6 mm).
7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches (6 mm per 300 mm) of dowel.
8. Joint Spacing: 3 inches (75 mm).
9. Contraction Joint Depth: Plus 1/4 inch (6 mm), no minus.
10. Joint Width: Plus 1/8 inch (3 mm), no minus.

## 3.10 FIELD QUALITY CONTROL

A. Testing Agency: Contractor shall **engage** a qualified testing agency to perform tests and inspections.

B. Testing Services: Testing and inspecting of composite samples of fresh concrete obtained according to ASTM C 172/C 172M 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 5000 sq. ft. (465 sq. 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.

3. Air Content: ASTM C 231/C 231M, pressure method; 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 (4.4 deg C) and below and when it is 80 deg F (27 deg C) and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C 39/C 39M; test one specimen at seven days and two specimens at 28 days.

    a. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.

C. Strength of each concrete mixture will be satisfactory if 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 (3.4 MPa).

D. Test results shall be reported in writing to Design Professional, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Design Professional but will not be used as sole basis for approval or rejection of concrete.

F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Design Professional.

G. Concrete paving will be considered defective if it does not pass tests and inspections.

H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

I. Prepare test and inspection reports.

## 3.11 REPAIR AND PROTECTION

A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Design Professional.

B. Drill test cores, where directed by Design Professional, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with portland cement concrete bonded to paving with epoxy adhesive.

C. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Material completion inspections.

END OF SECTION 321313

# SECTION 321373 - CONCRETE PAVING JOINT SEALANTS

## 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. Cold-applied joint sealants.
2. Hot-applied joint sealants.
3. Cold-applied, fuel-resistant joint sealants.
4. Hot-applied, fuel-resistant joint sealants.
5. Joint-sealant backer materials.
6. Primers.

B. Related Requirements:

1. Section 079200 "Joint Sealants" for sealing nontraffic and traffic joints in locations not specified in this Section.

### 1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Site.

### 1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch-wide joints formed between two 6-inch-long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

C. Paving-Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and testing agency.

B. Product Certificates: For each type of joint sealant and accessory.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Product Testing: Test joint sealants using a qualified testing agency.

1.7 FIELD 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, GENERAL

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.

2.2 COLD-APPLIED JOINT SEALANTS

A. Single-Component, Nonsag, Silicone Joint Sealant: ASTM D 5893/D 5893M, Type NS.

1. To be determined.

B. Single-Component, Self-Leveling, Silicone Joint Sealant: ASTM D 5893/D 5893M, Type SL.
1. To be determined.

C. Multicomponent, Nonsag, Urethane, Elastomeric Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25, for Use T.

1. To be determined.

D. Single Component, Pourable, Urethane, Elastomeric Joint Sealant: ASTM C 920, Type S, Grade P, Class 25, for Use T.
1. To be determined.

E. Multicomponent, Pourable, Urethane, Elastomeric Joint Sealant: ASTM C 920, Type M, Grade P, Class 25, for Use T.
1. To be determined.

## 2.3 HOT-APPLIED JOINT SEALANTS

A. Hot-Applied, Single-Component Joint Sealant: ASTM D 6690, Type I.
1. To be determined.

B. Hot-Applied, Single-Component Joint Sealant: ASTM D 6690, Type I or Type II.
1. To be determined.

C. Hot-Applied, Single-Component Joint Sealant: ASTM D 6690, Type I, II, or III.
1. To be determined.

D. Hot-Applied, Single-Component Joint Sealant: ASTM D 6690, Type IV.
1. To be determined.

## 2.4 COLD-APPLIED, FUEL-RESISTANT JOINT SEALANTS

A. Fuel-Resistant, Single-Component, Pourable, Modified-Urethane, Elastomeric Joint Sealant: ASTM C 920, Type S, Grade P, Class 25, for Use T.
1. To be determined.

B. Fuel-Resistant, Multicomponent, Pourable, Modified-Urethane, Elastomeric Joint Sealant: ASTM C 920, Type M, Grade P, Class 12-1/2 or 25, for Use T.
1. To be determined.

## 2.5 HOT-APPLIED, FUEL-RESISTANT JOINT SEALANTS

A. Hot-Applied, Fuel-Resistant, Single-Component Joint Sealants: ASTM D 7116, Type I or Type II.
1. To be determined.

B. Hot-Applied, Fuel-Resistant, Single-Component Joint Sealants: ASTM D 7116, Type III.
1. To be determined.

## 2.6 JOINT-SEALANT BACKER MATERIALS

A. Joint-Sealant Backer Materials: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by joint-sealant manufacturer, based on field experience and laboratory testing.

B. Round Backer Rods for Cold- and Hot-Applied Joint Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

C. Round Backer Rods for Cold-Applied Joint Sealants: ASTM D 5249, Type 3, of diameter and density required to control joint-sealant depth and prevent bottom-side adhesion of sealant.

D. Backer Strips for Cold- and Hot-Applied Joint Sealants: ASTM D 5249; Type 2; of thickness and width required to control joint-sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

## 2.7 PRIMERS

A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Examine joints 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: Before installing joint sealants, clean out joints immediately to comply with joint-sealant manufacturer's written instructions.

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

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. 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.

C. Install joint-sealant backings 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 immediately following backing installation, using proven techniques that comply with the following:

1. Place joint sealants so they fully contact 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.

## 3.4 CLEANING AND PROTECTION

A. Clean off excess joint sealant as the Work progresses, by methods and with cleaning materials approved in writing by joint-sealant manufacturers.

B. 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 Material 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.

## 3.5 PAVING-JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Joints within concrete paving[ <**PJS-#**>].

1. Joint Location:

   a. Expansion and isolation joints in concrete paving.
   b. Contraction joints in concrete paving.
   c. Other joints as indicated.

2. Joint Sealant: Single-component, nonsag, silicone joint sealant, Single-component, self-leveling, silicone joint sealant, Multicomponent, nonsag, urethane, elastomeric joint sealant, Single component, pourable, urethane, elastomeric joint sealant, Multicomponent, pourable, urethane, elastomeric joint sealant], orHot-applied, single-component joint sealant.
3. Joint-Sealant Color: to be determined.

B. Joint-Sealant Application: Joints within concrete paving and between concrete and asphalt paving.

1. Joint Location:

   a. Joints between concrete and asphalt paving.
   b. Joints between concrete curbs and asphalt paving.
   c. Other joints as indicated.

2. Joint Sealant: Hot-applied, single-component joint sealant.
3. Joint-Sealant Color: to be determined.

C. Joint-Sealant Application: Fuel-resistant joints within concrete paving.

1. Joint Location:

   a. Expansion and isolation joints in concrete paving.
   b. Contraction joints in concrete paving.
   c. Other joints as indicated.

2. Joint Sealant: Fuel-resistant, single-component, pourable, modified-urethane, elastomeric joint sealant, Fuel-resistant, multicomponent, pourable, modified-urethane, elastomeric joint sealant, or Hot-applied, fuel-resistant, single-component joint sealant.
3. Joint-Sealant Color: to be determined.

END OF SECTION 321373

# SECTION 32 14 13.19 – PERMEABLE INTERLOCKING CONCRETE PAVEMENT

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Work consists of furnishing and installing a Permeable Interlocking Concrete Pavement (PICP) System in accordance with these specifications and in general conformance with the lines, grades, design, and dimensions shown on the plans.
2. Installation work includes:
   a. Verifying subgrade elevations and slope generally conform to the lines, grades, infiltration rate, density, and site conditions depicted in the construction documents;
   b. Furnishing and installing geotextile and/or geomembrane liner (where required), horizontal drainage piping (where required), subbase course, base course, bedding course, edge restraint, concrete pavers and permeable joint material in general conformance to the lines and grades shown on the construction documents.

B. Related Requirements:

1. Section 31 20 00 Earth Moving
2. Section 31 32 19 Geotextile for soil stabilization and Layer separation
3. Section 32 13 13 Concrete Paving

### 1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):
1. ASTM C33 Standard Specification for Concrete Aggregates
2. ASTM C94 Standard Specification for Ready-Mixed Concrete
3. ASTM C131 Standard Test Method for Resistance to Degradation of Small-Sized Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
4. ASTM C136 Standard Test Method for Sieve Analysis of Fine and Coarse-Grained Aggregates
5. ASTM C140 Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units
6. ASTM C936 Standard Specification for Solid Concrete Interlocking Paving Units
7. ASTM C979 Standard Specification for Pigments for Integrally Colored Concrete
8. ASTM C1645 Standard Test Method for Freeze-thaw and De-icing Salt Durability of Solid Interlocking Paving Units
9. ASTM C1781 Standard Test Method for Surface Infiltration Rate of Permeable Unit Pavement Systems
10. ASTM D698 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort

11. ASTM D1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort
12. ASTM D3034 Standard Specification for Type PSM Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings
13. ASTM D3350 Standard Specification for Polyethylene Plastic Pipe and Fittings Materials
14. ASTM D4873 Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples
15. ASTM E2835 Standard Test Method for Measuring Deflections using a Portable Impulse Plate Load Test Device

B. Interlocking Concrete Pavement Institute (ICPI)
1. Permeable Interlocking Concrete Pavement manual (latest edition)
2. Permeable Design Pro software for hydrologic and structural design
3. Tech Specs and Technical Bulletins

## 1.3 SUBMITTALS

A. Contractor shall submit to the owner for approval a minimum of four full-size samples of each concrete paver type/size/thickness/color/finish specified. The samples shall represent the range of shape, texture, and color permitted for the respective type. Color(s) will be selected by Owner's representative from Manufacturer's standard colors.

B. Prior to delivery of the associated material to the site, the Contractor shall submit the following product-specific documentation for approval:
1. Aggregates
   a. Sieve analysis per ASTM C136 for subbase, base, bedding and joint aggregate materials
   b. Minimum 3 lb. sample of each material for independent testing.
2. Concrete Pavers:
   a. Test results from an independent testing laboratory for compliance to ASTM C936.
   b. Safety Data Sheets (SDS).
   c. One 18-inch x 18-inch panel of each type of geosynthetic (geotextile or geomembrane Liner) to be used for inspection and testing. The sample panels shall be uniformly rolled and shall be wrapped in plastic to protect the material from moisture and damage during shipment. Samples shall be externally tagged for easy identification. External identification shall include the name of the manufacturer; product type; product grade; lot number; and physical dimensions.

## 1.4 QUALITY ASSURANCE

A. Contractor Qualifications:
1. Contractor shall submit a list of five (5) previously constructed projects of similar size and magnitude prior to the bid date to be qualified. Contact names, telephone numbers, and date of completion shall be listed for each project.

2. Contractor shall conform to all local, state/provincial licensing and bonding requirements.

B. Mockups: Build mockups to verify selections made under submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
   1. Install a 10 ft x 10 ft paver area following the installation practices described in Article 3.2 to 3.4. This area shall be used to verify joint sizes; lines; laying pattern(s); stitching details (for mechanical installation); color(s); and, texture of the job.
   2. To provide a proper representation of color blend, blending during installation of sample mock-up will be pulled from a minimum of 3 cubes.
   3. This area shall be the standard from which the work will be judged.
   4. Subject to approval by the Owner, the mock-up may be retained as part of the finished work. If mock-up is not retained, remove and dispose of mock-up at the completion of the project.

## 1.5 DELIVERY, STORAGE, AND HANDLING

A. Contractor shall coordinate delivery and paving schedule to minimize interference with normal use of buildings adjacent to paving.

B. Contractor shall check all materials upon delivery to assure that the proper materials have been received and are in good condition before signing off on the manufacturer’s packing slip.

C. Contractor shall protect all materials from damage or contamination due to job site conditions and in accordance with manufacturer's recommendations. Damaged or contaminated materials shall not be incorporated into the work.

D. Concrete pavers shall be delivered to the site in steel banded, plastic banded, or plastic wrapped cubes capable of transfer by forklift or clamp lift. Unload and store concrete pavers at the job site in such a manner that no damage occurs to the product.

E. Contractor shall handle and transport aggregates to avoid segregation, contamination, and degradation and keep different materials sufficiently separated as to prevent mixing. The material shall not be dumped or stored one material on top of another unless it is part of the installation process. Materials shall be covered to prevent removal by wind.

F. Geosynthetics shall be delivered, stored and handled in accordance with ASTM D4873.

## 1.6 ENVIRONMENTAL CONDITIONS

A. Pavers shall not be installed during heavy rain, freezing conditions or snowfall.

B. Pavers shall not be installed on frozen soil subgrade or aggregates.

1.7 MAINTENANCE MATERIALS

A. Provide 50 square feet additional paver material for use by Owner for maintenance and repair.

B. Store extra paver materials in Owner-designated location.

PART 2 - PRODUCTS

2.1 PERMEABLE INTERLOCKING CONCRETE PAVERS

A. Permeable Interlocking Concrete Pavers Basis-of-Design:
   1. Paver Name: Aqualine 3-Piece
      a. Thickness: 3-1/8 inches (80 mm)
      b. Color: To be selected from SRI range of colors
      c. Finish: Standard (Smooth)
      d. Pattern: Belgard Standard Paving Detail, Aqualine 3-piece Multi-cobble Ashlar stack Pattern
      e. Supplier:
         Local Oldcastle Supplier an Oldcastle Company
         Jonesboro, GA 30236
      f. Contact Person: Brent Davis, 770.478.8817 or 770.695.3951

B. Pavers shall meet the minimum material and physical properties set forth in ASTM C 936, Standard Specification for Interlocking Concrete Paving Units.
   1. Measured length or width of test specimens shall not differ by more than +/- 0.063 in, while measured thickness shall not differ by more than +/- 0.125 in.
   2. Average compressive strength of 8,000 psi (55 MPa) with no individual unit under 7,200 psi (50 MPa) when tested in accordance with ASTM C140.
   3. Average absorption of 5% or less with no unit greater than 7% when tested in accordance with ASTM C140.
   4. Efflorescence shall not be a cause for rejection.
   5. Pigment in Concrete Pavers shall conform to ASTM C979.

2.2 AGGREGATE MATERIALS

A. General Requirements:
   1. Clean, non-plastic aggregate, free from deleterious or foreign matter, manufactured from crushed rock. Recycled aggregates shall not be used.
   2. Percent of angular and sub-angular particles greater than 90%. Rounded river gravel shall not be used.
   3. LA Abrasion of the aggregate used shall be less than 40 as per ASTM C131.
   4. All aggregates shall be washed and have less than 2% passing the No. 200 (0.075 mm) sieve.
   5. All aggregate material gradations shall be tested in accordance with ASTM C136.

