



Priority Projects

Design Development Specifications

Strawberry Park Elementary Addition and Renovations

TAB Associates, Inc.
Architect's Project 1935.02

February 20, 2020



TAB Associates, Inc.

TAB Associates, Inc.

Steamboat Springs School District
Strawberry Park Elementary – Addition/Renovations

1935.02

SECTION 000101 - PROJECT TITLE PAGE

PROJECT MANUAL

FOR

SSSD - STRAWBERRY PARK ELEMENTARY

STEAMBOAT SPRINGS SCHOOL DISTRICT

39620 AMETHYST ST

STEAMBOAT SPRINGS , COLORADO 80487

DATE: (DESIGN DEVELOPMENT- 02/20/20)

PREPARED BY: GREG MACIK

TAB ASSOCIATES, INC.

END OF SECTION

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SECTION 000102 - PROJECT INFORMATION

PART 1 GENERAL

1.1 PROJECT IDENTIFICATION

- A. Project Name: Strawberry Park Elementary - Renovations and Addition.
- B. Project Name: SSSD - Strawberry Park Elementary, located at:
 - C. Owner's Project Number: 1935.02.
 - 39620 Amethyst St.
 - Steamboat Springs, Colorado 80487.
- D. The Owner, hereinafter referred to as Owner: Steamboat Springs School District
- E. Owner's Project Manager: Dynamic Program Management

1.2 PROJECT DESCRIPTION

- A. Summary Project Description: Interior Renovations and Addition.

1.3 PROJECT CONSULTANTS

- A. The Architect, hereinafter referred to as Architect: TAB Associates, Inc..
 - 1. Address: 56 Edwards Village Blvd, Suite 210.
 - 2. City, State, Zip: Edwards, CO 81632.
 - 3. Phone/Fax: 970-766-1470.

1.4 PROCUREMENT TIMETABLE

- A. The Owner reserves the right to change the schedule or terminate the entire procurement process at any time.

1.5 PROCUREMENT DOCUMENTS

- A. Availability of Documents: Complete sets of procurement documents may be obtained:
 - 1. From Owner at the Project Manager's address listed above.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 000103 - PROJECT DIRECTORY

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Identification of project team members and their contact information.

1.2 OWNER:

- A. Name: Steamboat Springs School District.
 - 1. Address Line 1: 39610 Amethyst Dr.
 - 2. City: Steamboat Springs.
 - 3. State: Colorado.
 - 4. Zip Code: 80487.
 - 5. Telephone: (970) 879-7550.
- B. Primary Contact: All correspondence from the Contractor to the Architect will be through this party, unless alternate arrangements are mutually agreed upon at preconstruction meeting.
 - 1. Title: Mark Rydberg.

1.3 CONSULTANTS:

- A. Architect: Design Professional of Record. All correspondence from the Contractor regarding construction documents authored by Architect's consultants will be through this party, unless alternate arrangements are mutually agreed upon at preconstruction meeting.
 - 1. Company Name: TAB Associates, Inc.
 - a. Address Line 1: 56 Edwards Village Blvd.
 - b. Address Line 2: Suite 210.
 - c. City: Edwards.
 - d. State: Colorado.

- e. Zip Code: 81632.
- f. Telephone: 970-766-1470.
- 2. Primary Contact: .
 - a. Title: Greg Macik.
- B. Civil Engineering Consultant:
 - 1. Company Name: Alpine Engineering.
 - a. Address Line 1: 34510 Highway 6.
 - b. City: Edwards.
 - c. State: Colorado.
 - d. Zip Code: 81632.
 - e. Telephone: 970-446-6844.
- C. Landscape Architecture Consultant:
 - 1. Company Name: DHM Design.
 - a. Address Line 1: 900 South Broadway.
 - b. Address Line 2: Suite 300.
 - c. City: Denver.
 - d. State: Colorado.
 - e. Zip Code: 80209.
 - f. Telephone: 303-892-5566.
- D. Structural Engineering Consultant:
 - 1. Company Name: Jirsa/Hedrick.
 - a. Address Line 1: 8490 E. Crescent Parkway.
 - b. Address Line 2: Suite 250.

- c. City: Greenwood Village.
- d. State: Colorado.
- e. Zip Code: 80111.
- f. Telephone: 303-318-6539.

E. Mechanical Engineering Consultant - Mechanical, Electrical, Plumbing and Technology:

- 1. Company Name: BG Works.
 - a. Address Line 1: P.O. Box 9650.
 - b. City: Avon.
 - c. State: Colorado.
 - d. Zip Code: 81620.
 - e. Telephone: 970-949-6108.

F. Acoustical Consultant or Acoustician:

- 1. Company Name: Wave Engineering.
 - a. Address Line 1: 1100 W. Littleton Blvd.
 - b. City: Littleton.
 - c. State: Colorado.
 - d. Zip Code: 80120.
 - e. Telephone: 720-446-9283.

G. Kitchen Consultant:

- 1. Company Name: Kitchen Tech.
 - a. Telephone: 303-835-2018.

1.4 CONSTRUCTION MANAGER:

- A. Company Name: Dynamic Program Management.

1. Telephone: 970-986-2274.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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END OF SECTION

SECTION 011000 - SUMMARY

PART 1 GENERAL

1.1 PROJECT

- A. Project Name: SSSD - Strawberry Park Elementary
- B. Owner's Name: Steamboat Springs School District.
- C. Architect's Name: TAB Associates, Inc..
- D. Additional Project contact information is specified in Section 000103 - Project Directory.
- E. The Project consists of the construction of Interior Renovations and an Addition.

1.2 CONTRACT DESCRIPTION

1.3 DESCRIPTION OF ALTERATIONS WORK

- A. Scope of demolition and removal work is indicated on drawings and specified in Section 024100.

1.4 OWNER OCCUPANCY

- A. Owner intends to continue to occupy adjacent portions of the existing building during the entire construction period.
- B. Owner intends to occupy the Project upon Substantial Completion.
- C. Owner intends to occupy a certain portion of the Project prior to the completion date for the conduct of normal operations.
- D. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.
- E. Schedule the Work to accommodate Owner occupancy.

1.5 CONTRACTOR USE OF SITE AND PREMISES

- A. Provide access to and from site as required by law and by Owner:
 - 1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.

2. Do not obstruct roadways, sidewalks, or other public ways without permit.
- B. Existing building spaces may not be used for storage.
- C. Utility Outages and Shutdown:
 1. Do not disrupt or shut down life safety systems, including but not limited to fire sprinklers and fire alarm system, without 7 days notice to Owner and authorities having jurisdiction.
 2. Prevent accidental disruption of utility services to other facilities.

1.6 WORK SEQUENCE

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 012500 - SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Procedural requirements for proposed substitutions.

1.2 DEFINITIONS

- A. Substitutions: Changes from Contract Documents requirements proposed by Contractor to materials, products, assemblies and equipment.
 - 1. Substitutions for Cause: Proposed due to changed Project circumstances beyond Contractor's control.
 - a. Unavailability.
 - b. Regulatory changes.
 - 2. Substitutions for Convenience: Proposed due to possibility of offering substantial advantage to the Project.

1.3 REFERENCE STANDARDS

- A. CSI/CSC Form 13.1A - Substitution Request (After the Bidding/Negotiating Phase) Current Edition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

- A. A Substitution Request for products, assemblies, materials and equipment constitutes a representation that the submitter:
 - 1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.
 - 2. Agrees to provide the same warranty for the substitution as for the specified product.

3. Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.
 4. Waives claims for additional costs or time extension that may subsequently become apparent.
- B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.
- C. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.
1. No specific form is required. Contractor's Substitution Request documentation must include the following:
 - a. Project Information:
 - 1) Official project name and number, and any additional required identifiers established in Contract Documents.
 - 2) Owner's, Architect's, and Contractor's names.
 - b. Substitution Request Information:
 - 1) Discrete and consecutive Substitution Request number, and descriptive subject/title.
 - 2) Indication of whether the substitution is for cause or convenience.
 - 3) Issue date.
 - 4) Reference to particular Contract Document(s) specification section number, title, and article/paragraph(s).
 - 5) Description of Substitution.
 - 6) Reason why the specified item cannot be provided.
 - 7) Differences between proposed substitution and specified item.
 - 8) Description of how proposed substitution affects other parts of work.
 - c. Attached Comparative Data: Provide point-by-point, side-by-side comparison addressing essential attributes specified, as appropriate and relevant for the item:
 - 1) Physical characteristics.
 - 2) In-service performance.
 - 3) Expected durability.

- 4) Visual effect.
 - 5) Sustainable design features.
 - 6) Warranties.
 - 7) Other salient features and requirements.
 - 8) Include, as appropriate or requested, the following types of documentation:
 - (a) Product Data:
 - (b) Samples.
 - (c) Drawings, when required to show impact on adjacent construction elements.
- d. Impact of Substitution:
- 1) Savings to Owner for accepting substitution.
 - 2) Change to Contract Time due to accepting substitution.
- D. Limit each request to a single proposed substitution item.
1. Submit an electronic document, combining the request form with supporting data into single document.

3.2 SUBSTITUTION PROCEDURES DURING PROCUREMENT

- A. Instructions to Bidders specifies time restrictions for submitting requests for substitutions during the bidding period, and the documents required.

3.3 SUBSTITUTION PROCEDURES DURING CONSTRUCTION

- A. Submittal Form (after award of contract):
1. Submit substitution requests by completing CSI/CSC Form 13.1A - Substitution Request. See this form for additional information and instructions. Use only this form; other forms of submission are unacceptable.
- B. Architect will consider requests for substitutions only within 15 days after date of Agreement.
- C. Submit request for Substitution for Cause within 14 days of discovery of need for substitution, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.

- D. Submit request for Substitution for Convenience immediately upon discovery of its potential advantage to the project, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.
1. In addition to meeting general documentation requirements, document how the requested substitution benefits the Owner through cost savings, time savings, greater energy conservation, or in other specific ways.
 2. Document means of coordinating of substitution item with other portions of the work, including work by affected subcontractors.
 3. Bear the costs engendered by proposed substitution of:
 - a. Owner's compensation to the Architect for any required redesign, time spent processing and evaluating the request.
- E. Substitutions will not be considered under one or more of the following circumstances:
1. When they are indicated or implied on shop drawing or product data submittals, without having received prior approval.
 2. Without a separate written request.
 3. When acceptance will require revisions to Contract Documents.

3.4 RESOLUTION

- A. Architect may request additional information and documentation prior to rendering a decision. Provide this data in an expeditious manner.
- B. Architect will notify Contractor in writing of decision to accept or reject request.

3.5 ACCEPTANCE

- A. Accepted substitutions change the work of the Project. They will be documented and incorporated into work of the project by Change Order, Construction Change Directive, Architectural Supplementary Instructions, or similar instruments provided for in the Conditions of the Contract.

3.6 CLOSEOUT ACTIVITIES

- A. See Section 017800 - Closeout Submittals, for closeout submittals.

- B. Include completed Substitution Request Forms as part of the Project record. Include both approved and rejected Requests.

END OF SECTION

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SECTION 013000 - ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. General administrative requirements.
- B. Electronic document submittal service.
- C. Progress meetings.
- D. Contractor's daily reports.
- E. Progress photographs.
- F. Submittals for review, information and project closeout.
- G. Number of copies of submittals.
- H. Requests for Interpretation (RFI) procedures.
- I. Submittal procedures.

1.2 REFERENCE STANDARDS

- A. AIA G716 - Request for Information 2004.
- B. AIA G810 - Transmittal Letter 2001.
- C. CSI/CSC Form 12.1A - Submittal Transmittal Current Edition.
- D. CSI/CSC Form 13.2A - Request for Interpretation Current Edition.

1.3 GENERAL ADMINISTRATIVE REQUIREMENTS

- A. Comply with requirements of Section 017000 - Execution and Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.
- B. Make the following types of submittals to Architect:
 - 1. Requests for Interpretation (RFI).

2. Requests for substitution.
3. Shop drawings, product data, and samples.
4. Test and inspection reports.
5. Design data.
6. Manufacturer's instructions and field reports.
7. Applications for payment and change order requests.
8. Progress schedules.
9. Coordination drawings.
10. Correction Punch List and Final Correction Punch List for Substantial Completion.
11. Closeout submittals.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 ELECTRONIC DOCUMENT SUBMITTAL SERVICE

- A. All documents transmitted for purposes of administration of the contract are to be in electronic (PDF, MS Word or MS Excel) format, as appropriate to the document, and transmitted via an Internet-based submittal service that receives, logs and stores documents, provides electronic stamping and signatures, and notifies addressees via email.
 1. Besides submittals for review, information, and closeout, this procedure applies to Requests for Interpretation (RFIs), progress documentation, contract modification documents (e.g. supplementary instructions, change proposals, change orders), applications for payment, field reports and meeting minutes, Contractor's correction punchlist, and any other document any participant wishes to make part of the project record.
 2. Contractor and Architect are required to use this service.
 3. It is Contractor's responsibility to submit documents in allowable format.

4. Subcontractors, suppliers, and Architect's consultants will be permitted to use the service at no extra charge.
5. Users of the service need an email address, internet access, and PDF review software that includes ability to mark up and apply electronic stamps (such as Adobe Acrobat, www.adobe.com, or Bluebeam PDF Revu, www.bluebeam.com), unless such software capability is provided by the service provider.
6. Paper document transmittals will not be reviewed; emailed electronic documents will not be reviewed.
7. All other specified submittal and document transmission procedures apply, except that electronic document requirements do not apply to samples or color selection charts.

3.2 PROGRESS MEETINGS

- A. Schedule and administer meetings throughout progress of the work at maximum weekly intervals.
- B. Attendance Required:
 1. Contractor.
 2. Owner.
 3. Architect.
 4. Contractor's superintendent.
- C. Agenda:
 1. Review minutes of previous meetings.
 2. Review of work progress.
 3. Field observations, problems, and decisions.
 4. Identification of problems that impede, or will impede, planned progress.
 5. Review of submittals schedule and status of submittals.
 6. Review of RFIs log and status of responses.
 7. Review of off-site fabrication and delivery schedules.

8. Maintenance of progress schedule.
 9. Corrective measures to regain projected schedules.
 10. Planned progress during succeeding work period.
 11. Coordination of projected progress.
 12. Maintenance of quality and work standards.
 13. Effect of proposed changes on progress schedule and coordination.
 14. Other business relating to work.
- D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.3 DAILY CONSTRUCTION REPORTS

- A. Include only factual information. Do not include personal remarks or opinions regarding operations and/or personnel.
- B. Prepare a daily construction report recording the following information concerning events at Project site and project progress:
1. Date.
 2. High and low temperatures, and general weather conditions.
 3. List of subcontractors at Project site.
 4. Safety, environmental, or industrial relations incidents.
 5. Meetings and significant decisions.
 6. Stoppages, delays, shortages, and losses. Include comparison between scheduled work activities (in Contractor's most recently updated and published schedule) and actual activities. Explain differences, if any. Note days or periods when no work was in progress and explain the reasons why.
 7. Testing and/or inspections performed.
 8. Signature of Contractor's authorized representative.