B. Bedding Course/Joint Fill Material – open-graded aggregate conforming to the following gradation:

*Note: No. 89 or No. 9 stone may be used as joint fill material. If No. 8 stone material is not available locally, No. 89 can be used as a bedding course if choke criteria is met with underlying base aggregate.*

ASTM C33 size No. 8

| Sieve Size | Percent Passing |
|---|---|
| 1/2 in. (12.5 mm) | 100 |
| 3/8 in. (9.5 mm) | 85 to 100 |
| No. 4 (4.75 mm) | 10 to 30 |
| No. 8 (2.36 mm) | 0 to 10 |
| No. 16 (1.18 mm) | 0 to 5 |
| No. 200 (0.075 mm) | 0 – 2 |

C. Base Course Material - open graded aggregate conforming to the following gradation:

ASTM C33 size No. 57

| Sieve Size | Percent Passing |
|---|---|
| 1-½ in. (37.5 mm) | 100 |
| 1 in. (25 mm) | 95 to 100 |
| 1/2 in. (12.5 mm) | 25 to 60 |
| 3/8 in. (9.5 mm) | 0 to 10 |
| No. 4 (4.75 mm) | 0 to 5 |
| No. 200 (0.075 mm) | 0 - 2 |

D. Subbase Course Material – open-graded aggregate conforming to the following gradation:

*Note: ASTM No. 3 or No. 4 may be used as subbase material if No. 2 stone in unavailable locally.*

ASTM C33 size No. 2

| Sieve Size | Percent Passing |
|---|---|
| 3 in. (75 mm) | 100 |
| 2- ½ in. (63 mm) | 90 to 100 |
| 2 in. (50 mm) | 35 to 70 |
| 1-½ in. (37.5 mm) | 0 to 15 |
| ¾ in. (19 mm) | 0 to 5 |
| No. 200 (0.075 mm) | 0 – 2 |

## 2.3 EDGE RESTRAINTS

A. Edge restraints shall be cast in place concrete curbs in general conformance with the specifications and dimensions in the construction documents

## 2.4 PIPE UNDERDRAINS

A. Where shown on the plans, pipe underdrains shall be perforated or slotted PVC pipe manufactured in accordance with ASTM D3034 or corrugated HDPE pipe manufactured in accordance with ASTM D3350 and comply with the requirements of Section 33 46 14.19 - Pipe Underdrains.

# PART 3 - EXECUTION

## 3.1 PREPARATION

A. Prior to commencement of any work, the Contractor shall conduct a pre-construction meeting with the Owner, Designer, and affected sub-trades. The pre-construction meeting should establish contractor responsibilities and at a minimum verify:
   1. The location of the mock-up, and whether it will be part of the final construction or need to be removed.
   2. The site layout is in general conformance to the construction documents. In particular, the location and elevation of discharge points (if any) of the pipe underdrains.
   3. The subgrade lines and elevations are in general conformance with the construction documents. The subgrade elevations shall be within +/- 0.1 ft of the specified grades.
   4. The minimum slope of subgrade shall be at least 0.5% or as specified in the design.
   5. Subgrade soil conditions and grades meet the requirements in the construction documents.
   6. The details of the site's erosion and sediment control plan.

B. Proof-roll prepared subgrade according to requirements in Section 31 20 00 Earth Moving to identify soft pockets and areas of excess yielding. Proceed with subbase installation only after deficient subgrades have been corrected. Scarify subgrade surface following any stabilization efforts before installing subbase course.

C. If compaction is required in the construction documents, Contractor shall verify compaction of the subgrade is in general conformance with the construction documents prior to placing subbase materials.

D. Once the Contractor has confirmed the subgrade conditions are in general conformance with the requirements in the construction documents, the Contractor shall begin installing the subbase material. By initiating installation of the subbase material, the Contractor acknowledges acceptance of the subgrade.

## 3.2 INSTALLATION OF SUBBASE AND BASE COURSES

A. Keep the area where the pavement is to be constructed free from sediment during the entire job. Any materials contaminated with sediment shall be removed and replaced with clean material.

B. Install membrane liner and any associated cushion geotextile in accordance with the manufacturer's recommendations. The membrane liner is applied to the bottom and sides of the excavation for non-infiltration purposes and must include a drainage pipe. Allow for enough membrane liner to exceed the final elevation of the surface. After completion of the surface, the excess liner should be cut flush with the finished grade. Membrane lines shall be welded together and boots installed around all protrusions.]

C. Install geotextiles as required in accordance with the specifications and drawings. The geotextile is applied to the bottom and sides of the excavation with overlapping joints a minimum of 12 inches. Overlaps to be constructed to "shingle" moisture from upstream panel to downstream panel. Allow for enough geotextile to exceed the final elevation of the surface. After completion of the surface, the excess geotextile should be cut flush with the finished grade.

D. Install the subbase course and base course at the thicknesses, compaction rates, surface tolerances, and elevations outlined below.
   1. Place and spread the first layer of subbase without displacing or damaging the geosynthetics (if used). To prevent damage, tracked vehicles shall not be allowed directly on the geotextiles or geomembranes during the initial spreading process of the subbase layer.
   2. The aggregate should be spread and compacted in uniform layers not exceeding 6-inch loose thickness. Compaction is performed using either a 10 T (10 ton) vibratory roller or a minimum 13,500 lb-f centrifugal force reversible vibratory plate compactor. For each lift, make at least two passes in the vibratory mode and at least two passes in the static mode and continue compaction until there is no visible movement in the materials.
   3. At the specified elevation(s), install the pipe underdrains in accordance with the manufacturer's recommendations. Ensure the pipes are sloped to provide proper drainage to the outlets. Pipes shall be surrounded by a minimum of 4 inches of base course material to prevent damage during compaction. Care must be taken not to damage pipe underdrains during subsequent aggregate installation.
   4. Final subbase surface tolerance shall be plus or minus 0.1 ft over a 10-foot straight edge laid in any direction.
   5. Final base surface tolerance shall be plus or minus 3/4 inch over a 10-foot straight edge laid in any direction.
   6. Provide proper compaction near curbs, grade beams, concrete collars around utility structures, lights standards, tree wells, building edges and other protrusions as applicable to the project.

## 3.3 INSTALLATION OF EDGE RESTRAINTS

A. All concrete edge restraints shall be constructed to dimensions and grades in general conformance with the construction documents and shall be supported on a compacted base not less than 6-inch thick and meet local requirements or the requirements of Section 32 13 73 Concrete Paving, whichever are more restrictive. All concrete shall be in accordance with ASTM C94 requirements.

## 3.4 INSTALLATION OF BEDDING COURSE, PAVERS, AND JOINT MATERIAL

A. Spread the bedding course evenly over the base course and screed to a nominal 2 in. thickness utilizing an approved mechanical spreader or by screed rails and boards. Do not use the bedding material to fill depressions in the base course surface. Surface tolerances shall be +/- 3/8 inch over a 10-foot straight edge.

B. Ensure that concrete pavers are free of foreign material before installation. Concrete pavers shall be inspected for color distribution and all chipped, damaged, or discolored concrete pavers shall be replaced. Initiation of concrete paver placement shall be deemed to represent acceptance of the pavers.

C. Lay the concrete pavers in the pattern(s) shown on the drawings. Maintain straight pattern lines. For mechanical installations, follow the stitching details as submitted and verified during the mock-up.

D. Paving units shall be installed simultaneously from a minimum of 3 bundles for hand installations, and 6 bundles for mechanical installations to provide proper color blending.

E. Joints between the individual concrete pavers shall be uniformly maintained and installed in accordance with the in-place dimensions

F. Fill gaps at the edges of the paved area with cut pavers or edge units. Do not install cut pavers smaller than one-third of a whole paver along edges subject to vehicular traffic – trim two pavers to fit.

G. Cut pavers using a masonry saw or splitting device. Upon completion of cutting, the area must be swept clean of all debris.

H. Using a low amplitude plate compactor capable of at least 5,000 lbs. (22 kN) compaction at a frequency of 75 Hz –100 Hz, compact and seat the concrete pavers into the bedding course.

I. The pavers shall be compacted to achieve consolidation of the bedding course and brought to level and profile by not less than three passes. Initial compaction should proceed as closely as possible following the installation of the paving units and prior to the acceptance of any traffic.

J. Any units that are structurally damaged during compaction shall be immediately removed and replaced.

K. Apply the joint material to the surface and sweep into the joints and voids. Fill joints and voids then sweep off excess material before vibrating the material down into the joints using a plate compactor. This will typically require two to three passes with the plate compactor.

L. Do not compact within 6 feet of unrestrained edges of the paving units.

M. All work to within 6 feet (1 m) of the laying face must be left fully compacted at the end of each day.

N. Sweep off excess aggregate when the job is complete.

## 3.5 AS-BUILT CONSTRUCTION TOLERANCES

A. Final inspection shall be conducted to verify conformance to the drawings after removal of excess aggregate. All pavements shall be finished to lines and levels to ensure positive drainage at all drainage outlets and channels.

B. The final surface elevations shall not deviate more than +/- 3/8 inch under a 10 ft long straight edge.

C. Lippage shall be no greater than 1/8-inch difference in height between adjacent pavers.

D. Bond lines for the pavers shall be +/- 1/2-inch over a 50-foot string ling.

E. Verify the in-situ surface infiltration rate of the permeable pavement is a minimum of 100 in/hour using ASTM C1781.

## 3.6 MAINTENANCE AND PROTECTION

A. At the completion of the work, the Contractor shall provide the Owner with the manufacturer's PICP System Operation and Maintenance Guidelines.

B. Once the work is complete, the Owner shall be responsible for protecting the work from sediment deposition and damage due to subsequent construction activity on the site.

END OF SECTION 32 14 13.19

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# SECTION 32 8400

# SITE IRRIGATION

## PART 1 - GENERAL

### 1.1 SUMMARY

A. The Heritage Park restroom project site includes an existing landscape irrigation system; a record drawing will be provided to the contractor for this system by the owner's representative but this drawing may not reflect as-built conditions; it is the contractor's responsibility to locate, protect, remove or repair any of the existing system as necessary due to construction activity. The contractor is also responsible for providing new irrigation for the resulting landscaping accompanying this project and tie the new irrigation lines to the existing system. The contractor shall provide design and installation as directed in this specification.

### 1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including bidding requirements, general and supplemental conditions and specifications sections apply to the work of this section.

### 1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design 100 percent coverage irrigation system, including comprehensive engineering analysis by qualified irrigation professional, using performance requirements and design criteria indicated.

B. Minimum Working Pressures: The following are minimum pressure requirements for piping, valves and specialties unless otherwise indicated:
   1. Irrigation Main Piping: 200 psig
   2. Circuit Piping: 150 psig

C. Related Work:
   1. Electrical Connection: Contractor shall assure power connections to the controller and other equipment are completed. Coordinate access requirements in advance as needed.
   2. Water Supply: Contractor shall assure water meter is installed and providing water and the system requirements (gpm/psi), as stated on plans, is present. Coordinate meter installation with General Contractor. Inform Owner's Representative immediately should meter not be producing required gallons per minute and water pressure.

D. The application for and purchase of all necessary licenses and permits shall be a part of the Contractor's responsibility.

E. Refer to plans from existing building for existing irrigation system information.

F. Provide all labor, materials, and equipment required by or inferred from the drawings and specifications to complete work of this section.

G. Provide additional work and materials required by local authorities at no extra cost to owner.

### 1.4 QUALITY ASSURANCE

A. Industry Reference Standards:
   1. American Society For Testing and Materials (ASTM) Annual Book of ASTM Standards, Latest Edition.
   2. National Fire Protection Agency (NFPA), Latest Edition.
   3. National Electric Code (NEC), Latest Edition.

B. Qualifications:

1. Installer Qualifications: Engage a company specializing in irrigation installation acceptable to the Owner representative. Installer shall have successfully completed five projects similar to scope and size, as indicated in:
   a. Firm experience period: Five years of experience.
   b. Field foreman experience: Five years of experience with installing firm.

C. Codes and Standards:
1. Perform irrigation work in compliance with applicable requirements of governing authorities having jurisdiction. County regulations supersede these specifications. Notify Owner's Designated Representative in writing of all discrepancies immediately.

D. Substitutions:
1. If the contractor desires to make substitutions of materials, sufficient descriptive literature and material samples must be furnished to establish the material.
2. Similar substitute. In addition, the contractor must state his reasons for desiring substitute materials. Submit this request and information in writing to Owner representative.
3. Acceptable Manufacturers are:
   a. Hunter Industries Sprinkler Manufacturing Company, San Marcos, California
   b. Rain Bird Sprinkler Manufacturing Company, Glendora, California.
   c. The Toro Company, Riverside, California.

E. Approval and Selection of Materials and Work:
1. The selection of all materials and the execution of all operations required under the Drawings and Specifications is subject to the approval of the Owner representative. They have the right to reject any and all materials and any and all work which, in their opinion, does not meet the requirements of the Contract Documents at any stage of the operations. Remove rejected work and or materials from project site and replace promptly.

F. Workmanship:
1. Install materials and equipment in a neat and professional manner following manufacturer's recommendations.

**1.5 SUBMITTALS**

A. Product Data - Landscape Irrigation System:
1. For information, submit (Prior to commencement of work) five (5) copies of manufacturer's technical data and installation instructions for all components of landscape irrigation system. Each submittal is to clearly identify manufacturer, product and series/model number.

B. Delegated Design Drawings – Landscape Irrigation System:
1. Prior to commencement of work, submit 2 delegated design drawings for layout of all components of landscape irrigation system. Delegated design drawings to clearly identify all locations and types of fixtures and elements included in the system and relation to planting beds. Refer to Irrigation Plan Delegated Design Requirements, sheet L301 for further information.

**1.6 PROJECT RECORD DOCUMENTS**

A. As-Built Drawings – Landscape Irrigation System:

1. Submit ACAD 2018 (or earlier) digital as built drawing, PDF (.pdf format) files and two (2) sets of printed as-built drawings of the final irrigation system installation prior to final acceptance for review and approval. As-built drawings to be clearly and neatly drawn on a digital file base of the original design. All automatic and manual valves, hose bibs or quick coupling valves, main line and wiring routing, controller, backflow preventer, meter and tap, and wire splices are to be shown with actual dimensions to three reference points so they may be located easily in the field. Submittals of approved as-built drawings will precede any application for final payment by the contractor.