3.4 PROGRESS PHOTOGRAPHS

- A. Submit new photographs at least once a month, within 3 days after being taken.
- B. Photography Type: Digital; electronic files.
- C. Provide photographs of site and construction throughout progress of work produced by an experienced photographer, acceptable to Architect.
- D. Views:
 - 1. Provide non-aerial photographs from four cardinal views at each specified time, until date of Substantial Completion.
 - 2. Consult with Architect for instructions on views required.
 - 3. Provide factual presentation.
 - 4. Provide correct exposure and focus, high resolution and sharpness, maximum depth of field, and minimum distortion.
- E. Digital Photographs: 24 bit color, minimum resolution of 1024 by 768, in JPG format; provide files unaltered by photo editing software.
 - 1. Delivery Medium: Via email.
 - 2. File Naming: Include project identification, date and time of view, and view identification.
 - 3. PDF File: Assemble all photos into printable pages in PDF format, with 2 to 3 photos per page, each photo labeled with file name; one PDF file per submittal.

3.5 REQUESTS FOR INTERPRETATION (RFI)

- A. Definition: A request seeking one of the following:
 - 1. An interpretation, amplification, or clarification of some requirement of Contract Documents arising from inability to determine from them the exact material, process, or system to be installed; or when the elements of construction are required to occupy the same space (interference); or when an item of work is described differently at more than one place in Contract Documents.
 - 2. A resolution to an issue which has arisen due to field conditions and affects design intent.

- B. Whenever possible, request clarifications at the next appropriate project progress meeting, with response entered into meeting minutes, rendering unnecessary the issuance of a formal RFI.
- C. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.
 - 1. Prepare a separate RFI for each specific item.
 - a. Review, coordinate, and comment on requests originating with subcontractors and/or materials suppliers.
 - b. Do not forward requests which solely require internal coordination between subcontractors.
 - 2. Prepare in a format and with content acceptable to Owner.
 - 3. Prepare using software provided by the Electronic Document Submittal Service.
 - 4. Combine RFI and its attachments into a single electronic file. PDF format is preferred.
- D. Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is definitely not included.
 - 1. Improper RFIs: Requests not prepared in compliance with requirements of this section, and/or missing key information required to render an actionable response. They will be returned without a response, with an explanatory notation.
 - 2. Frivolous RFIs: Requests regarding information that is clearly indicated on, or reasonably inferable from, Contract Documents, with no additional input required to clarify the question. They will be returned without a response, with an explanatory notation.
- E. Attachments: Include sketches, coordination drawings, descriptions, photos, submittals, and other information necessary to substantiate the reason for the request.
- F. RFI Log: Prepare and maintain a tabular log of RFIs for the duration of the project.
 - 1. Highlight items requiring priority or expedited response.
 - 2. Highlight items for which a timely response has not been received to date.

- G. Review Time: Architect will respond and return RFIs to Contractor within seven calendar days of receipt. For the purpose of establishing the start of the mandated response period, RFIs received after 12:00 noon will be considered as having been received on the following regular working day.

3.6 SUBMITTAL SCHEDULE

- A. Submit to Architect for review a schedule for submittals in tabular format.
1. Coordinate with Contractor's construction schedule and schedule of values.
 2. Format schedule to allow tracking of status of submittals throughout duration of construction.
 3. Arrange information to include scheduled date for initial submittal, specification number and title, submittal category (for review or for information), description of item of work covered and role and name of subcontractor.
 4. Account for time required for preparation, review, manufacturing, fabrication and delivery when establishing submittal delivery and review deadline dates.
 - a. For assemblies, equipment, systems comprised of multiple components and/or requiring detailed coordination with other work, allow for additional time to make corrections or revisions to initial submittals, and time for their review.

3.7 SUBMITTALS FOR REVIEW

- A. When the following are specified in individual sections, submit them for review:
1. Product data.
 2. Shop drawings.
 3. Samples for selection.
 4. Samples for verification.
- B. Submit to Architect for review for the limited purpose of checking for compliance with information given and the design concept expressed in Contract Documents.
- C. Samples will be reviewed for aesthetic, color, or finish selection.

- D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 017800 - Closeout Submittals.

3.8 SUBMITTALS FOR INFORMATION

- A. When the following are specified in individual sections, submit them for information:

1. Design data.
2. Certificates.
3. Test reports.
4. Inspection reports.
5. Manufacturer's instructions.
6. Manufacturer's field reports.
7. Other types indicated.

- B. Submit for Architect's knowledge as contract administrator or for Owner.

3.9 SUBMITTALS FOR PROJECT CLOSEOUT

- A. Submit Correction Punch List for Substantial Completion.

- B. Submit Final Correction Punch List for Substantial Completion.

- C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 017800 - Closeout Submittals:

1. Project record documents.
2. Operation and maintenance data.
3. Warranties.
4. Bonds.
5. Other types as indicated.

- D. Submit for Owner's benefit during and after project completion.

3.10 NUMBER OF COPIES OF SUBMITTALS

- A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.
- B. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.
 - 1. After review, produce duplicates.
 - 2. Retained samples will not be returned to Contractor unless specifically so stated.

3.11 SUBMITTAL PROCEDURES

- A. General Requirements:
 - 1. Use a single transmittal for related items.
 - 2. Transmit using approved form.
 - a. Use Contractor's form, subject to prior approval by Architect.
 - 3. Sequentially identify each item. For revised submittals use original number and a sequential numerical suffix.
 - 4. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.
 - 5. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
 - 6. Deliver each submittal on date noted in submittal schedule, unless an earlier date has been agreed to by all affected parties, and is of the benefit to the project.
 - a. Upload submittals in electronic form to Electronic Document Submittal Service website.
 - 7. Schedule submittals to expedite the Project, and coordinate submission of related items.

- a. For each submittal for review, allow 10 days excluding delivery time to and from the Contractor.
 - b. For sequential reviews involving Architect's consultants, Owner, or another affected party, allow an additional [] days.
 - c. For sequential reviews involving approval from authorities having jurisdiction (AHJ), in addition to Architect's approval, allow an additional 30 days.
8. Provide space for Contractor and Architect review stamps.
 9. When revised for resubmission, identify all changes made since previous submission.
 10. Distribute reviewed submittals. Instruct parties to promptly report inability to comply with requirements.
 11. Incomplete submittals will not be reviewed, unless they are partial submittals for distinct portion(s) of the work, and have received prior approval for their use.
 12. Submittals not requested will be recognized, and will be returned "Not Reviewed",
- B. Product Data Procedures:
1. Submit only information required by individual specification sections.
 2. Collect required information into a single submittal.
 3. Do not submit (Material) Safety Data Sheets for materials or products.
- C. Shop Drawing Procedures:
1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.
 2. Do not reproduce Contract Documents to create shop drawings.
 3. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.
- D. Samples Procedures:
1. Transmit related items together as single package.

2. Identify each item to allow review for applicability in relation to shop drawings showing installation locations.
3. Submit actual samples not photocopies or computer generated color charts.

3.12 SUBMITTAL REVIEW

- A. Submittals for Review: Architect will review each submittal, and approve, or take other appropriate action.
- B. Submittals for Information: Architect will acknowledge receipt and review. See below for actions to be taken.
- C. Architect's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.
- D. Architect's and consultants' actions on items submitted for review:
 1. Authorizing purchasing, fabrication, delivery, and installation:
 - a. "Reviewed", or language with same legal meaning.
 - b. "Furnish as Corrected", or language with same legal meaning.
 - 1) At Contractor's option, submit corrected item, with review notations acknowledged and incorporated.
 2. Not Authorizing fabrication, delivery, and installation:
- E. Architect's and consultants' actions on items submitted for information:
 1. Items for which no action was taken:
 - a. "Action Not Required" - to notify the Contractor that the submittal has been received for record only.
 2. Items for which no action was taken:
 - a. "Submit Specific Item" - no further action is required from Contractor.

END OF SECTION

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SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Re-use of existing products.
- B. Transportation, handling, storage and protection.
- C. Product option requirements.
- D. Substitution limitations.
- E. Procedures for Owner-supplied products.
- F. Maintenance materials, including extra materials, spare parts, tools, and software.

1.2 REFERENCE STANDARDS

- A. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.3 SUBMITTALS

- A. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- B. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- C. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
 - 1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

PART 2 PRODUCTS

2.1 EXISTING PRODUCTS

- A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by Contract Documents.
- B. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the Owner, or otherwise indicated as to remain the property of the Owner, become the property of the Contractor; remove from site.

2.2 NEW PRODUCTS

- A. Provide new products unless specifically required or permitted by Contract Documents.
- B. Use of products having any of the following characteristics is not permitted:

2.3 PRODUCT OPTIONS

- A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.
- C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

2.4 MAINTENANCE MATERIALS

- A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.
- B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 EXECUTION

3.1 SUBSTITUTION LIMITATIONS

- A. See Section 012500 - Substitution Procedures.

3.2 OWNER-SUPPLIED PRODUCTS

- A. Owner's Responsibilities:
 - 1. Arrange for and deliver Owner reviewed shop drawings, product data, and samples, to Contractor.

2. Arrange and pay for product delivery to site.
3. On delivery, inspect products jointly with Contractor.
4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
5. Arrange for manufacturers' warranties, inspections, and service.

B. Contractor's Responsibilities:

1. Review Owner reviewed shop drawings, product data, and samples.
2. Receive and unload products at site; inspect for completeness or damage jointly with Owner.
3. Handle, store, install and finish products.
4. Repair or replace items damaged after receipt.

3.3 TRANSPORTATION AND HANDLING

- A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.
- B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.
- C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.
- D. Transport and handle products in accordance with manufacturer's instructions.
- E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.
- F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.
- G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.
- H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.4 STORAGE AND PROTECTION

- A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. See Section 017419.
- B. Store and protect products in accordance with manufacturers' instructions.
- C. Store with seals and labels intact and legible.
- D. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.
- E. For exterior storage of fabricated products, place on sloped supports above ground.
- F. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.
- G. Comply with manufacturer's warranty conditions, if any.
- H. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- I. Prevent contact with material that may cause corrosion, discoloration, or staining.
- J. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- K. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION

SECTION 017000 - EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Examination, preparation, and general installation procedures.
- B. Cutting and patching.
- C. Surveying for laying out the work.
- D. Cleaning and protection.
- E. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.

1.2 RELATED REQUIREMENTS

- A. Section 011000 - Summary: Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials.
- B. Section 017800 - Closeout Submittals: Project record documents, operation and maintenance data, warranties, and bonds.
- C. Section 024100 - Demolition: Demolition of whole structures and parts thereof; site utility demolition.
- D. Section 078400 - Firestopping.

1.3 REFERENCE STANDARDS

- A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations 2019.

1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.
 - 1. On request, submit documentation verifying accuracy of survey work.

2. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in compliance with Contract Documents.
 3. Submit surveys and survey logs for the project record.
- C. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.
1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences. Include design drawings and calculations for bracing and shoring.
 2. Identify demolition firm and submit qualifications.
 3. Include a summary of safety procedures.
- D. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
1. Structural integrity of any element of Project.
 2. Integrity of weather exposed or moisture resistant element.
 3. Efficiency, maintenance, or safety of any operational element.
 4. Visual qualities of sight exposed elements.
 5. Work of Owner or separate Contractor.

1.5 QUALIFICATIONS

- A. For surveying work, employ a land surveyor registered in Colorado and acceptable to Architect. Submit evidence of surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate. Employ only individual(s) trained and experienced in collecting and recording accurate data relevant to ongoing construction activities,
- B. For design of temporary shoring and bracing, employ a Professional Engineer experienced in design of this type of work and licensed in Colorado.

1.6 PROJECT CONDITIONS

- A. Use of explosives is not permitted.
- B. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

- C. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.
- D. Perform dewatering activities, as required, for the duration of the project.
- E. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
- F. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
 - 1. Provide dust-proof enclosures to prevent entry of dust generated outdoors.
 - 2. Provide dust-proof barriers between construction areas and areas continuing to be occupied by Owner.
- G. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
 - 1. Minimize amount of bare soil exposed at one time.
 - 2. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.
 - 3. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.
 - 4. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.
- H. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.
 - 1. At All Times: Excessively noisy tools and operations will not be tolerated inside the building at any time of day; excessively noisy includes jackhammers.
- I. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.
- J. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local

regulations.

1.7 COORDINATION

- A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
- B. Notify affected utility companies and comply with their requirements.
- C. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- D. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- E. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- F. Coordinate completion and clean-up of work of separate sections.
- G. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

PART 2 PRODUCTS

2.1 PATCHING MATERIALS

- A. New Materials: As specified in product sections; match existing products and work for patching and extending work.
- B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.
- C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 016000 - Product Requirements.

PART 3 EXECUTION

EXECUTION AND CLOSEOUT REQUIREMENTS

3.1 EXAMINATION

- A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.
- B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.
- C. Examine and verify specific conditions described in individual specification sections.
- D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.
- E. Verify that utility services are available, of the correct characteristics, and in the correct locations.
- F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.2 PREPARATION

- A. Clean substrate surfaces prior to applying next material or substance.
- B. Seal cracks or openings of substrate prior to applying next material or substance.
- C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.3 LAYING OUT THE WORK

- A. Verify locations of survey control points prior to starting work.
- B. Promptly notify Architect of any discrepancies discovered.
- C. Protect survey control points prior to starting site work; preserve permanent reference points during construction.
- D. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.
- E. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.

- F. Utilize recognized engineering survey practices.
- G. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
 - 1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
 - 2. Grid or axis for structures.
 - 3. Building foundation, column locations, ground floor elevations.
- H. Periodically verify layouts by same means.
- I. Maintain a complete and accurate log of control and survey work as it progresses.

3.4 GENERAL INSTALLATION REQUIREMENTS

- A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.
- B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.
- C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.
- D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.
- E. Make neat transitions between different surfaces, maintaining texture and appearance.

3.5 CUTTING AND PATCHING

- A. Whenever possible, execute the work by methods that avoid cutting or patching.
- B. Perform whatever cutting and patching is necessary to:
 - 1. Complete the work.
 - 2. Fit products together to integrate with other work.
 - 3. Provide openings for penetration of mechanical, electrical, and other services.

4. Match work that has been cut to adjacent work.
 5. Repair areas adjacent to cuts to required condition.
 6. Repair new work damaged by subsequent work.
 7. Remove samples of installed work for testing when requested.
 8. Remove and replace defective and non-complying work.
- C. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.
- D. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.
- E. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.
- F. Restore work with new products in accordance with requirements of Contract Documents.
- G. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- H. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 078400, to full thickness of the penetrated element.
- I. Patching:
1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
 2. Match color, texture, and appearance.
 3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.6 PROGRESS CLEANING

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
- B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
- C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
- D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.7 PROTECTION OF INSTALLED WORK

- A. Protect installed work from damage by construction operations.
- B. Provide special protection where specified in individual specification sections.
- C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- G. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.8 ADJUSTING

- A. Adjust operating products and equipment to ensure smooth and unhindered operation.