B. Operation Manual:
   1. Three (3) copies, bound in one-inch diameter, three ring binders, indexed and tabbed for easy reference, and labeled on spine and cover. Manual to include the following:
      a. Approved submittals as specified herein.
      b. Installation instructions and references for each irrigation component.
      c. Operation Instructions: Recommended operation sequence, frequency and length of operation cycle, and guidelines of general operation of irrigation system with relation to operation of systems during different seasons of the year.
   2. Maintenance Instructions:
      a. Manufacturer's product data, installation, maintenance instructions, and recommended procedures.
      b. Copies of completed warranty information.

C. Controller Chart:
   1. Prepare two typewritten charts laminated in plastic on both sides with the following information:
      a. Identify zone valve number as to size, location, type of heads per that zone number and length of watering time for average watering schedule. Place one in controller and provide one to General Contractor or Owners Representative.

## 1.7 DELIVERY, STORAGE, AND HANDLING

A. Materials shall be delivered to the site in accordance with manufacturer's recommendation for shipment and protection of materials as to not damage the parts or decrease useful life of the equipment.

B. Storage of all materials shall be in locations designated and approved by Owner/General Contractor.

C. Store materials away from detrimental elements.

D. Handle, load, unload, stack, and transport materials as recommended by manufacturer.

## 1.8 SITE CONDITIONS

A. Contractor to verify the existing minimum water pressure flow at the site prior to system design, and again prior to installation.

B. Insurance on irrigation materials or equipment stored or installed is the responsibility of the irrigation contractor. Such insurance shall cover fire, theft and vandalism. Should the contractor elect not to provide for such insurance, he will in no way hold the Owner responsible for any losses incurred by the aforementioned acts. The irrigation contractor is responsible for all costs incurred in replacing damaged or stolen materials or equipment prior to acceptance by General Contractor or Owners Representative.

C. Provide and maintain all passageways, guard fences, warning lights and other protection devices required by the local authorities.

D. Existing Grades. Existing grades will be within .2 feet of grades shown on the Civil Engineering Drawings at time of irrigation work. Determine condition of existing grades prior to beginning the Work. When irregular or incomplete grading conditions are encountered, notify the Owner in writing before beginning the Work. Perform Work in a manner which will avoid damage to finished grading and drainage resulting from the work covered in these Contract Documents. Any damages shall be repaired at the contractor's expense

E. Existing Site Improvements: Perform work in a manner which will avoid possible damage. The contractor is responsible for any damage of mechanical damage as well as damage resulting from leaks in the irrigation system whether due to negligence or otherwise.

F. Test Water Conditions: The contractor shall check the pressure at the **irrigation point of connection** and confirm minimum operating pressure before initiating design and before installation commences.

1. In the event the water pressure does not meet minimum operating pressure at the irrigation point of connection noted before design, notify Owner's Representative. The irrigation consultant will make recommendations concerning the development of a booster pump station capable of providing the flow and the pressure required.
2. In the event the water pressure significantly exceeds the operating pressure noted in the specifications, provide a pressure regulator downstream of the backflow preventer.

G. Sleeves, if required, are to be installed by the General Contractor. Irrigation sleeves shall be installed as per details. If sleeving horizontal depth exceeds the detailed requirement by six inches (6"), it will be the responsibility of the General Contractor to expose the horizontal ends below finish grade. The General Contractor is to expose irrigation sleeves for irrigation contractor prior to start of irrigation work in all areas where sleeving is not installed as per details. Coordination and scheduling for excavation of sleeve ends is the responsibility of the irrigation contractor.

H. Coordinate and schedule all work with General Contractor

I. Damages resulting from irrigation installation to work of other trades must be repaired at the expense of the irrigation contractor in a timely fashion.

J. Make minor adjustments to system layout as may be required and requested at no additional cost to the Owner

K. Keep project site clean and orderly at all times during construction.

L. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:

1. Notify Construction Manager and Owner no fewer than 2 days in advance of proposed interruption of water service.
2. Do not proceed with interruption of water service without Owner's written permission.

## 1.9 CODES, INSPECTION & PERMITS

A. The entire installation shall fully comply with all local and state law and ordinances and with all the established codes applicable thereto.

B. The contractor shall take out all required permits, arrange for all necessary inspections and shall pay any fees and expenses in conjunction with the same as a part of the work under this section at no additional cost to the owner.

**1.10 SITE DISTURBANCES**

A. Take precautions to insure that equipment and vehicles do not disturb or damage existing site grading, walks, curbs, pavements, utilities, plants and other existing items and elements on public and private property.

B. Verify locations and depths of all underground utilities prior to commencing excavation.

C. Repair and/or return to original condition any damage caused by irrigation contractor's negligence at no cost to the Owner.

**1.11 PROTECTION OF PERSONS AND PROPERTY**

A. Barricade open excavations occurring as part of this work and post warning lights.

B. Operate warning lights as recommended by authorities having jurisdiction.

C. Protect structures, utilities, sidewalks, pavements, curbs, and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazard created by this work.

**1.12 WARRANTY**

A. Warranty all work for a period of one year, starting on the date of Material Completion, against defects in materials, equipment, workmanship and any repairs required resulting from leaks or other defects of workmanship, material, or equipment.

B. Repair unsatisfactory conditions promptly at no cost to the Owner.

C. Emergency repairs may be made by the Owner without relieving the irrigation contractor of his warranty obligations.

D. Repair settling of backfilled trenches occurring during the warranty period, including restoration of damaged plantings, paving or improvements resulting from settling of trenches or repair operations.

E. Respond to Owner's request for repair work within ten (10) days. If not, Owner may proceed with such necessary repairs at the irrigation contractor's expense.

**PART 2 - PRODUCTS**

**2.1 GENERAL**

A. All materials throughout the system shall be new, in perfect condition, and the best quality available.

B. After award of the contract and prior to beginning of work, submit for approval five (5) copies of the complete list of materials proposed. No deviations from the specifications shall be allowed except as noted.

C. Specific requirements concerning the various materials and the arrangement in which they are to be installed are shown on the drawings.

D. Quality & Size:

1. Material specified by name and/or model number in the specifications, on the site or detailed drawings are used for the purpose of identification of materials and to insure specific use of that material in the construction of the system. No substitutions will be permitted without approval. (See Substitutions).

2. All materials shall have a minimum guarantee of one year against material defects or defective workmanship.

**2.2 PIPE AND FITTINGS**

A. Pipe sizes shall conform to those shown on the drawings. No substitutions of smaller pipe sizes will be permitted, but substitutions of larger size may be approved. All pipe damaged or rejected because of defects shall be removed from the site at the time of said rejection.

B. All plastic pipe sizes 4" and above shall be Class 200 SDR 21, Type 1120/1220, unplasticized ridgid PVC pipe with integral bell and rubber ring gasket unless otherwise specified. Pipe from sizes 3" to ½"shall be Sch 40, solvent weld, PVC pipe. All pipe shall be supplied in 20' standard lengths. All pipe that is exposed or not below grade shall be Schedule 80 PVC.

C. Fittings for integral bell with rubber ring gasket pipe shall be of the gasket type. Fittings for solvent weld pipe shall be a Schedule 40 PVC fitting rated for 200 psi (ASTM D-3139).

D. All pipe fittings size 4" and greater shall be gasket type. All fittings 3" and under shall be Schedule 40 solvent weld.

E. Solvent weld PVC pipe, if and when used in construction of this system, shall be rigid PVC pipe and shall be assembled using appropriate PVC pipe cleaner/primer and solvent cement in accordance with the manufacturer's recommendations.

F. All solvent weld fittings shall conform to Schedule 40 or Schedule 80 PVC dimensions and specifications for solvent weld fittings.

G. Expansion Joints: Install every 300 feet of solvent weld piping (every 200 feet on runs shorter than 300 feet.

H. Runs of pipe over 20' length must be installed with standard 20' length sections. Unnecessary joints or couplings are not acceptable.

I. Drip Irrigation Tubing: Provide drip tubing as indicated on plan, (if applicable). Tubing is to conform to manufacturer's specifications.

J. PVC Pipe Couplings, Located Within Sleeves: 4" and smaller to be solvent weld. 6" and larger to be mechanical joints. Upon exiting sleeves, pipe solvent weld or integral bell and rubber gasket, must be adhered to with thrust block installation as described in Specification Section 2.7A.

K. Installer shall utilize thrust blocking and/or restraints as per manufacturer's specifications related to pipe type, pipe size, and local environmental conditions.

**2.3 RISERS**

A. Provide Threaded Schedule 80 PVC Risers, where required.

**2.4 ELECTRIC WIRING**

A. Two-Wire Controls

1. 120 Volt AC Wiring: 120-volt service to controller shall consist of three wires: one black, one white, and one ground. Electrical service to be provided by **Contractor** unless otherwise directed by owner.
2. Splices in controller wiring shall be waterproof.
3. Control Wiring shall be 24 volt solid wire U.L. approved for direct burial in ground.
4. Joining of underground wires shall be made with watertight connectors in valve boxes. No splicing between boxes is acceptable.
5. All wire connections in valve boxes; first example shall stay open until the Designer approves.

6. Install LSP-1 Surge Protection Device every 500 feet, with Ground Rod, on two-wire path and at end of wire run that terminates in field (star configuration).

B. Traditional-Wiring
1. Control wire shall be type UF, UL approved, for direct burial and shall be gauge 14 or larger for the control wire and gauge 12 or larger for common wire.
2. Joining of underground wires shall be made with watertight connectors in valve boxes. No splicing between boxes is acceptable. Utilize DBR/Y-6 Connections unless directed otherwise.
3. All wire connections in valve boxes; first example shall stay open until the Designer approves.

**2.5 PVC PIPE CEMENT AND PRIMER**

A. Provide solvent cement and primer for PVC solvent weld pipe and fittings as recommended by the manufacturer. Pipe joints for solvent weld pipe to be belled end. Pipe joints for gasket pipe to be integral ring type. Insert gaskets shall not be accepted.

B. Solvent weld cement shall adhere to ASTM D2564 and installed according to ASTM F656.All solvent weld fittings must be primed.

**2.6 THREADED CONNECTIONS**

A. Threaded PVC Connections shall be made up, using teflon tape.

B. Connection between mainline pipe fittings and automatic or manual control valves shall be made using Schedule 80 threaded fittings and nipples.

**2.7 THRUST BLOCKS**

A. Mainline piping shall have thrust blocks sized and placed in accordance with the pipe manufacturer's recommendations. Thrust blocks shall be a standard poured concrete mix in accordance with ASTM C-150, ASTM C-33, and ASTM C-94 with a compressive strength (28 days) of 2000 PSI. Thrust blocks shall be installed at all tees, elbows, 45's, crosses, reducers, plugs, caps, and valves. The contractor shall be responsible for the stability of all thrust blocks. No "pre-cast" or "pre-bagged" thrust blocks shall be allowed. The contractor shall protect all pipe joint connections, control wires, communication cables, and power supply wiring from concrete by approved means.

**2.8 PIPE AND WIRE SLEEVES**

A. Sleeves to be installed:
1. The General Contractor shall install irrigation system pipe and wire sleeves conforming to the following:
a. Class 200 SDR 21 PVC Type 1120 or 1220: Size as indicated on plan and installed by General Contractor.
b. All pipe sleeves shall extend a minimum of 18" beyond the edges of pavement.
c. All pipe sleeves to be installed beneath future/existing road surfaces shall be PVC Pipe Class 200 SDR 21 or jack and bore steel pipe as per GDOT specifications and as shown on plans.
d. All irrigation system wires shall be sleeved separately from main or lateral lines.
e. All pipe sleeves shall be installed at the minimum depth specified for mainlines, lateral lines, and electric wire.

f. The General Contractor shall coordinate all pipe sleeve locations and depths prior to initiating installation of the irrigation system.

g. The irrigation contractor shall be responsible to adjust the system layout as necessary to properly align with all pipe sleeves at no additional cost.

B. Existing Sleeves: The General Contractor shall verify, mark and/or locate all existing sleeves initially installed by General Contractor for irrigation contractor and notify Owner representative &/or Owner of any discrepancies.

**2.9 SPRINKLER HEADS**

A. Spray and rotary sprinklers: Provide as required. Heads perform to Manufacturer's Specifications concerning diameter of throw and gallonage at given pressure.

B. Drip Irrigation Emitters shall be of the in-line or insertable variety as required).

**2.10 DRIP IRRIGATION SPECIALTIES**

A. Manufacturers: Provide product by one of the following:
1. Hunter Industries Incorporated.
2. Rain Bird Corporation.
3. Toro Company (The); Irrigation Division.

B. Description:
1. Drip Tubes with Direct Attached Emitters: Flexible PE or PVC with plugged end.
2. Pressure Compensating Emitters: Devices to deliver water at approximately 20 psig.
a. Body Material: PE or vinyl, with flow control.
b. Mounting: Inserted into tubing at set intervals.
3. Capacities and Characteristics:
a. Emitter Spacing: 12" or as needed to appropriately irrigate plantings.
b. Emitter Flow: 0.4 GPH or as needed to appropriately irrigate plantings
c. Line spacing: uniform spacing of 18" or as needed to appropriately irrigate plantings

C. Application Pressure Regulators: Plastic housing, NPS 3/4, with corrosion-resistant internal parts; capable of controlling outlet pressure to approximately 20 psig.

D. Filter Units: Plastic housing, with corrosion-resistant internal parts; of size and capacity required for devices downstream from unit.

E. Air Relief Valves: Plastic housing, with corrosion-resistant internal parts.

F. Vacuum Relief Valves: Plastic housing, with corrosion-resistant internal parts.

**2.11 AUTOMATIC CONTROLLER**

A. Each controller location must be easily accessible for maintenance. Provide for the possibility of making minor timing adjustments to the controller in the field.

B. Provide computer controllers capable of fully automatic, as well as manual operation of the system. Controller housing is to be a wall or pedestal mounted, as noted on the Drawings, weatherproof, lockable cabinet.

C. Provide controller which operates on a minimum of 110 volts AC power input and is capable of operating 24 volt AC electric remote control valves, with a reset circuit breaker to protect from overload. Contractor is responsible for connection to 120 VAC power to controller.

D. Each station shall have a time setting that can be set from one minute to ten hours, or set to omit the station from the irrigation cycle.

E. The controller must be constructed so that all internal parts are accessible through the controller door without disturbing the cabinet installation.

**2.12 ELECTRICAL CONTROL VALVES**

A. Provide electric remote control valve model. Valve to conform to Manufacturer's Specifications concerning performance and at given pressures.