3.9 FINAL CLEANING

- A. Use cleaning materials that are nonhazardous.
- B. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.

- C. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.
- D. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
- E. Clean filters of operating equipment.
- F. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, drainage systems and site.
- G. Clean site; sweep paved areas, rake clean landscaped surfaces.
- H. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.10 CLOSEOUT PROCEDURES

- A. Make submittals that are required by governing or other authorities.
- B. Accompany Project Coordinator on preliminary inspection to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's Notice of Substantial Completion.
- C. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.
- D. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's Substantial Completion inspection.
- E. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.
- F. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.
- G. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.
- H. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

END OF SECTION

SECTION 017800 - CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Project Record Documents.
- B. Operation and Maintenance Data.
- C. Warranties and bonds.

1.2 RELATED REQUIREMENTS

- A. Section 013000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.
- B. Individual Product Sections: Specific requirements for operation and maintenance data.
- C. Individual Product Sections: Warranties required for specific products or Work.

1.3 SUBMITTALS

- A. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.
- B. Operation and Maintenance Data:
 - 1. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
 - 2. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
 - 3. Submit two sets of revised final documents in final form within 10 days after final inspection.
- C. Warranties and Bonds:
 - 1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.

2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 PROJECT RECORD DOCUMENTS

- A. Maintain on site one set of the following record documents; record actual revisions to the Work:
 1. Drawings.
 2. Specifications.
 3. Addenda.
 4. Change Orders and other modifications to the Contract.
 5. Reviewed shop drawings, product data, and samples.
 6. Manufacturer's instruction for assembly, installation, and adjusting.
- B. Ensure entries are complete and accurate, enabling future reference by Owner.
- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress.
- E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
 1. Changes made by Addenda and modifications.
- F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
 1. Field changes of dimension and detail.
 2. Details not on original Contract drawings.

3.2 OPERATION AND MAINTENANCE DATA

- A. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
- B. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.
- C. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.3 WARRANTIES AND BONDS

- A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.
- B. Verify that documents are in proper form, contain full information, and are notarized.
- C. Co-execute submittals when required.
- D. Retain warranties and bonds until time specified for submittal.

END OF SECTION

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SECTION 017900 - DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.1 SUMMARY

- A. Demonstration of products and systems to be commissioned and where indicated in specific specification sections.
- B. Training of Owner personnel in operation and maintenance is required for:
 - 1. All software-operated systems.
 - 2. HVAC systems and equipment.
 - 3. Electrical systems and equipment.
 - 4. Items specified in individual product Sections.
- C. Training of Owner personnel in care, cleaning, maintenance, and repair is required for:
 - 1. Roofing, waterproofing, and other weather-exposed or moisture protection products.
 - 2. Finishes, including flooring, wall finishes, ceiling finishes.
 - 3. Items specified in individual product Sections.

1.2 RELATED REQUIREMENTS

- A. Section 017800 - Closeout Submittals: Operation and maintenance manuals.

1.3 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures; except:
 - 1. Make all submittals specified in this section, and elsewhere where indicated for commissioning purposes, directly to the Commissioning Authority.
 - 2. Submit one copy to the Commissioning Authority, not to be returned.
 - 3. Make commissioning submittals on time schedule specified by Commissioning Authority.

4. Submittals indicated as "Draft" are intended for the use of the Commissioning Authority in preparation of overall Training Plan; submit in editable electronic format, Microsoft Word 2003 preferred.
- B. Draft Training Plans: Owner will designate personnel to be trained; tailor training to needs and skill-level of attendees.
1. Submit to Commissioning Authority for review and inclusion in overall training plan.
 2. Submit not less than four weeks prior to start of training.
 3. Revise and resubmit until acceptable.
 4. Provide an overall schedule showing all training sessions.
 5. Include at least the following for each training session:
 - a. Identification, date, time, and duration.
 - b. Description of products and/or systems to be covered.
 - c. Name of firm and person conducting training; include qualifications.
 - d. Intended audience, such as job description.
 - e. Objectives of training and suggested methods of ensuring adequate training.
 - f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
 - g. Media to be used, such as slides, hand-outs, etc.
 - h. Training equipment required, such as projector, projection screen, etc., to be provided by Contractor.
- C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.
1. Include applicable portion of O&M manuals.
 2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.

3. Provide one extra copy of each training manual to be included with operation and maintenance data.
- D. Video Recordings: Submit digital video recording of each demonstration and training session for Owner's subsequent use.
 1. Format: DVD Disc.
 2. Label each disc and container with session identification and date.

1.4 QUALITY ASSURANCE

- A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.
 1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.
 2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 DEMONSTRATION - GENERAL

- A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner.
- B. Demonstrations conducted during Functional Testing need not be repeated unless Owner personnel training is specified.
- C. Demonstration may be combined with Owner personnel training if applicable.
- D. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
 1. Perform demonstrations not less than two weeks prior to Substantial Completion.
 2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

- E. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.

- 1. Perform demonstrations not less than two weeks prior to Substantial Completion.

3.2 TRAINING - GENERAL

- A. Commissioning Authority will prepare the Training Plan based on draft plans submitted.
- B. Conduct training on-site unless otherwise indicated.
- C. Owner will provide classroom and seating at no cost to Contractor.
- D. Do not start training until Functional Testing is complete, unless otherwise specified or approved by the Commissioning Authority.
- E. Provide training in minimum two hour segments.
- F. The Commissioning Authority is responsible for determining that the training was satisfactorily completed and will provide approval forms.
- G. Training schedule will be subject to availability of Owner's personnel to be trained; re-schedule training sessions as required by Owner; once schedule has been approved by Owner failure to conduct sessions according to schedule will be cause for Owner to charge Contractor for personnel "show-up" time.
- H. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
 - 1. The location of the O&M manuals and procedures for use and preservation; backup copies.
 - 2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
 - 3. Typical uses of the O&M manuals.
- I. Product- and System-Specific Training:
 - 1. Review the applicable O&M manuals.
 - 2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.

3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
 4. Provide hands-on training on all operational modes possible and preventive maintenance.
 5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
 6. Discuss common troubleshooting problems and solutions.
 7. Discuss any peculiarities of equipment installation or operation.
 8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
 9. Review recommended tools and spare parts inventory suggestions of manufacturers.
 10. Review spare parts and tools required to be furnished by Contractor.
 11. Review spare parts suppliers and sources and procurement procedures.
- J. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

END OF SECTION

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PART 1 GENERAL**1.1 DESCRIPTION**

- A. Work Included: Removal and satisfactory disposal of buildings, foundations, fences, signs, structures, pavements, traffic control devices, utilities, and other obstructions not designated or permitted to remain.
- B. Related Work:
 - 1. Site Clearing: Section 311000
 - 2. Earthwork: Section 310000
 - 3. Erosion and Sedimentation Control: Section 312500

1.2 PERMITS

- A. Fugitive Dust
- B. Road Cut
- C. Stormwater Discharge Permit (CDPHE)
- D. Construction Dewatering (CDPHE)
- E. 404 Permit

1.3 JOB CONDITIONS

Protection: Protect all vegetation, utilities, structures, and other facilities to remain, from damage in manner acceptable to Engineer. Maintain designated temporary roadways, walkways, and detours.

PART 2 PRODUCTS

None

PART 3 EXECUTION**3.1 PAVEMENTS, CURBS, GUTTER, FLATWORK**

- A. Remove all pavements, curbs, gutter, and flatwork not designated to remain. Where existing construction is to be partially removed, saw edges to remain in place on straight line with vertical face.