B. Remote Control Valves shall be installed with single station or approved 2-wire decoder.

**2.13 VALVE BOXES**

A. Control Valves and Hose Bibs: Shall be suitable and adjustable for valves used or approved with non-hinged covers.

B. Backflow Preventer: Shall be Rectangular Valve Box with non-hinged cover.

C. Isolation Valves and Wire Splices: Shall be suitable and industry standard.

D. All valve boxes are to be black in color with black colored covers, with open bottoms and openings for piping, designed for installing flush with grade. To be rectangular with PE sidewalls and cover material. All valve boxes to have 2 cubic feet of 1/2"-3/4" crushed stone.

**2.14 GATE VALVES**

A. Provide all gate valves for isolation purposes, allowing full diameter opening when in full open position.

B. Manually operated valves: same size as line.

C. Valves 2 ½" or smaller: brass construction, threaded, and rated for 200 psi WOG.

D. Valves 3" or larger: cast iron fitted with rubber ring, slab-type gasket.

**2.15 HOSE BIBS**

A. Shall be all cast brass or bronze body, and shall be installed below grade in a 12:X18: valve box.

**2.16 QUICK COUPLING VALVES:**

A. QCV's will be used as a source to the pressurized main line so that a hose can be attached and used for manual and watering. The quick coupling valve will be constructed of brass with a spring loaded seal that will keep the valve in a closed position until the key is inserted into the valve. The valve will also have a hinged aluminum cap to prevent any debris getting into the internal mechanism of the valve. All QVC's will be installed on a triple elbow swing joint.

B. Quick Coupling Keys shall be of the single lug variety. Attached to the key will be a hose swivel adapter sized to the commonly used hose on the project. The key and swivel will both be constructed of brass as specified on the plans.

C. Quick coupler valves shall be 1". Valves to be mounted on Schedule 80 triple swing joint shown on detail sheet. The contractor will supply one (1) quick coupler key and one (1) swivel hose EL per every five (5) QCV to the Owner. Quick couplers shall be located 200 ft. apart or as specified on plans. All quick coupler valves shall be installed inside valve boxes.

**2.17 MANUAL DRAIN VALVES**

A. Provide at low points on mainline and zone lines of system (Sch 80 PVC Ball Valves).

B. Install drain valve assembly in 12"x 18" rectangular valve box and provide 12" layer of coarse gravel.

**2.18 POINT OF CONNECTION**

A. Point of connection for the irrigation system shall be at existing irrigation mainlines as shown and located on the delegated design plans provided by the Contractor. Refer to L301 Delegated Design Requirements for landscape areas to receive irrigation. The contractor shall connect proposed irrigation mainlines and extend the existing main lines as required, providing a watertight connection by approved methods.

**2.19 SURGE PROTECTION EQUIPMENT**

A. Provide Surge protection for controllers not equipped with primary surge protection.

B. The contractor is responsible for determining whether the above mentioned surge protection equipment is provided for in the controller as a “built-in” unit or if it must be supplied and installed separately

**2.20 METER**

A. To be installed by the General Contractor. Provide meter(s) as indicated on Drawings and comply with Manufacturer’s Specifications and applicable local codes.

**2.21 BACKFLOW PREVENTER**

A. Comply with requirements and codes of local governing authority regarding backflow prevention.

B. Provide the necessary materials, insulation/draining capabilities, and if required a dark green, insulated fiberglass enclosure.

C. Backflow preventers shall be installed by irrigation contractor. Backflow preventers shall be type suitable for use in high hazard cross connection to potable water system.

1. In absence of local codes or requirements, double check assembly backflow preventer installed in strict accordance with manufacturer’s written instructions shall be considered as minimum requirement.

**2.22 PRESSURE REDUCING VALVES**

A. Pressure reducing valve shall be provided and installed if extreme pressure conditions exist.

**2.23 RAINFALL AND FREEZE SENSORS**

A. Provide rainfall sensor to cancel operation of controller during substantial rainfall and freeze sensor, approved by Owner representative, to cancel operation of controller during freezing conditions.

**2.24 CENTRAL CONTROL SYSTEM (EXISTING)**

A. The installation contractor shall coordinate with the Owner to determine if system will be connected to central control system. If will, complete programming, communicating will be the responsibility of the installation contractor’s before final acceptance will occur.

**PART 3 - EXECUTION**

**3.1 GENERAL**

A. Supervision: Provide a competent superintendent and necessary assistants on the job while Work is in progress. The Superintendent represents the irrigation contractor in all functions and directions given to him by the Owner are binding as if given to the contractor in person.

B. Inspection of Work in Progress: During the installation, the Owner representative will make regular inspections and reject any work and materials which do not meet the requirements

called for in the Contract Documents. Rejected work must be promptly corrected at no additional cost to the owner and no time extensions will be allowed for this reason.

C. Inspect project site prior to start of work to determine that all site conditions are acceptable for irrigation work to begin. Inform Owner representative of unsuitable conditions. Do not proceed with installation of irrigation system until unsatisfactory conditions have been corrected in a manner acceptable to installer.

**3.2 PREPARATION**

A. Locate all existing underground utilities prior to trenching and/or boring operations. Obtain utility locations from Owner and/or General Contractor and utilize utility locating services when necessary.

B. Layout of Mains and Laterals: Layout sprinkler mainlines and perform line adjustments and site modifications to laterals prior to excavation.

C. Coordinate all installation with landscape planting work, especially fine grading and soil preparation for planting areas.

D. Coordinate and cooperate with all other contractors to enable the work to proceed as rapidly and efficiently as possible.

E. Layout of Sprinkler Heads: Stake sprinkler head locations and check for uniformity of coverage and correctness of pattern.

F. Gate Valve and Valve Locations: Locate to assure ease of access for maintenance and that no physical interference with other elements of the project exist in turf areas only, unless otherwise noted.

G. Furnish temporary support, adequate protection and maintenance of all underground and surface utilities, structures, drains, sewers, and other obstructions encountered in the progress of the work.

H. The contractor shall be acquainted with all site conditions. Should utilities not shown on the plans be found during excavation, the contractor shall promptly notify the Owner for instructions as to further actions. Failure to do so will make the contractor liable for any and all damage thereto rising from the operations subsequent to discovery of such utilities not shown in plan.

I. Where the grade or alignment of the pipe is obstructed by existing utility structures such as conduit, ducts, pipe branch connections to sewer mains, main drains, water services, etc., the obstruction shall be permanently supported, relocated, removed or reconstructed by the contractor in cooperation with the owner of such utility. No deviation from the required line or grade shall be made without the written direction of the Owner.

**3.3 EXCAVATION**

A. All excavation is unclassified and includes all materials encountered that are not classified as rock excavation.

B. Report exceptions to the Owner representative before excavation. An adjustment in price will be established which includes removal and disposal of the unsuitable material, and the acquiring of additional backfill material.

C. Excavation in newly sodded areas: Prior to excavation, remove sod, preserve and replace after backfilling is completed.

D. Excavation in established grass or newly seeded areas: After excavation and backfilling is completed, re-grade trenched area consistent with surrounding area and re-seed with 100% pure seed of type grass existing. Mulch with straw and water.

E. Excavation through existing asphalt: Cutting, removal and replacement of asphalt, as noted on the drawing, is the responsibility of the irrigation contractor.

**3.4 SLEEVING INSTALLATION (BY GENERAL CONTRACTOR)**

A. Location of sleeving shown on the plans is schematic. General Contractor to make adjustments necessary to accommodate existing vegetation, utilities and other existing conditions.

B. Repair of damage to existing utilities, structures or other construction resulting from installation of sleeves is the responsibility of the Sleeving Contractor.

C. Irrigation sleeves shall be installed as per details. If sleeving horizontal depth exceeds the detailed requirement by (6") six inches, it will be the responsibility of the General Contractor to expose the horizontal ends below finish grade. In all areas where sleeving is not installed as per details the General Contractor is to expose irrigation sleeves for irrigation contractor prior to the start of the irrigation work.

**3.5 PIPE INSTALLATION**

A. General:

1. The contractor shall stake out the location of each run of pipe, sprinkler heads, and valves prior to trenching.
2. The trench shall be of sufficient width and depth for installation of the pipe as indicated herein. The contractor shall cause minimum disturbances to all existing conditions wherever possible. The contractor shall bore under existing pavement and sidewalks rather than cut and restore. No pavement shall be cut without the Owner's permission.
3. Pipe shall be delivered and stored on the job site with suitable protection against any damage to pipe and fittings.
4. Trenches shall be made wide enough to allow a minimum of four inches between parallel pipe lines. Parallel lines shall not be installed directly over one another. Provide minimum coverage as follows:
   a. 18" minimum cover over mainlines and sleeves up to 3".
   b. 18" minimum cover over control wires from controller to valves.
   c. 12" minimum cover over lateral lines.
   d. Maintain all warning signs, shoring, barricades, flares and red lanterns as required by the Safety Orders of the Division of Industrial Safety and any local ordinances and codes.
5. The pipe and fittings shall be carefully inspected before installation in the trench. All rocks over 2" diameter and unsuitable bearing shall be removed from trench in strict accordance with the manufacturer's recommendations.
   a. Solvent welded joints shall be made only on clean, dry, square cut, smooth pipe sections. The fittings shall be "dry" tested for proper size before solvent is applied. The assembly shall proceed in strict accordance with recommended procedures furnished by the manufacturer.
   b. Solvent welded pipe sections shall be "snaked" from side to side in the trench to prevent joint rupture due to thermal contraction.

c. Pipe openings shall be plugged during construction to prevent entrance of foreign materials.

6. BACKFILL:
   a. Backfill shall be carefully placed to avoid pipe dislocation. Backfill material shall be free of rocks, stumps, roots and other unsuitable material. In planting areas, the top six inches (6”) shall be suitable planting soil. Backfill shall be placed in six inch (6”) lifts and shall be thoroughly compacted to prevent excessive settling. Backfill under pavement or sidewalks shall be compacted to 98% of maximum A.A.S.H.O. T-180 density.
   b. The surface of backfilled trenches shall be even with the surrounding ground surface.
   c. Plant locations shall take precedence over sprinkler and pipe locations.
   d. The contractor shall coordinate the routing of lines and final head locations with the placement of specimen trees and shrubs.

B. PIPE JOINTS
   1. Follow manufacturer’s recommendations. Pipes 3” and smaller use solvent weld system. Pipes 4” and larger use approved compression type push-on joints. Use pipe and bell from the same manufacturer.
   2. Solvent weld PVC Pipe, assemble according to manufacturer’s recommendations, using appropriate PVC pipe cleaner/primer and solvent cement.
   3. Main Line: Install according to manufacturer’s recommendations. Provide concrete thrust blocks at all directional changes on all mainline pipe 3” and larger as per details.
      a. Pipe and Fittings: Solvent Weld fittings must conform to Schedule 40 or Schedule 80 PVC dimensions and specifications for solvent weld fittings.
      b. Lateral Lines and Risers: Install according to manufacturer’s recommendations using standard techniques. Combine lateral lines and main supply lines in common trenches wherever possible. Install risers such that no excessive movement occurs while sprinkler head is in operation. Height of risers to be in accordance with planned and existing plant material. Height of all risers is subject to approval of Owner representative. Flush lateral lines and risers prior to installation of sprinkler heads. Above ground risers must be painted color approved by Owner representative and/or Owners Representative.

**3.6 SPRINKLER HEAD INSTALLATION**

A. The contractor shall be responsible for the exact location of all sprinkler heads, acknowledging that the plans are schematic in nature. The contractor shall accordingly place all sprinkler heads, adjust all nozzles, spray patterns, and make whatever other adjustments that may be required to give the landscaped areas full, complete, and proper coverage and distribution, and to meet all manufacturer’s requirements. All such adjustments and additions shall be at the contractor’s expense.

B. Sprinkler heads located along curbs and edges of paving shall be installed 6” from back of curb or paving. Along roadways without curbs, sprinkler heads shall be located 18” from edge of pavement.

C. Sprinkler heads shall be installed as designated on the drawings. The top of all heads shall be flush with finish grade or top of curb.

D. All sprinkler head risers above finished grade shall be staked with EMT and painted with exterior alkyd enamel paint flat black. The contractor shall provide sample of paint to the Owner representative prior to installation. Use black UV approved wire ties only.

E. In no case shall the spacing of heads exceed the maximum recommended by the manufacturer.

F. Before sprinkler heads are set, the contractor shall flush the lines thoroughly to insure there is no foreign matter in the lines.

G. High Pop-Up Shrub Heads: Finish height to be determined by Owner representative.

H. Backfill around sprinkler head assembly in such manner as to stabilize the sprinkler head so that no lateral motion is exhibited during operation.

I. Sprinkler Heads on Risers: Maintain on Schedule 80 PVC riser coupled by a Schedule 40 F.I.P.T. coupling to a polyethylene riser first out of the lateral fitting. Height of all heads in bed areas to be determined in the field by the Owner representative.

J. Drip Irrigation Emitters (if required) are to be located in a manner that will provide optimum concentration of water to the plant material.

**3.7 ELECTRICAL CONNECTIONS AND CONTROL WIRE**

A. Shall be in strict accordance with latest addition of National Electrical Code (NEC) and local electrical codes.

B. Provide electrical connection to system as designated on construction drawings and as specified herein.

C. General:
   1. Do not run control and power supply wiring in same conduit.
   2. Provide continuous runs of wire between controller and valves. Splices shall be made with one of the following:
      a. Water-tight connectors, such as utilized for valves, and located within valve box for ease of locating.
      b. The location of any and all electrical splices shall be shown on the as-built.
   3. Bury control wire beside mainline pipe in same trench. Bundle and tape together at not more than ten foot intervals.

D. Expansion Loops: Constructed by wrapping wire around ¾- inch diameter pipe to create coil.
   1. Provide 24-inch coils at each wire splice, not including valves, and at each change of wire direction.
   2. Provide 36-inch coils at each control valve and where each valve enters conduit for automatic controller.

E. Provide looped slack at directional changes in supply line to allow for contraction of wires.

F. Keep wire splices to a minimum and provide ten inch round valve box at each splice location.

G. Pass wires under existing or future paving, construction, etc. through PVC sleeves provided by General Contractor.

**3.8 CONTROL EQUIPMENT**

A. Install automatic valves and controllers according to manufacturer’s recommendations.

B. Location and installation shall be as shown on construction drawings and approved by Owner prior to installation.

C. Provide rigid conduits for both power supply and control wiring.

1. Control wire conduit shall extend to 18 inches below grade.
2. Secure conduit to wall with anchors and screws.
3. Provide electrical grounding for controller in accordance with manufacturer's written instructions.
4. Installation Contractor shall adhere to all manufacturer specifications for installation of 2-wire, decoder based control system, including installation of surge protection, control wiring, decoder installation, etc.