3.2 BRIDGES, SEWERS, CULVERTS, DRAINAGE STRUCTURES

- A. Do not remove structures in use until arrangements have been made to accommodate traffic.
- B. For structures removed down to natural stream bottom, remove those parts outside stream to 1' below ground. Remove all portions within limits of new construction as necessary to accommodate new work.

C. Maintain satisfactory traffic bypass at all times.

3.3 STRUCTURES

Remove structures within project limits or as shown on drawings. Protect portions to remain from damage. Damage to be repaired at Contractor's expense.

3.4 UTILITIES

Remove designated utility lines within project limits, properly capping or plugging existing lines to remain.

3.5 DISPOSAL

Deposit all removed material in designated waste areas. Grade and shape disposal site. Complete topsoil and reseedling of site if required. Where disposal sites are not designated, remove and dispose of all waste materials off site.

3.06 RESTORATION

After removal of obstruction, fill and compact to finish grade in accordance with these specifications.

END OF SECTION 024113

SECTION 024100 - DEMOLITION

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Selective demolition of building elements for alteration purposes.

1.2 RELATED REQUIREMENTS

- A. Section 011000 - Summary: Limitations on Contractor's use of site and premises.
- B. Section 011000 - Summary: Sequencing and staging requirements.
- C. Section 016000 - Product Requirements: Handling and storage of items removed for salvage and relocation.
- D. Section 017000 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.

1.3 REFERENCE STANDARDS

- A. 29 CFR 1926 - U.S. Occupational Safety and Health Standards current edition.
- B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations 2019.

1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Site Plan: Showing:
 - 1. Areas for temporary construction and field offices.
 - 2. Areas for temporary and permanent placement of removed materials.
- C. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.
 - 1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences.
 - 2. Identify demolition firm and submit qualifications.

- D. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

PART 2 PRODUCTS -- NOT USED

PART 3 EXECUTION

3.1 SCOPE

- A. Remove paving and curbs as required to accomplish new work.
- B. Remove concrete slabs on grade within site boundaries.
- C. Remove fences and gates.
- D. Remove other items indicated, for salvage, relocation and recycling.

3.2 GENERAL PROCEDURES AND PROJECT CONDITIONS

- A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
 - 1. Obtain required permits.
 - 2. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
 - 3. Provide, erect, and maintain temporary barriers and security devices.
 - 4. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
 - 5. Do not close or obstruct roadways or sidewalks without permit.
 - 6. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.
 - 7. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.
- B. Do not begin removal until receipt of notification to proceed from Owner.
- C. Protect existing structures and other elements that are not to be removed.

1. Provide bracing and shoring.
 2. Prevent movement or settlement of adjacent structures.
 3. Stop work immediately if adjacent structures appear to be in danger.
- D. Minimize production of dust due to demolition operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.
- E. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos containing materials, lead, PCB's, and mercury.
- F. Hazardous Materials: Comply with 29 CFR 1926 and state and local regulations.
- G. Perform demolition in a manner that maximizes salvage and recycling of materials.
1. Dismantle existing construction and separate materials.
 2. Set aside reusable, recyclable, and salvageable materials; store and deliver to collection point or point of reuse.
- H. Partial Removal of Paving and Curbs: Neatly saw cut at right angle to surface.

3.3 EXISTING UTILITIES

- A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.
- B. Protect existing utilities to remain from damage.
- C. Do not disrupt public utilities without permit from authority having jurisdiction.
- D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.
- E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.
- F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.
- G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

- H. Prepare building demolition areas by disconnecting and capping utilities outside the demolition zone; identify and mark utilities to be subsequently reconnected, in same manner as other utilities to remain.

3.4 SELECTIVE DEMOLITION FOR ALTERATIONS

- A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
 - 1. Verify that construction and utility arrangements are as indicated.
 - 2. Report discrepancies to Architect before disturbing existing installation.
 - 3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.
- B. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
- C. Remove existing work as indicated and as required to accomplish new work.
 - 1. Remove items indicated on drawings.
- D. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical and Telecommunications): Remove existing systems and equipment as indicated.
 - 1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components.
 - 2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
 - 3. Verify that abandoned services serve only abandoned facilities before removal.
 - 4. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification.
- E. Protect existing work to remain.
 - 1. Prevent movement of structure; provide shoring and bracing if necessary.
 - 2. Perform cutting to accomplish removals neatly and as specified for cutting new work.

3. Repair adjacent construction and finishes damaged during removal work.
4. Patch as specified for patching new work.

3.5 DEBRIS AND WASTE REMOVAL

- A. Remove debris, junk, and trash from site.
- B. Leave site in clean condition, ready for subsequent work.
- C. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

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SECTION 031510 - POST-INSTALLED CONCRETE AND MASONRY ANCHORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes requirements for materials and equipment for post-installed mechanical and adhesive anchors in concrete and grouted masonry.
- B. Related Sections include the following:
 - 1. Division 03 Section "Cast-in-Place Concrete".
 - 2. Division 04 Section "Unit Masonry".

1.3 SUBMITTALS

- A. Product Data: If requested, manufacturer's product literature and installation instructions for each type of anchor indicated.
- B. Samples: If requested, representative length and diameters of each type of anchor shown on the drawings.
- C. ICC ES Reports: If requested, ICC Evaluation Service report indicating conformance with ICC-ES Acceptance Criteria.
- D. For all connections designed by others, submit calculations stamped and signed by a registered Professional Engineer for review and approval by the Engineer of Record.
- E. Field quality-control test and inspection reports.
- F. If requested, installer qualification certificates.

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency qualified according to ASTM E 329 for testing indicated. All inspectors shall have Adhesive Anchor Inspector certifications for adhesive anchors.
- B. Installer Qualifications: All installers shall have ACI/CRSI AAI (Adhesive Anchor Installer) certification for adhesive anchors.
- C. Installer Training: Prior to beginning the work, manufacturer or manufacturer's representative shall provide on-site training for all contractor's personnel who will be installing anchors.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to project site in manufacturer's or distributor's original packaging undamaged, and with printed installation instructions.
- B. Store and handle all materials in accordance with manufacturer's recommendations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Simpson Strong-Tie Company, Pleasanton, CA www.simpsonanchors.com
 - 2. Hilti Fastening Systems, Tulsa, OK www.us.hilti.com
 - 3. DeWalt / Powers, Towson, MD www.powers.com

2.2 MATERIALS

- A. Deformed Reinforcing Bars: Deformed steel rebar conforming to ASTM A615. Permissible sizes as described in each adhesive products ICC report.
- B. Interior Use: For use in conditioned environments free from potential moisture, provide zinc plated carbon steel anchors.
- C. Exterior Use: In exposed or potentially wet environments, and for attachment of exterior cladding materials, provide galvanized or stainless steel anchors. Stainless steel nuts and washers shall be of matching alloy group of equal or greater strength than the rod. Avoid installing stainless steel anchors in contact with galvanically dissimilar metals.

2.3 MECHANICAL ANCHORS

- A. Expansion, screw or undercut anchors having current ICC approval for use in cracked and uncracked concrete, and seismic loadings, with a published ICC Evaluation Service report. Type and size as indicated on the drawings.
- B. Approved products for anchoring to concrete are as follows:
 - 1. Hilti Kwik Bolt TZ Expansion Anchor (ICC-ES ESR-1917)
 - 2. Hilti Kwik HUS EZ (ICC-ES ESR-3027)
 - 3. Hilti HDI-P TZ Drop-in Anchor (ICC-ES ESR 4236)
 - 4. Simpson Strong-Bolt Expansion Anchor (ICC-ES ESR-1771)
 - 5. Simpson Titen HD Screw Anchor (ICC-ES ESR-2713)
 - 6. DeWalt / Powers Power-Stud+ SD2 Expansion Anchor (ICC-ES ESR-2502)
 - 7. DeWalt / Powers Wedge-Bolt+ Screw Anchor (ICC-ES ESR-2526)
- C. Approved products for anchoring to grouted masonry are as follows:
 - 1. Hilti Kwik Bolt 3 Expansion Anchor (ICC-ES ESR-1385)
 - 2. Hilti Kwik HUS-EZ Screw Anchor (ICC-ES ESR-3027)

3. Simpson Titen HD Screw Anchor (ICC-ES ESR-1056)
4. Simpson Wedge-All Wedge Anchor (ICC-ES ESR-1396)
5. DeWalt / Powers Power-Stud+ SD1 Expansion Anchor (ICC-ES ESR-2966)
6. DeWalt / Powers Wedge-Bolt+ Screw Anchor (ICC-ES ESR-1678)

2.4 ADHESIVE ANCHORS

- A. Threaded carbon steel rod complete with required nuts, washers, adhesive system and manufacturer's installation instructions. Current ICC approval for use in cracked and uncracked concrete, and seismic loadings, with a published ICC Evaluation Service report required. Type and size as indicated on drawings. Adhesive anchors shall be qualified for a long-term temperature of 110°.
- B. Approved products for anchoring to concrete are as follows:
 1. Hilti HIT-HY 200 Safe-Set Epoxy Adhesive (ICC-ES ESR-3187).
 2. Hilti HIT-RE 500 V3 Safe-Set Epoxy Adhesive (ICC-ES ESR-3814)
 3. Simpson SET-3G Epoxy Adhesive (ICC-ES ESR-2508)
 4. DeWalt / Powers Pure 110+ Epoxy Adhesive (ICC-ES ESR-3298)
- C. Approved products for anchoring to grouted masonry are as follows:
 1. Hilti HIT-HY 270 Safe-Set Epoxy Adhesive (ICC-ES ESR-4143).
 2. Simpson SET Epoxy Adhesive (ICC-ES ESR-1772) or Acrylic-Tie Adhesive (ICC-ES ESR 5791)
 3. DeWalt / Powers AC100+ Gold Acrylic Adhesive (ICC-ES ESR-3200)
- D. Approved products for anchoring to hollow masonry are as follows:
 1. Hilti HIT-HY 270 Safe-Set Epoxy Adhesive with matching screen tubes (ICC-ES ESR-4143).

2.5 SUBSTITUTIONS

- A. Substitution request for alternate products must be approved in writing by the structural engineer of record prior to use. Contractor shall provide calculations demonstrating that the substituted product is capable of achieving the performance values of the specified product. Substitutions will be evaluated by their having an ICC ESR showing compliance with the relevant building code for seismic uses, load resistance, installation category, and availability of comprehensive installation instructions. Adhesive anchor evaluation will also consider creep, in-service temperature and installation temperature.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions

1. Base Material Strength: Unless otherwise specified, do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength, or a minimum age of 21 days, whichever is longer.
2. Temperature of concrete surface and ambient air temperature must meet manufacturer's requirements prior to use of adhesive anchor products.
3. Embedded Items: Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Exercise care in coring or drilling to avoid damaging existing reinforcing or embedded items. Take precautions as necessary to avoid damaging anything embedded in the concrete including prestressing tendons, electrical and telecommunications conduit, and gas lines. Notify the Engineer if reinforcing steel or other embedded items are encountered during drilling.
4. Beginning of installation indicates acceptance of existing conditions.
5. Base material shall be dry, unless noted otherwise.
6. In masonry applications, cells at anchor, and for one course above and below the anchor, shall be solid grouted.

3.2 INSTALLATION

- A. Installation shall comply with all manufacturer's instructions.
- B. Manufacturer shall provide on-site training for all personnel who will be installing post-installed adhesive anchors at the beginning of the work.
- C. All installers shall be ACI/CRSI AAI certified.
- D. Where manufacturer recommends use of special tools for installation of anchors, such tools shall be used, unless otherwise permitted specifically by the Engineer.
- E. Drill holes with rotary impact hammer drills using carbide-tipped bits or core drills using diamond core bits. Drill bits shall be of diameters as specified by the anchor manufacturer. Unless otherwise shown on the Drawings, all holes shall be drilled perpendicular to the concrete surface. Where anchors are to be installed in cored holes, use core bits with matched tolerances as specified by the manufacturer. Cored holes may only be used if acceptable to the engineer and the manufacturer.
- F. Holes shall be cleared of debris after holes are drilled per manufacturer's instructions. For adhesive installations, at a minimum, holes shall be blown out with oil-free compressed air and shall be brushed with a wire or nylon brush. Holes shall then be blown out one additional time with oil-free compressed air. Additional hole cleaning requirements may be required by manufacturer.
- G. During adhesive curing time period, the temperature of the substrate shall be kept above the minimum substrate temperature as defined by the manufacturer. Contractor shall determine the appropriate means and methods to ensure that the temperature is kept above the required minimum temperature required before adhesive installation is begun.

3.3 FIELD QUALITY CONTROL

- A. Inspection: Special inspection, periodic or continuous, of post-installed anchors shall be provided as required by the ICC-ES report for that anchor and not less than the following:

1. Continuously observe the installation of a minimum of the first two of each type of anchor. Verify anchor type, anchor dimensions, hole dimensions, anchor spacing, edge distances, anchor embedment and adherence to the manufacturer's published installation instructions. For adhesive anchors also verify hole cleaning technique, adhesive expiration date and proper mixing and dispensing.
 2. Subsequent inspection of installation will be required when there is a change of personnel doing the installation. Change is defined as any one or more persons drilling or preparing holes, or installing anchors.
 3. Visually inspect 100% of all installed anchors.
- B. Reporting: Daily reports shall reference the applicable ICC-ES report number, indicate that all specified criteria were complied with and provide itemized verification of all inspected items. The Special Inspector shall immediately report any deviations from the requirements to the Engineer.
- C. Defective Work: Installations that are not approved by the Special Inspector shall be considered defective. Additional testing and inspection, as directed by the Engineer and at Contractor's expense, will be performed to determine acceptability of defective work.
- 3.4 REPAIR OF DEFECTIVE WORK
- A. Remove and replace misplaced, defective or malfunctioning anchors. Fill empty anchor holes and patch failed anchor locations with high-strength, non-shrink non-metallic grout.