**3.9 VALVES**

A. Do not locate beneath paved surfaces.

B. Install plumb to within 1/16 inch.

C. Gate Valves: Install as located and detailed on the drawings.

D. Quick Coupling Valves: Installed on mainline pipe every two hundred feet unless noted otherwise on plan. Top of quick coupler valves shall be six inches to top of valve box. Top of gravel layer shall be three inches below top of valve. The connection between the mainline and quick coupler valve shall be with a threaded Schedule 80 PVC pipe.

E. Electric Control Valves: Installed in specified valve boxes.. The valve box shall have six inch layer of ¾" pea gravel installed below the bottom of the valve. The valve shall be connected to the mainline with Schedule 80 PVC extensions as necessary to insure valve is properly positioned in the valve box as shown in the details. Electric control valves shall be installed where shown and grouped together where practical. The contractor shall place no closer than three feet from edges of sidewalks, walk edges, buildings and walls, and no closer than seven feet from the back of curb along roadways or centerline of swales. The contractor shall adjust the valve to provide flow rate of rated operating pressure required for each sprinkler circuit.

F. In the event that the valve box does not extend to the base of the electric control valve because of specific field conditions or complications as verified and approved by the Owner prior to installation, the contractor shall provide and install valve box extension(s) per industry standards.

**3.10 VALVE BOXES**

A. All valves are to be housed in valve boxes. Install according to manufacturer's recommendations, and as shown on the drawings. Position boxes at a height that will not cause them to interfere with maintenance machinery (e.g., mowers) and such that soil and mulch do no wash into the box. Locate valve box in mulched or natural areas one foot inside the bed line. Where no mulched or natural areas exist nearby, install valve box in turf area. Install no more than two valve boxes together when installed in turf areas.

**3.11 PAINT**

A. Exterior alkyd enamel (color to be chosen and approved by Owner representative) shall be used on above ground PVC risers and other designated irrigation equipment. The irrigation contractor shall provide paint sample prior to execution of painting.

**3.12 SURGE PROTECTION EQUIPMENT**

A. Install surge protection equipment on primary (110 VAC) power lines in accordance with the electrical grounding instructions included with each controller. Connect each surge protection unit to at least two 5/8" diameter by nine foot long copper clad grounding electrode driven into the soil to its full depth. Place electrodes no closer than two (2) feet from the controller

cabinet or any control or power wire. Be consistent in locating ground rods throughout the installation with respect to controller positions.

B. Ground wire between surge protection device and grounding electrode to be single strand bare copper wire at least one size greater than the wire supplying power to the control unit. Route ground wire away from power and control wires where possible. When it is necessary to pass through the controller cabinet wall use two (2) #L-70 copper grounding lugs and a brass bolt as noted on the drawings. Use a #WE 5/8 ground rod clamp (single piece and bolt) to make connection between ground rod and ground wire. Bury ground wire passing between controller and ground rod a minimum of ten inches. Cover the top of the rod and the clamp itself with a four inch round cover with lid at grade level.

**3.13 TESTING**

A. The contractor shall notify Owner representative **seventy-two (72) hours** in advance of testing.

B. Prior to backfilling of mainline fittings, the contractor shall fill the mainline piping with water, in the presence of the Owner's representative, taking care to purge the air from the piping by operating all the sprinkler control valves one or more times or such other means as may be necessary. A small, high pressure pump or other means of maintaining a continuous water supply shall be connected to the mainline and set so as to maintain **120 PSI** in the mainline system for four (4) hours without interruption. Piping may be tested in sections to expedite the work. Remove and repair piping, connections, valves which do not pass the hydrostatic testing. Check all lateral lines downstream from valves: repair as necessary: re-check and repair until no leaks are present. Lateral line testing shall be conducted during the operating testing of the system by checking visually the ground surface until no leaks in this portion of the system are evident. Leaks shall be repaired or paid for by the contractor at any time the leaks appear during the warranty period.

C. Adjustment and Coverage of System: Coordinate pressure testing with adjustments and coverage test of system so both may occur at the same time. The contractor shall balance and adjust the various components of the system so that the overall operation of the system is most efficient. This includes a synchronization of the controllers, adjustments to pressure regulators, pressure relief valves, part circle sprinkler heads, and individual station adjustments of the controller.

D. All items of construction and operation of the irrigation system are subject to inspection and testing by the Owner representative. Any item may be rejected because of noncompliance with the plans and specifications, non-suitability, poor materials, inadequate workmanship or improper assembly or other causes which would prevent the system from functioning properly, or which, in the Owner representative's opinion, would be detrimental to the longevity of the irrigation system, or which would necessitate excessive manual labor and maintenance.

E. The contractor shall fully comply with the schedule of testing and inspection, as well as any other tests or inspections that may be ordered by the Owner representative. All labor, materials, and equipment required for testing and inspections shall be furnished at the sole expense of the contractor. Work stoppages for testing, inspection and replacement or repair of any inadequate item shall not add to the allocated time of completion.

F. All repairs, replacements, adjustments and reconstruction required to pass said inspections and tests shall be at the contractor's sole expense.

G. The contractor shall be responsible for the full and proper maintenance of the irrigation system, including but not limited to, adjustments, repairs, integration with the master control system, etc. The contractor's responsibility for maintenance (exclusive of replacements or repairs within the guarantee/warranty period) shall terminate on the date of Material Completion for the entire project or designated portion thereof as declared by the Owner representative according to the conditions of the contract, provided the contractor has provided the Owner representative with (2) irrigation as-built drawings done on ACAD 2010 digital format, three (3) copies of Operation and Maintenance Manuals as specified.

H. Test of all grounding systems shall measure number of OHMS as recommended by manufacturer when measured with vibrasound equipment. All testing to be at the contractor's expense, by neutral company, with OHMS readings for each grounding field given to the Owner at completion.

I. Final inspection shall be made when the complete system is in place, operable, and all repairs, additions, adjustments and other work is complete. At such time, the contractor shall adequately demonstrate the proper operation of the system, shall show the systems complete conformance with the plans and specifications, and demonstrate that the irrigation system gives proper and adequate coverage of all landscaped areas.

J. Final acceptance by the Owner in no way removes the Contractor of the responsibility to make further repairs, corrections and adjustments to eliminate any deficiencies which may later be discovered, including moving or adding additional sprinklers if needed. Moreover, the contractor shall fully honor the one (1) year warranty outlined herein.

**3.14 BALANCING AND ADJUSTMENT**

A. Balance and adjust the various components of the sprinkler system so that the overall operation of the system is most efficient. This includes synchronization of the controllers, adjustments to pressure regulators, part circle sprinkler heads, and individual station adjustments on the controllers.

B. Upon completion of the irrigation system, perform a coverage test with the Owner's Representative to determine if the irrigation coverage is adequate. Correct any inadequacies.

**3.15 IRRIGATION DISTRIBUTION AND SPRINKLER OPERATION TESTING**

A. Upon completion of the irrigation system, and after head installation, test the entire system for proper operation. Flush all air from the system and check components for proper operation. The follow tests must be performed and completed with no leaks prior to Material Completion:

1. 4-hour test at 1.5 times the system operating pressure.
2. 24-hour test at the system operating pressure.

**3.16 OWNER ORIENTATION**

A. Upon completion of the work and at a time acceptable to the Owner representative and Owner, the irrigation contractor is responsible for the orientation of the Owner's maintenance personnel in the operation, maintenance, and repair of the system. Furnish copies of all available parts lists, troubleshooting lists and specifications sheets, to the Owner representative.

1. Operating and Maintenance Manuals shall constitute the basis of orientation.

B. Set the initial watering schedules and programming of the automatic controllers at direction of Owner representative or Owner's Designated Representative.

**3.17 WINTERIZING THE SYSTEM**

A. If required by the Owner, the irrigation system shall be winterized the first winter season following the completion of the project. The irrigation piping shall be winterized by first blowing the system clear of water using compressed air (80 psi maximum) admitted into the piping at a quick coupling valve or hose bib located at a higher elevation on the system piping. Activate individual zones, higher zones first, then proceed successively through the system towards lower elevations. Proceed through all zones twice. The air compressor used to winterize the system must have an engine separate from the compressor tanks to prevent high temperature air from being injected directly into the PVC piping.

**3.18 CLEAN UP AND PROTECTION**

A. During irrigation work, keep site clean and orderly.

B. Upon completion of work, clear grounds of debris, superfluous materials and all equipment. Remove to the satisfaction of the Owner representative.

C. Protect irrigation work and materials from damage due to irrigation operations, operations by other contractors, trades and trespassers. Maintain protection until Date of Material Completion.

D. Cover all openings in to system as it is being installed to prevent obstructions in the pipe and the breakage, misuse or disfigurements of the equipment.

E. Theft: Irrigation Contractor is responsible for theft of equipment and material at the jobsite before, during, and after installation, until Date of Material Completion of the work.

**3.19 WARRANTY AND REPLACEMENT**

A. The irrigation contractor shall furnish warranties in <u>writing</u> certifying that the quality and Workmanship of all materials and installation furnished is in accordance with these specifications and in accordance with original manufacturer's warranties. Irrigation Contractor shall further see to the fulfillment of all manufacturer's warranties. Irrigation Contractor shall warrant the installation workmanship for a period of one (1) year from Date of Completion or Acceptance of the installation, or any accepted portion of the installation.

B. Should the irrigation contractor be notified that work or replacements are warranted under these conditions, he shall provide the required service and/or replacements promptly within two (2) days.

**3.20 INSPECTION AND ACCEPTANCE**

A. Periodic inspections will be made by the Owner representative to review the quality and progress of the work. Work found to be unacceptable must be corrected within five calendar days. Remove rejected materials promptly from the project.

B. Upon completion of work, the contractor shall notify the Owner representative and Owner at least ten (10) days prior to requested date of inspection for Material Completion of all portions of the work. Owner representative will issue a punch list for work to be corrected. All work on the punch list must be completed within five (5) working days from the date of inspection. Where inspected irrigation work does not comply with requirements, replace rejected work. If such replacements are not completed within the time specified, the irrigation contractor may be considered in default of the contract, and the Owner may use the Contract Retainage to hire other contractors to finish the work.

C. It will be the responsibility of the irrigation contractor to provide a reliable communication system (i.e. Two way radios or remote radio control activation system) for Material Completion and all periodic inspections.

D. If an inspection to verify Material Completion has been scheduled and the Owner representative arrives at the site and determines that the irrigation system is not substantially complete (all system components in place, operational and checked) the contractor shall be responsible for all costs incurred by the Owner representative to inspect the site. Reimbursable expenses include but are not limited to the following: mileage, airfare, consultant's time, parking fee, meals, rental car, etc. All incurred expenses will be deducted from the final contract amount.

E. Certificate of Material Completion will be issued for acceptable work and completion of asbuilt drawings when the Owner representative verifies the system for Material Completion. If punch list items are issued with the Certificate, they must be corrected within five (5) working days.

**3.21 CODES AND ORDINANCES**

A. All materials, installation parameters, and operations shall conform to all applicable codes and ordinances. It is the Contractor's responsibility to investigate and follow all regulations. Contractor is responsible to verify applicable codes and ordinances prior to submitting bid. Before bid submittal, it is the Contractor's responsibility to notify the Irrigation Consultant/Designer at least 5 days before bid submittal, of any changes due to code or ordinance discrepancies. If the Contractor does not comply with this process and notification, the Contractor shall be responsible for the necessary installation change and redesign costs for non-compliance.

**3.22 PERMITS AND FEES**

A. The Contractor shall obtain, at his expense, all required permits and shall pay all required fees. Any penalties imposed due to failure to obtain any permit or pay any fee shall be the responsibility of the Contractor.

END OF SECTION 328400

# SECTION 32 9200
# TURF AND LAWN GRASSES

## 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. Seeding.
2. Sodding.

B. Related Requirements:

1. Section 329300 "Plants" for trees, shrubs, ornamental grasses, ground covers, and other plants as well as border edgings and mow strips.

### 1.3 DEFINITIONS

A. Finish Grade: Elevation of finished surface of planting soil.

B. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

C. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. Pests include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

D. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth. See Section 329115 "Soil Preparation" and drawing designations for planting soils.

E. Subgrade: The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

### 1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

### 1.5 INFORMATIONAL SUBMITTALS

A. Certification of grass seed.

1. Certification of each seed mixture for turfgrass sod. Include identification of source and name and telephone number of supplier.

B. Product Certificates

### 1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful turf establishment.

1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
2. Pesticide Applicator: State licensed, commercial.

### 1.7 DELIVERY, STORAGE, AND HANDLING

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

B. Sod: Harvest, deliver, store, and handle sod according to requirements in "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" sections in TPI's "Guideline Specifications to Turfgrass Sodding." Deliver sod within 24 hours of harvesting and in time for planting promptly. Protect sod from breakage and drying.

**PART 2 - PRODUCTS**

**2.1 SEED**

A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Rules for Testing Seeds" for purity and germination tolerances.

B. Seed Species: as indicated on drawings.

1. Quality: State-certified seed of grass species as listed below for solar exposure.
2. Quality: Seed of grass species as listed below for solar exposure, with not less than 85 percent germination, not less than 95 percent pure seed, and not more than 0.5 percent weed seed.

**2.2 TURFGRASS SOD**

A. Turfgrass Sod: Blue Tag Certified sod complying with "Specifications for Turfgrass Sod Materials" in TPI's "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture that is strongly rooted and capable of vigorous growth and development when planted.

B. Turfgrass Species: as indicated on drawings.

**2.3 FERTILIZERS**

A. Commercial Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water insoluble nitrogen, phosphorus and potassium in the following composition.

1. Composition: 20 percent nitrogen, 10 percent phosphorous and 10 percent potassium by weight.

B. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.
2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

**2.4 MULCHES**

A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.

B. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch (25-mm) sieve; soluble salt content of 2 to 5 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

**2.5 PESTICIDES**

A. General: Pesticide, registered and approved by the EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

**PART 3 - EXECUTION**

**3.1 TURF AREA PREPARATION**

A. General: Prepare planting area for soil placement and mix planting soil according to Section 329115 "Soil Preparation."

B. Placing Planting Soil: Blend planting soil in place.

1. Reduce elevation of planting soil to allow for soil thickness of sod.

C. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

D. Before planting, obtain Design Professional's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

E. If area's need to be seeded all prepared between September 15th and April 15th, the contractor must return after April 15th but before May 30th and must water and maintain until full stand of grass is in place

**3.2 SEEDING**

A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph (8 km/h).

1. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.
2. Do not use wet seed or seed that is moldy or otherwise damaged.
3. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.

B. Sow seed at a total rate of according to manufacturer's recommendations.

C. Rake seed lightly into top 1/8 inch (3 mm) of soil, roll lightly, and water with fine spray.

D. Protect seeded areas with slopes not exceeding 1:6 by spreading straw mulch. Spread uniformly at a minimum rate of 2 tons/acre (42 kg/92.9 sq. m) to form a continuous blanket 1-1/2 inches (38 mm) in loose thickness over seeded areas. Spread by hand, blower, or other suitable equipment.

E. Protect seeded areas from hot, dry weather or drying winds by applying compost mulch within 24 hours after completing seeding operations. Soak areas, scatter mulch uniformly to a thickness of 3/16 inch (4.8 mm) and roll surface smooth.

**3.3 SODDING**

A. Lay sod within 24 hours of harvesting. Do not lay sod if dormant or if ground is frozen or muddy.

B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to soil or sod during installation. Tamp and roll lightly to ensure contact with soil, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.

1. Lay sod across slopes exceeding 1:3.
2. Anchor sod on slopes exceeding 1:6 with wood pegs or steel staples spaced as recommended by sod manufacturer but not less than two anchors per sod strip to prevent slippage.

C. Saturate sod with fine water spray within two hours of planting. During first week after planting, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches (38 mm) below sod.

D. DORMANT SOD

1. Dormant Bermuda or Zoysia sod can be installed. However, Contractor shall assume responsibility for all sod through establishment and until final acceptance.

**3.4 TURF MAINTENANCE**

A. General: Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.

B. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than one-third of grass height. Remove no more than one-third of grass-leaf

growth in initial or subsequent mowings. Retain applicable subparagraphs below for mowing height. For seed mixtures, base selection on predominant species to be established.

**3.5 SATISFACTORY TURF**

A. Turf installations shall meet the following criteria as determined by Design Professional:

1. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. (0.92 sq. m) and bare spots not exceeding 5 by 5 inches (125 by 125 mm).
2. Satisfactory Sodded Turf: At end of maintenance period, a healthy, well-rooted, even-colored, viable turf has been established, free of weeds, open joints, bare areas, and surface irregularities.

B. Use specified materials to reestablish turf that does not comply with requirements, and continue maintenance until turf is satisfactory.

**3.6 CLEANUP AND PROTECTION**

A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of them off Owner's property.

C. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.

D. Remove nondegradable erosion-control measures after grass establishment period.

**END OF SECTION 329200**

# SECTION 32 9300
# PLANTS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section Includes:

1. Plants.

2. Tree stabilization.

B. Related Requirements:

1. Section 015639 "Temporary Tree and Plant Protection" for protecting, trimming, pruning, repairing, and replacing existing trees to remain that interfere with, or are affected by, execution of the Work.

2. Section 329200 “Turf and Lawn Grasses” for turf installation requirements.

### 1.3 DEFINITIONS

A. Backfill: The earth used to replace or the act of replacing earth in an excavation.

B. Balled and Burlapped Stock: Plants dug with firm, natural balls of earth in which they were grown, with a ball size not less than diameter and depth recommended by ANSI Z60.1 for type and size of plant required; wrapped with burlap, tied, rigidly supported, and drum laced with twine with the root flare visible at the surface of the ball as recommended by ANSI Z60.1.

C. Balled and Potted Stock: Plants dug with firm, natural balls of earth in which they are grown and placed, unbroken, in a container. Ball size is not less than diameter and depth recommended by ANSI Z60.1 for type and size of plant required.

D. Bare-Root Stock: Plants with a well-branched, fibrous-root system developed by transplanting or root pruning, with soil or growing medium removed, and with not less than the minimum root spread according to ANSI Z60.1 for type and size of plant required.

E. Container-Grown Stock: Healthy, vigorous, well-rooted plants grown in a container, with a 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 plant required.

F. Fabric Bag-Grown Stock: Healthy, vigorous, well-rooted plants established and grown in-ground in a porous fabric bag with well-established root system reaching sides of fabric bag. Fabric bag size is not less than diameter, depth, and volume required by ANSI Z60.1 for type and size of plant.

G. Finish Grade: Elevation of finished surface of planting soil.

H. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also include

substances or mixtures intended for use as a plant regulator, defoliant, or desiccant. Some sources classify herbicides separately from pesticides.

I. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. Pests include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

J. Planting Area: Areas to be planted.

K. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth. See Section 329113 "Soil Preparation" for drawing designations for planting soils.

L. Plant; Plants; Plant Material: These terms refer to vegetation in general, including trees, shrubs, vines, ground covers, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.

M. Root Flare: Also called "trunk flare." The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.

N. Stem Girdling Roots: Roots that encircle the stems (trunks) of trees below the soil surface.

O. Subgrade: The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

## 1.4 COORDINATION

A. Coordination with Turf Areas (Lawns): Plant trees, shrubs, and other plants after finish grades are established and before planting turf areas unless otherwise indicated.

1. When planting trees, shrubs, and other plants after planting turf areas, protect turf areas, and promptly repair damage caused by planting operations.

## 1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

## 1.6 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Plant Materials: Include quantities, sizes, quality, and sources for plant materials.

2. Plant Photographs: Include color photographs in digital format of each required species and size of plant material as it will be furnished to Project. Take photographs from an angle depicting true size and condition of the typical plant to be furnished. Include a clearly demarcated scale rod. For species where more than 20 plants are required, include a minimum of three photographs showing the average plant, the best quality plant, and the worst quality plant to be furnished. Identify each photograph with the full scientific name of the plant, plant size, and name of the growing nursery.

B. Samples for Verification: For each of the following:

1. Organic Compost Mulch: 1-pint volume of each organic mulch required; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch. Each Sample shall be typical

of the lot of material to be furnished; provide an accurate representation of color, texture, and organic makeup.

2. Mineral Mulch: 2 lb (1.0 kg) of each mineral mulch required, in sealed plastic bags labeled with source of mulch. Sample shall be typical of the lot of material to be delivered and installed on-site; provide an accurate indication of color, texture, and makeup of the material.

## 1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For landscape Installer. Include list of similar projects completed by Installer demonstrating Installer's capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of owners' contact persons.

B. Sample Warranty: For special warranty.

## 1.8 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful establishment of plants.

1. Experience: Three years' experience in landscape installation in addition to requirements in Section 014000 "Quality Requirements."

2. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.

3. Pesticide Applicator: State licensed, commercial.

B. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.

C. Measurements: Measure according to ANSI Z60.1. Do not prune to obtain required sizes.

1. Trees and Shrubs: Measure with branches and trunks or canes in their normal position. Take height measurements from or near the top of the root flare for field-grown stock and container-grown stock. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip to tip. Take caliper measurements 6 inches above the root flare for trees up to 4-inch caliper size, and 12 inches above the root flare for larger sizes.

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

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

1. Notify Owner representative of sources of planting materials seven days in advance of delivery to site.

## 1.9 DELIVERY, STORAGE, AND HANDLING

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

B. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.

2. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.

3. Accompany each delivery of bulk materials with appropriate certificates.

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

D. Handle planting stock by root ball.

E. 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.

F. Deliver plants after preparations for planting have been completed and install immediately. If planting is delayed more than six hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.

1. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.

2. Do not remove container-grown stock from containers before time of planting.

3. Water root systems of plants stored on-site deeply and thoroughly with a fine-mist spray. Water as often as necessary to maintain root systems in a moist, but not overly wet condition.

## 1.10 FIELD CONDITIONS

A. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.

B. Planting Restrictions: Plant woody and perennial material between September 15 and May 15 to take advantage of optimum weather conditions for planting. Sod installation shall be limited to the period between May 1 and October 1. Coordinate planting periods with maintenance periods to provide required maintenance from date of Material Completion.

C. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements.

## 1.11 WARRANTY

A. Special Warranty: 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 abuse, lack of adequate maintenance, or neglect by Owner.

b. Structural failures including plantings falling or blowing over.

c. Faulty performance of tree stabilization.

d. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Periods: From date of Material Completion.

a. Trees, Shrubs, Vines, and Ornamental Grasses: 12 months.

b. Ground Covers, Biennials, Perennials, and Other Plants: 12 months.

3. Include the following remedial actions as a minimum:

a. Immediately remove dead plants and replace unless required to plant in the succeeding planting season.

b. Replace 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 plant is required except for losses or replacements due to failure to comply with requirements.

d. Provide extended warranty for period equal to original warranty period, for replaced plant material.

**PART 2 - PRODUCTS**

**2.1 PLANT MATERIAL**

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

1. Trees with damaged, crooked, or multiple leaders; tight vertical branches where bark is squeezed between two branches or between branch and trunk ("included bark"); crossing trunks; cut-off limbs more than 3/4 inch in diameter; or with stem girdling roots are unacceptable.

2. Collected Stock: Do not use plants harvested from the wild, from native stands, from an established landscape planting, or not grown in a nursery unless otherwise indicated.

B. Provide plants of sizes, grades, and ball or container sizes complying with ANSI Z60.1 for types and form of plants required. Plants of a larger size may be used if acceptable to Owner representative, with a proportionate increase in size of roots or balls.

C. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which begins at root flare according to ANSI Z60.1. Root flare shall be visible before planting.

D. Labeling: Label each plant of each variety, size, and caliper with a securely attached, waterproof tag bearing legible designation of common name and full scientific name, including genus and species. Include nomenclature for hybrid, variety, or cultivar, if applicable for the plant.

## 2.2 MULCHES

A. Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following:

1. Type: Aged, shredded hardwood. Cypress or colored mulch not acceptable.

2. Color: Natural.

B. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through a 1-inch sieve; soluble-salt content of 2 to 5 dS/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

1. Organic Matter Content: 50 to 60 percent of dry weight.

2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.

## 2.3 PESTICIDES

A. General: Pesticide registered and approved by the EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

B. Pre-Emergent Herbicide (Selective and Nonselective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.

C. Post-Emergent Herbicide (Selective and Nonselective): Effective for controlling weed growth that has already germinated.

D. Neonicotinoid herbicides on site use prohibiters.

## 2.4 TREE-WATERING DEVICES

A. The contractor will provide watering devices, equivalent to Gatorbags, Oozetube or other device as necessary for maintenance as directed by Owner representative until irrigation system is substantially complete and operating.

## 2.5 TREE-STABILIZATION MATERIALS

A. Proprietary Staking-and-Guying Devices: Proprietary stake or anchor and adjustable tie systems to secure each new planting by plant stem; sized as indicated and according to manufacturer's written recommendations. Choose from one of the following three manufacturers:

1. Arborbrace

2. ArborTie by Deeproot

3. Better Bilt Products, Inc.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine areas to receive plants, with Installer present, for compliance with requirements and conditions affecting installation and performance of the Work.

1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.

2. Verify that plants and vehicles loaded with plants can travel to planting locations with adequate overhead clearance.

3. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.

4. Uniformly moisten excessively dry soil that is not workable or which is dusty.

B. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Owner representative and replace with new planting soil.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

C. Lay out individual tree and shrub locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested, and obtain Owner representative's acceptance of layout before excavating or planting. Make minor adjustments as required.

D. Lay out plants at locations directed by Owner representative. Stake locations of individual trees and shrubs and outline areas for multiple plantings.

### 3.3 PLANTING AREA ESTABLISHMENT

A. General: Prepare planting area for soil placement and mix planting soil according to Section 329115 "Soil Preparation (Performance Specification)."

B. Placing Planting Soil: Blend planting soil in place.

C. Before planting, obtain Owner representative's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

D. Application of Mycorrhizal Fungi: At time directed by Owner representative, broadcast dry product uniformly over prepared soil at application rate according to manufacturer's written recommendations.

### 3.4 EXCAVATION FOR TREES AND SHRUBS

A. Planting Pits and Trenches: Excavate circular planting pits.

1. Excavate planting pits with sides sloping inward as indicated on drawings. Excavations with vertical sides are unacceptable. Trim perimeter of bottom leaving center area of bottom raised slightly to support root ball and assist in drainage away from center. Do not further disturb base. Ensure that root ball will sit on undisturbed base soil to prevent settling. Scarify sides of planting pit smeared or smoothed during excavation.

2. Excavate approximately three times as wide as ball diameter for balled and burlapped stock.

3. Excavate at least 12 inches wider than root spread and deep enough to accommodate vertical roots for bare-root stock.

4. Do not excavate deeper than depth of the root ball, measured from the root flare to the bottom of the root ball.

5. If area under the plant was initially dug too deep, add soil to raise it to the correct level and thoroughly tamp the added soil to prevent settling.

6. Maintain angles of repose of adjacent materials to ensure stability. Do not excavate subgrades of adjacent paving, structures, hardscapes, or other new or existing improvements.

7. Maintain supervision of excavations during working hours.

8. Keep excavations covered or otherwise protected when unattended by Installer's personnel.

9. If drain tile is indicated on Drawings or required under planting areas, excavate to top of porous backfill over tile.

B. Backfill Soil: Subsoil and topsoil removed from excavations may be used as backfill soil unless otherwise indicated.

C. Obstructions: Notify Owner representative if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.

1. Hardpan Layer: Drill 6-inch- diameter holes, 24 inches apart, into free-draining strata or to a depth of 10 feet, whichever is less, and backfill with free-draining material.

D. Drainage: Notify Owner representative if subsoil conditions evidence unexpected water seepage or retention in tree or shrub planting pits.

E. Fill excavations with water and allow to percolate away before positioning trees and shrubs.

## 3.5 TREE, SHRUB, AND VINE PLANTING

A. Inspection: At time of planting, verify that root flare is visible at top of root ball according to ANSI Z60.1. If root flare is not visible, remove soil in a level manner from the root ball to where the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements.

B. Roots: Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.

C. Balled and Burlapped Stock: Set each plant plumb and in center of planting pit or trench with root flare no more than 1 inch above adjacent finish grades.

1. Backfill: Planting soil. For trees, use excavated soil for backfill.

2. After placing some backfill around root ball to stabilize plant, carefully cut and remove burlap, rope, and wire baskets from tops of root balls and from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.

3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.

4. Continue backfilling process. Water again after placing and tamping final layer of soil.

D. Container-Grown Stock: Set each plant plumb and in center of planting pit or trench with root flare 1 inch above adjacent finish grades.

1. Backfill: Planting soil. For trees, use excavated soil for backfill.

2. Carefully remove root ball from container without damaging root ball or plant.

3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.

4. Continue backfilling process. Water again after placing and tamping final layer of soil.

E. Bare-Root Stock: Set and support each plant in center of planting pit or trench with root flare 1 inch above adjacent finish grade.

1. Backfill: Planting soil. For trees, use excavated soil for backfill.

2. Spread roots without tangling or turning toward surface. Plumb before backfilling, and maintain plumb while working.

3. Carefully work backfill in layers around roots by hand. Bring roots into close contact with the soil.

4. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.

5. Continue backfilling process. Water again after placing and tamping final layer of soil.

## 3.6 MECHANIZED TREE-SPADE PLANTING

A. Mechanized Tree-Spade Planting is not permitted.

## 3.7 TREE, SHRUB, AND VINE PRUNING

A. Remove only dead, dying, or broken branches. Do not prune for shape.

B. Prune, thin, and shape trees, shrubs, and vines as directed by Owner representative.

C. Prune, thin, and shape trees, shrubs, and vines according to standard professional horticultural and arboricultural practices. Unless otherwise indicated by Owner representative, do not cut tree leaders; remove only injured, dying, or dead branches from trees and shrubs; and prune to retain natural character.

D. Do not apply pruning paint to wounds.

## 3.8 TREE STABILIZATION

A. Trunk Stabilization by Staking and Guying: Install trunk stabilization as follows unless otherwise indicated on Drawings. Stake and guy trees more than 14 feet in height and more than 3 inches in caliper only when tree is on slope over 5:1 slope or when approved or directed by the Owner representative.

## 3.9 GROUND COVER AND PLANT PLANTING

A. Set out and space ground cover and plants other than trees, shrubs, and vines as indicated on Drawings in even rows with triangular spacing.

B. Use planting soil for backfill.

C. Dig holes large enough to allow spreading of roots.

D. For rooted cutting plants supplied in flats, plant each in a manner that minimally disturbs the root system but to a depth not less than two nodes.

E. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.

F. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.

G. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

## 3.10 PLANTING AREA MULCHING

A. Mulch backfilled surfaces of planting areas and other areas indicated.

1. Trees and Treelike Shrubs in Turf Areas: Apply organic mulch ring of 3-inch average thickness equal to radius around trunks or stems. Do not place mulch within 3 inches of trunks or stems.

2. Organic Mulch in Planting Areas: Apply 3-inch average thickness of organic mulch over whole surface of planting area, and finish level with adjacent finish grades. Do not place mulch within 3 inches of trunks or stems.

## 3.11 EDGING INSTALLATION

A. Shovel-Cut Edging: Separate mulched areas from turf areas, curbs, and paving with a 45-degree, 4- to 6-inch-(100- to 150-mm-) deep, shovel-cut edge.

## 3.12 PLANT MAINTENANCE

A. The contractor shall be responsible for and maintain the installed landscape until final completion of the contract.

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

C. 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.

D. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use integrated pest management practices when possible to minimize use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.

## 3.13 REPAIR AND REPLACEMENT

A. General: Repair or replace existing or new trees and other plants that are damaged by construction operations, in a manner approved by Owner representative.

1. Submit details of proposed pruning and repairs.

2. Perform repairs of damaged trunks, branches, and roots within 24 hours, if approved.

3. Replace trees and other plants that cannot be repaired and restored to full-growth status, as determined by Owner representative.

B. Remove and replace trees that are more than 25 percent dead or in an unhealthy condition before the end of the corrections period or are damaged during construction operations that Owner representative determines are incapable of restoring to normal growth pattern.

1. Provide new trees of same size as those being replaced.

2. Species of Replacement Trees: Same species being replaced.

## 3.14 CLEANING AND PROTECTION

A. During planting, keep adjacent paving and construction clean and work area in an orderly condition. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off Owner's property.

C. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.

D. After installation and before Material Completion, remove nursery tags, nursery stakes, tie tape, labels, wire, burlap, and other debris from plant material, planting areas, and Project site.

E. At time of Material Completion, verify that tree-watering devices are in good working order and leave them in place. Replace improperly functioning devices.

**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. Dielectric fittings.
3. Sleeves.
4. Identification devices.
5. Grout.
6. Piping system common requirements.
7. Equipment installation common requirements.
8. Concrete bases.
9. Metal supports and anchorages.

### 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. Product Data: For the following:

1. Dielectric fittings.
2. Identification devices.

### 1.4 QUALITY ASSURANCE

A. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

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 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 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. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

E. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

2.2 DIELECTRIC FITTINGS

A. Dielectric Fittings, General: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.

B. Dielectric Unions:

1. Description: Factory fabricated, union, NPS 2 and smaller.

a. Pressure Rating: 150 psig minimum 250 psig at 180 deg F.
b. End Connections: Solder-joint copper alloy and threaded ferrous; threaded ferrous.

C. Dielectric Flanges:

1. Description: Factory-fabricated, bolted, companion-flange assembly, NPS 2-1/2 to NPS 4 and larger.

a. Pressure Rating: 250 psig.

b. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric Couplings:

1. Description: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining, NPS 3 and smaller.

a. Pressure Rating: 300 psig at 225 deg F.
b. End Connections: Threaded.

E. Dielectric Nipples:

1. Description: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining.

a. Pressure Rating: 250 psig..
b. End Connections: Threaded or grooved.

## 2.3 SLEEVES

A. Mechanical sleeve seals for pipe penetrations are specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

B. Galvanized-Steel Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

C. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized, plain ends.

D. Cast-Iron Sleeves: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

E. Molded PVC Sleeves: Permanent, with nailing flange for attaching to wooden forms.

F. PVC Pipe Sleeves: ASTM D 1785, Schedule 40.

G. Molded PE Sleeves: Reusable, PE, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

## 2.4 IDENTIFICATION DEVICES

A. Equipment Nameplates: Metal permanently fastened to equipment with data engraved or stamped.

1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and essential data.
2. Location: Accessible and visible.

B. Snap-on Plastic Pipe Markers: Manufacturer's standard preprinted, semirigid, snap-on type. Include color-coding according to ASME A13.1, unless otherwise indicated.

C. Pressure-Sensitive Pipe Markers: Manufacturer's standard preprinted, color-coded, pressure-sensitive-vinyl type with permanent adhesive.

D. Pipes with OD, Including Insulation, Less Than 6 Inches: Full-band pipe markers, extending 360 degrees around pipe at each location.

E. Pipes with OD, Including Insulation, 6 Inches and Larger: Either full-band or strip-type pipe markers, at least three times letter height and of length required for label.

F. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.

1. Arrows: Either integrally with piping system service lettering to accommodate both directions of flow, or as separate unit on each pipe marker to indicate direction of flow.

G. Plastic Tape: Manufacturer's standard color-coded, pressure-sensitive, self-adhesive vinyl tape, at least 3 mils thick.

1. Width: 1-1/2 inches on pipes with OD, including insulation, less than 6 inches; 2-1/2 inches for larger pipes.
2. Color: Comply with ASME A13.1, unless otherwise indicated.

H. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch sequenced numbers. Include 5/32-inch hole for fastener.

1. Material: Valve manufacturer's standard solid plastic.
2. Size: 1-1/2 inches in diameter, unless otherwise indicated.
3. Shape: As indicated for each piping system.

I. Valve Tag Fasteners: Brass, wire-link or beaded chain; or brass S-hooks.

J. Engraved Plastic-Laminate Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.

1. Engraving: Engraver's standard letter style, of sizes and with terms to match equipment identification.
2. Thickness: 1/16 inch, for units up to 20 sq. in. or 8 inches in length, and 1/8 inch for larger units.
3. Fasteners: Self-tapping, stainless-steel screws or contact-type permanent adhesive.

K. Plastic Equipment Markers: Manufacturer's standard laminated plastic, in the following color codes:

1. Green: Cooling equipment and components.

2. Yellow: Heating equipment and components.
3. Brown: Energy reclamation equipment and components.
4. Blue: Equipment and components that do not meet criteria above.
5. Hazardous Equipment: Use colors and designs recommended by ASME A13.1.
6. Terminology: Match schedules as closely as possible. Include the following:

    a. Name and plan number.
    b. Equipment service.
    c. Design capacity.
    d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.

7. Size: 2-1/2 by 4 inches for control devices, dampers, and valves; 4-1/2 by 6 inches for equipment.

## 2.5 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post hardening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

# PART 3 - EXECUTION

## 3.1 DIELECTRIC FITTING APPLICATIONS

A. Dry Piping Systems: Connect piping of dissimilar metals with the following:

1. NPS 2 and Smaller: Dielectric unions.
2. NPS 2-1/2 and Larger: Dielectric flanges.

B. Wet Piping Systems: Connect piping of dissimilar metals with the following:

1. NPS 2 and Smaller: Dielectric couplings or dielectric nipples.
2. NPS 2-1/2 and Larger: Dielectric nipples.

## 3.2 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. Sleeves are not required for core-drilled holes.

J. Permanent sleeves are not required for holes formed by removable PE sleeves.

K. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of equipment areas or other wet areas 2 inches above finished floor level.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.

a. PVC Pipe Sleeves: For pipes smaller than NPS 6.
b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.

L. Verify final equipment locations for roughing-in.

M. Refer to equipment specifications in other Sections for roughing-in requirements.

## 3.3 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. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

E. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

F. Pressure-Sealed Joints: Assemble joints for plain-end copper tube and mechanical pressure seal fitting with proprietary crimping tool to according to fitting manufacturer's written instructions.

G. 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. 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.

H. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

I. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

J. Plastic Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain-End PE Pipe and Fittings: Use butt fusion.
2. Plain-End PE Pipe and Socket Fittings: Use socket fusion.

K. Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

## 3.4 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Install dielectric fittings at connections of dissimilar metal pipes.

## 3.5 EQUIPMENT INSTALLATION

A. Install equipment level and plumb, unless otherwise indicated.

B. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference with other installations. Extend grease fittings to an accessible location.

C. Install equipment to allow right of way to piping systems installed at required slope.

## 3.6 IDENTIFICATION

A. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.

1. Plastic markers, with application systems. Install on insulation segment if required for hot noninsulated piping.
2. Locate pipe markers on exposed piping according to the following:

a. Near each valve and control device.
b. Near each branch, excluding short takeoffs for equipment and terminal units. Mark each pipe at branch if flow pattern is not obvious.
c. Near locations where pipes pass through walls or floors or enter inaccessible enclosures.
d. At manholes and similar access points that permit view of concealed piping.
e. Near major equipment items and other points of origination and termination.

B. Equipment: Install engraved plastic-laminate sign or equipment marker on or near each major item of equipment.

1. Lettering Size: Minimum 1/4 inch high for name of unit if viewing distance is less than 24 inches, 1/2 inch high for distances up to 72 inches, and proportionately larger lettering for greater distances. Provide secondary lettering two-thirds to three-fourths of size of principal lettering.
2. Text of Signs: Provide name of identified unit. Include text to distinguish among multiple units, inform user of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

C. Adjusting: Relocate identifying devices that become visually blocked by work of this or other Divisions.

## 3.7 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in GDOT standards for cast-in-place concrete.

## 3.8 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Section 055000 "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor piped utility materials and equipment.

## 3.9 GROUTING

A. Mix and install grout for equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

END OF SECTION 330500

# SECTION 334100 - STORM UTILITY DRAINAGE PIPING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Pipe and fittings.
2. Manholes.
3. Nonpressure transition couplings.
4. Catch basins.
5. Stormwater inlets.
6. Pipe outlets.

### 1.2 ACTION SUBMITTALS

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

B. Shop Drawings:

1. Manholes: Include plans, elevations, sections, details, frames, and covers.
2. Catch basins and Stormwater inlets. Include plans, elevations, sections, details, frames, covers, and grates.

### 1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from storm drainage system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.

B. Profile Drawings: Show system piping in elevation. Draw profiles at horizontal scale of not less than 1 inch equals 50 feet and vertical scale of not less than 1 inch equals 5 feet. Indicate manholes and piping. Show types, sizes, materials, and elevations of other utilities crossing system piping.

C. Field quality-control reports.

### 1.4 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 no fewer than seven 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 NPS 3 to NPS 10: AASHTO M 252M, Type S, with smooth waterway for coupling joints.

1. Silttight Couplings: PE sleeve with ASTM D 1056, Type 2, Class A, Grade 2 gasket material that mates with tube and fittings.
2. Soiltight Couplings: AASHTO M 252M, corrugated, matching tube and fittings.

B. Corrugated PE Pipe and Fittings NPS 12 to NPS 60: AASHTO M 294M, Type S, with smooth waterway for coupling joints.
1. Connections shall use a rubber gasket in accordance with ASTM F-477.

### 2.2 PVC PIPE AND FITTINGS

A. PVC Corrugated Sewer Piping:

1. Pipe: ASTM F 949, PVC, corrugated pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: ASTM F 949, PVC molded or fabricated, socket type.
3. Gaskets: ASTM F 477, elastomeric seals.

### 2.3 CONCRETE PIPE AND FITTINGS

A. Reinforced-Concrete Sewer Pipe and Fittings: ASTM C 76.

1. Bell-and-spigot or tongue-and-groove ends and gasketed joints with ASTM C 443, rubber gaskets
2. Class: Class of pipe and wall thickness shall be in accordance with 1030-D, Georgia DOT specifications, Table no. 1.

### 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 Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.

C. Unshielded, Flexible Couplings:

1. Description: Elastomeric sleeve with corrosion-resistant-metal tension band and tightening mechanism on each end.

D. Ring-Type, Flexible Couplings:

1. Description: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

## 2.5 CLEANOUTS

A. Cast-Iron Cleanouts:

1. Description: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
2. Top-Loading Classification(s): Heavy Duty.
3. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

B. Plastic Cleanouts:

1. Description: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

## 2.6 MANHOLES

A. Standard Precast Concrete Manholes:

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. Base Section: 6-inch minimum thickness for floor slab and 6-inch minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
5. Riser Sections: 6-inch minimum thickness, and lengths to provide depth indicated.
6. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated, and top of cone of size that matches grade rings.
7. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
8. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
9. Steps: Individual FRP steps; FRP ladder; or ASTM A 615/A 615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or

anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 36 inches.

10. 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.

B. Manhole Frames and Covers:

1. Description: Ferrous; 24-inch ID by 7- to 9-inch riser with 4-inch- minimum width flange and 26-inch- diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."
2. Material: ASTM A 48/A 48M, Class 35 gray iron unless otherwise indicated.

## 2.7 CONCRETE

A. General: Cast-in-place concrete according to ACI 318, ACI 350/350R, and the following:

1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.

C. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.

1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.

   a. Invert Slope: 2 percent through manhole.

2. Benches: Concrete, sloped to drain into channel.

   a. Slope: 8 percent.

## 2.8 CATCH BASINS

A. Standard Precast Concrete Catch Basins:

1. Description: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. Base Section: 6-inch minimum thickness for floor slab and 6-inch minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
3. Riser Sections: 6-inch minimum thickness, 48-inch diameter, and lengths to provide depth indicated.
4. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
5. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
6. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and shape matching catch basin frame and grate. Include sealant recommended by ring manufacturer.
7. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch total thickness, that match 24-inch- diameter frame and grate.
8. Steps:Individual FRP steps; FRP ladder; or ASTM A 615/A 615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101, PP , wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of catch basin to finished grade is less than 36 inches.
9. Pipe Connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section.

B. Frames and Grates for rectangular structures: ASTM A 536, Grade 60-40-18, ductile iron designed for A-16, structural loading. Include flat grate with small square or short-slotted drainage openings.

1. Size: 24 by 24 inches minimum unless otherwise indicated.
2. Grate Free Area: Approximately 50 percent unless otherwise indicated.

C. Frames and Grates for round structures: ASTM A 536, Grade 60-40-18, ductile iron designed for A-16, structural loading. Include 24-inch ID by 7- to 9-inch riser with 4-inch minimum width flange, and 26-inch- diameter flat grate with small square or short-slotted drainage openings.

1. Grate Free Area: Approximately 50 percent unless otherwise indicated.

## 2.9 STORMWATER INLETS

A. Curb Inlets: Made with vertical curb opening, of materials and dimensions according to City of Johns Creek or Fulton County standards.

B. Combination Inlets: Made with vertical curb and horizontal gutter openings, of materials and dimensions according to City of Johns Creek or Fulton County standards. Include heavy-duty frames and grates.

C. Frames and Grates: Heavy duty, according to City of Johns Creek or Fulton County standards.

2.10 PIPE OUTLETS

A. Head Walls: Cast-in-place reinforced concrete, with apron and tapered sides.

B. Riprap Basins: Broken, irregularly sized and shaped, graded stone according to NSSGA's "Quarried Stone for Erosion and Sediment Control."

1. Average Size: NSSGA No. R-3, screen opening 2 inches.
2. Average Size: NSSGA No. R-4, screen opening 3 inches.
3. Average Size: NSSGA No. R-5, screen opening 5 inches.

C. Filter Stone: According to NSSGA's "Quarried Stone for Erosion and Sediment Control," No. FS-2, No. 4 screen opening, average-size graded stone.

D. Energy Dissipaters: According to NSSGA's "Quarried Stone for Erosion and Sediment Control," No. A-1, 3-ton average weight armor stone, unless otherwise indicated.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavating, trenching, and backfilling as specified in GDOT standards for grading complete.

3.2 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 manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.

F. Install gravity-flow, nonpressure drainage piping according to the following:

1. Install piping pitched down in direction of flow.

2. Install piping NPS 6 and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place concrete supports or anchors.
3. Install piping with 24-inch minimum cover.
4. Install PE corrugated sewer piping according to ASTM D 2321.
5. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.
6. Install reinforced-concrete sewer piping according to section 550 of the Georgia DOT standard specifications.

## 3.3 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure drainage piping according to the following:

1. Join corrugated PE piping according to ASTM D 3212 for push-on joints.
2. Join PVC corrugated sewer piping according to ASTM D 2321 for elastomeric-seal joints.
3. Join reinforced-concrete sewer piping according to ACPA's "Concrete Pipe Installation Manual" for rubber-gasketed joints.

## 3.4 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

1. Use Light-Duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.
2. Use Medium-Duty, top-loading classification cleanouts in paved foot-traffic areas.
3. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.

B. Set cleanout frames and covers in earth in cast-in-place concrete block, 18 by 18 by 12 inches deep. Set with tops 1 inch above surrounding earth grade or flush with surrounding pavement..

C. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

## 3.5 MANHOLE INSTALLATION

A. General: Install manholes, complete with appurtenances and accessories indicated.

B. Install precast concrete manhole sections with sealants according to ASTM C 891.

C. Where specific manhole construction is not indicated, follow manhole manufacturer's written instructions.

D. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 6 inches (76 mm) above finished surface elsewhere unless otherwise indicated.

## 3.6 CATCH BASIN INSTALLATION

A. Set frames and grates to elevations indicated.

## 3.7 STORMWATER INLET AND OUTLET INSTALLATION

A. Construct inlet head walls, aprons, and sides of reinforced concrete, as indicated.

B. Construct riprap of broken stone, as indicated.

C. Install outlets that spill onto grade, anchored with concrete, where indicated.

D. Install outlets that spill onto grade, with flared end sections that match pipe, where indicated.

E. Construct energy dissipaters at outlets, as indicated.

## 3.8 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318.

## 3.9 CONNECTIONS

A. Connect nonpressure, gravity-flow drainage piping in building's storm building drains as indicated in drawings.

B. Make connections to existing piping and underground manholes.

1. Make branch connections to underground manholes and structures by cutting into existing unit and creating an opening large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of manhole, or structure wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.

    a. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.
    b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.

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. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping unless otherwise indicated.

    a. Unshielded flexible couplings for same or minor difference OD pipes.
    b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
    c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

## 3.10 IDENTIFICATION

A. Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.

1. Use warning tape over ferrous piping.
2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

## 3.11 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.

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. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems according to requirements of authorities having jurisdiction.
3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
4. Submit separate report for each test.

5. Gravity-Flow Storm Drainage Piping: Test according to requirements of authorities having jurisdiction, UNI-B-6, and the following:

    a. Exception: Piping with soil tight joints unless required by authorities having jurisdiction.
    b. Option: Test plastic piping according to ASTM F 1417.
    c. Option: Test concrete piping according to ASTM C 924.

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.

END OF SECTION 334100

# SECTION 334600 - SUBDRAINAGE

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Perforated-wall pipe and fittings.
2. Geotextile filter fabrics.
3. Impermeable membranes

### 1.2 ACTION SUBMITTALS

A. Product Data: For geotextile filter fabrics.

## PART 2 - PRODUCTS

### 2.1 PERFORATED-WALL PIPES AND FITTINGS

A. Perforated PE Pipe and Fittings:

1. NPS 6 (DN 150) and Smaller: ASTM F405 or AASHTO M 252, Type CP; corrugated, for coupled joints.
2. NPS 8 (DN 200) and Larger: ASTM F667; AASHTO M 252, Type CP; or AASHTO M 294, Type CP; corrugated; for coupled joints.
3. Couplings: Manufacturer's standard, band type.

B. Perforated PVC Sewer Pipe and Fittings: ASTM D2729, bell-and-spigot ends, for loose joints.

### 2.2 DRAINAGE CONDUITS

A. Molded-Sheet Drainage Conduits: Prefabricated geocomposite with cuspated, molded-plastic drainage core wrapped in geotextile filter fabric.

1. Manufacturers: American Wick Drain, TenCate (Mirafi), or equivalent.
2. Nominal Size: 12 inches (305 mm) high by approximately 1 inch (25 mm) thick.

   a. Minimum In-Plane Flow: **30 gpm (114 L/min.)** at hydraulic gradient of **1.0** when tested according to ASTM D4716.

3. Nominal Size: 18 inches (457 mm) high by approximately 1 inch (25 mm) thick.

a. Minimum In-Plane Flow: **45 gpm (170 L/min.)** at hydraulic gradient of **1.0** when tested according to ASTM D4716.

4. Filter Fabric: PP geotextile.
5. Fittings: HDPE with combination NPS 4 and NPS 6 (DN 100 and DN 150) outlet connection.

2.3 GEOTEXTILE FILTER FABRICS

A. Description: Fabric of PP or polyester fibers or combination of both, with flow rate range from 110 to 330 gpm/sq. ft. when tested according to ASTM D 4491.

B. Structure Type: Nonwoven, needle-punched continuous filament.

1. Survivability: AASHTO M 288 Class 2
2. Styles: Flat and sock.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavating, trenching, and backfilling as specified in GDOT standards for grading complete.

3.2 FOUNDATION DRAINAGE INSTALLATION

A. Place impervious fill material on subgrade adjacent to bottom of footing after concrete footing forms have been removed. Place and compact impervious fill to dimensions indicated, but not less than 6 inches deep and 12 inches wide.

B. Lay flat-style geotextile filter fabric in trench and overlap trench sides.

C. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than 4 inches.

D. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with tape.

E. Install drainage piping as indicated in Part 3 "Piping Installation" Article for foundation subdrainage.

F. Add drainage course to width of at least 6 inches on side away from wall and to top of pipe to perform tests.

G. After satisfactory testing, cover drainage piping to width of at least 6 inches on side away from footing and above top of pipe to within 12 inches of finish grade.

H. Install drainage course and wrap top of drainage course with flat-style geotextile filter fabric.

I. Place layer of flat-style geotextile filter fabric over top of drainage course, overlapping edges at least 4 inches.

J. Place backfill material over compacted drainage course. Place material in loose-depth layers not exceeding 6 inches. Thoroughly compact each layer. Final backfill to finish elevations and slope away from building.

## 3.3 UNDERSLAB DRAINAGE INSTALLATION

A. Excavate for underslab drainage system after subgrade material has been compacted but before drainage course has been placed. Include horizontal distance of at least 6 inches (150 mm) between drainage pipe and trench walls. Grade bottom of trench excavations to required slope, and compact to firm, solid bed for drainage system.

B. Lay flat-style geotextile filter fabric in trench and overlap trench sides.

C. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than 4 inches.

D. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with tape.

E. Install drainage piping as indicated in Part 3 "Piping Installation" Article for underslab subdrainage.

F. Add drainage course to width of at least 6 inches on side away from wall and to top of pipe to perform tests.

G. After satisfactory testing, cover drainage piping with drainage course to elevation of bottom of slab, and compact and wrap top of drainage course with flat-style geotextile filter fabric.

## 3.4 LANDSCAPING DRAINAGE INSTALLATION

A. Provide trench width to allow installation of drainage conduit. Grade bottom of trench excavations to required slope, and compact to firm, solid bed for drainage system.

B. Lay flat-style geotextile filter fabric in trench and overlap trench sides.

C. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than 4 inches (100 mm), as indicated on drawings.

D. Install drainage conduits as indicated in Part 3 "Piping Installation" Article for landscaping subdrainage with horizontal distance of at least 6 inches (150 mm) between conduit and trench walls. Wrap drainage conduits without integral geotextile filter fabric with flat-style geotextile filter fabric before installation. Connect fabric sections with adhesive or tape.

E. Add drainage course to top of drainage conduits.

F. After satisfactory testing, cover drainage conduit to within 12 inches (300 mm) of finish grade.

G. Install drainage course and wrap top of drainage course with flat-style geotextile filter fabric.

H. Place layer of flat-style geotextile filter fabric over top of drainage course, overlapping edges at least 4 inches (100 mm).

I. Fill to Grade: Place satisfactory soil fill material over drainage course. Place material in loose-depth layers not exceeding 6 inches (150 mm). Thoroughly compact each layer. Fill to finish grade.

## 3.5 PIPING INSTALLATION

A. Install piping beginning at low points of system, true to grades and alignment indicated, with unbroken continuity of invert. Bed piping with full bearing in filtering material. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions and other requirements indicated.

1. Foundation Subdrainage: Install piping level and with a minimum cover of 36 inches unless otherwise indicated.
2. Underslab Subdrainage: Install piping level.
3. Retaining-Wall Subdrainage: When water discharges at end of wall into stormwater piping system, install piping level and with a minimum cover of 36 inches unless otherwise indicated.
4. Landscaping Subdrainage: Install piping pitched down in direction of flow, at a minimum slope of **0.5** percent and with a minimum cover of 24 inches unless otherwise indicated on the drawings.
5. Lay perforated pipe with perforations down.
6. Excavate recesses in trench bottom for bell ends of pipe. Lay pipe with bells facing upslope and with spigot end entered fully into adjacent bell.

B. Use increasers, reducers, and couplings made for different sizes or materials of pipes and fittings being connected. Reduction of pipe size in direction of flow is prohibited.

C. Install thermoplastic piping according to ASTM D 2321.

## 3.6 PIPE JOINT CONSTRUCTION

A. Join perforated PE pipe and fittings with couplings according to ASTM D 3212 with loose banded, coupled, or push-on joints.

B. Special Pipe Couplings: Join piping made of different materials and dimensions with special couplings made for this application. Use couplings that are compatible with and fit materials and dimensions of both pipes.

## 3.7 CLEANOUT INSTALLATION

A. Comply with requirements for cleanouts specified in Section 334100 "Storm Utility Drainage Piping."

B. Cleanouts for Foundation, Retaining-Wall and Landscape Subdrainage:

1. Install cleanouts from piping to grade. Locate cleanouts at beginning of piping run and at changes in direction. Install fittings so cleanouts open in direction of flow in piping.
2. In vehicular-traffic areas, use NPS 4 cast-iron soil pipe and fittings for piping branch fittings and riser extensions to cleanout. Set cleanout frames and covers in a cast-in-place concrete anchor, 18 by 18 by 12 inches deep. Set top of cleanout flush with grade.
3. In nonvehicular-traffic areas, use NPS 4 cast-iron pipe and fittings for piping branch fittings and riser extensions to cleanout. Set cleanout frames and covers in a cast-in-place concrete anchor, 12 by 12 by 6 inches deep. Set top of cleanout 1 inch above grade.
4. Comply with requirements for concrete as specified in GDOT standards for cast-in-place concrete.

C. Cleanouts for Underslab Subdrainage:

1. Install cleanouts and riser extensions from piping to top of slab. Locate cleanouts at beginning of piping run and at changes in direction. Install fittings so cleanouts open in direction of flow in piping.
2. Use NPS 4 cast-iron soil pipe and fittings for piping branch fittings and riser extensions to cleanout flush with top of slab.

## 3.8 CONNECTIONS

A. Comply with requirements for piping specified in Section 334100 "Storm Utility Drainage Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect low elevations of subdrainage system to solid-wall-piping storm drainage system.

## 3.9 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. After installing drainage course to top of piping, test drain piping with water to ensure free flow before backfilling.
2. Remove obstructions, replace damaged components, and repeat test until results are satisfactory.

B. Drain piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

## 3.10 CLEANING

A. Clear interior of installed piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed. Place plugs in ends of uncompleted pipe at end of each day or when work stops.

END OF SECTION 334600