END OF SECTION 031510

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SECTION 033000 - CAST-IN-PLACE CONCRETE

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 cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.
- B. Related Requirements:
 - 1. Section 033300 "Architectural Concrete" for general building applications of specially finished formed concrete.
 - 2. Section 035300 "Concrete Topping" for emery- and iron-aggregate concrete floor toppings.
 - 3. Section 312000 "Earth Moving" for drainage fill under slabs-on-grade.
 - 4. Section 321313 "Concrete Paving" for concrete pavement and walks.
 - 5. Section 321316 "Decorative Concrete Paving" for decorative concrete pavement and walks.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.
- B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete 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 Subcontractor.
 - e. Special concrete finish Subcontractor.
2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, anchor rod and anchorage device installation tolerances, steel reinforcement installation, methods for achieving specified floor and slab flatness and levelness floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
 1. **Product Data:** For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 2. **Product Certificates:** For materials manufactured within 100 miles of Project, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each raw material.
 3. **Laboratory Test Reports:** For **[liquid floor treatments] [and] [curing and sealing compounds]**, indicating compliance with requirements for low-emitting materials.
- C. 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.
- D. 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. Elevations at ¼" = 1'-0" scale shall be included to show beam and wall reinforcing layout.
- E. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
 1. Location of construction joints is subject to approval of the Architect.
- F. Vapor Barriers:
 1. Quality Control/Assurance

- a. Summary of test results per paragraph 9.3 of ASTM E1745.
- b. Manufacturer's samples and literature.
- c. Manufacturer's installation instructions for placement, seaming, penetration prevention and repair, and perimeter seal per ASTM E1643.
- d. All mandatory ASTM E1745 testing must be performed on a single production roll per ASTM E1745 Section 8.1.
- e. Contact vapor barrier manufacturer to schedule a pre-construction meeting and to coordinate a review, in-person or digital, of the vapor barrier installation.
- f. Manufacturer's Life of the Building Warranty.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Welding certificates.
- C. Material Certificates: For each of the following, signed by manufacturers:
 1. Cementitious materials.
 2. Admixtures.
 3. Form materials and form-release agents.
 4. Steel reinforcement and accessories.
 5. Fiber reinforcement.
 6. Waterstops.
 7. Curing compounds.
 8. Floor and slab treatments.
 9. Bonding agents.
 10. Adhesives.
 11. Vapor barriers.
 12. Semirigid joint filler.
 13. Joint-filler strips.
 14. Repair materials.
- D. Material Test Reports: For the following, from a qualified testing agency:
 1. Aggregates: Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.
- E. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.
- F. Field quality-control reports.
- G. Minutes of preinstallation conference.

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/C 94M 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, acceptable to authorities having jurisdiction, 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.
 - 2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician, Grade II.
- D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M.
- 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."

1.8 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on concrete mixtures.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.
- B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

1.10 FIELD CONDITIONS

- A. 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.
- B. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1, and as follows:
1. Maintain concrete temperature below 95 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 Contractor'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.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

- A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
1. ACI 301.
 2. ACI 117.

2.2 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that 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.
 2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
 - a. High-density overlay, Class 1 or better.
 - b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.

- c. Structural 1, B-B or better; mill oiled and edge sealed.
 - d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.
3. Overlaid Finnish birch plywood.
- 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. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
 - D. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation.
 - E. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.
 - F. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
 - G. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
 - H. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
 - I. Form Ties: Factory-fabricated, removable or snap-off glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish units that leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
 - 2. Furnish ties that, when removed, leave holes no larger than 1 inch in diameter in concrete surface.
 - 3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.3 STEEL REINFORCEMENT

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than [25] [60] <Insert value> percent.
- B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
- C. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.

- D. Deformed-Steel Wire: ASTM A 1064/A 1064M.
- E. Plain-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, plain, fabricated from as-drawn steel wire into flat sheets.
- F. Deformed-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, flat sheet.

2.4 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60, plain-steel bars, cut 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. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.

2.5 CONCRETE MATERIALS

- A. Regional Materials: Concrete shall be manufactured within 100 miles of Project site from aggregates[**and cementitious materials**] that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site.
- B. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.
- C. Cementitious Materials:
 - 1. Portland Cement: ASTM C 150/C 150M. See Concrete Mix Matrix for cement type.
 - 2. Fly Ash: ASTM C 618, **[Class F] [Class F or C]**.
 - 3. Slag Cement: ASTM C 989/C 989M, Grade 100 or 120.
 - 4. Silica Fume: ASTM C 1240, amorphous silica.
- D. Normal-Weight Aggregates: ASTM C 33/C 33M, **[Class 3S] [Class 3M] [Class 1N]** **<Insert class>** coarse aggregate or better, graded. Provide aggregates from a single source[**with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials**].

1. Maximum Coarse-Aggregate Size: **[1-1/2 inches] [1 inch] [3/4 inch] <Insert dimension>** nominal.
 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
- F. Crystalline Waterproofing Admixture / Additive: Concrete waterproofing system shall be of the crystalline type that chemically controls and permanently fixes a non-soluble crystalline structure throughout the capillary voids of the concrete. The system shall cause the concrete to become sealed against the penetration of liquids from any direction and shall protect the concrete from deterioration due to harsh environmental conditions.
1. Manufacturer Qualifications: Manufacturer to be ISO 9001 registered, and to have no less than 10 years' experience in manufacturing the crystalline waterproofing additive for the required work. Manufacturer must be capable of providing field service representation during construction phase. Manufacturers that cannot provide the performance test data specified herein will not be considered for the project.
 2. Applicator: Installer of crystalline waterproofing additive shall be approved by the manufacturer or manufacturer's representative in writing.
 3. Pre-Installation Conference: Prior to installation of waterproofing, conduct meeting with Architect/Engineer, owner's representative, applicator (concrete supplier), concrete placer and waterproofing manufacturer's representative to verify and review the following:
 - a. Project requirements for waterproofing as set out in Contract Documents.
 - b. Manufacturer's product data including application instructions.
 4. Technical Consultation: The waterproofing manufacturer's representative shall provide technical consultation on waterproofing application.
- G. Color Pigment: ASTM C 979/C 979M, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, **[free of carbon black,]** nonfading, and resistant to lime and other alkalis.
1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)

2. Color: **[As indicated by manufacturer's designation] [Match Architect's sample] [As selected by Architect from manufacturer's full range].**

H. Water: ASTM C 94/C 94M, ASTM C1602, and potable.

2.6 FIBER REINFORCEMENT

- A. Carbon-Steel Fiber: ASTM A 820/A 820M, Type 1, cold-drawn wire, deformed, minimum of **[1.5 inches] [2 inches] [2.4 inches] <Insert dimension>** long, and aspect ratio of **[35 to 40] [45 to 50] [60 to 65] <Insert ratio>**.

1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)

- B. Carbon-Steel Fiber: ASTM A 820/A 820M, Type 2, cut sheet, deformed, minimum of **[1.5 inches] [2 inches] [2.4 inches] <Insert dimension>** long, and aspect ratio of **[35 to 40] [45 to 50] [60 to 65] <Insert ratio>**.

1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)

- C. Synthetic Micro-Fiber: Monofilament polypropylene micro-fibers engineered and designed for use in concrete, complying with ASTM C 1116/C 1116M, Type III, **[1/2 to 1-1/2 inches] [1 to 2-1/4 inches] <Insert dimensions>** long.

1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)

- D. Synthetic Micro-Fiber: Fibrillated polypropylene micro-fibers engineered and designed for use in concrete, complying with ASTM C 1116/C 1116M, Type III, **[1/2 to 1-1/2 inches] [1 to 2-1/4 inches] <Insert dimensions>** long.

1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)

- E. Synthetic Macro-Fiber: Polyolefin macro-fibers engineered and designed for use in concrete, complying with ASTM C 1116/C 1116M, Type III, **[1 to 2-1/4 inches] <Insert dimensions>** long.

1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)

2.7 WATERSTOPS

- A. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch.

1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)

2.8 VAPOR BARRIERS

- A. Plastic Vapor Barriers: Stego Industries, Inc., Stego Wrap Vapor Barrier, or alternate if approved by architect per submittal requirements. ASTM E 1745, Class A, 15 mil thickness. Include manufacturer's recommended adhesive or pressure-sensitive tape.
- B. Vapor barrier shall have a perm rating of less than or equal to 0.01 perms before and after mandatory conditioning tests per ASTM E1745 Section 7.1, and a perm rating that also meets or exceeds the flooring system including the adhesive.

2.9 FLOOR AND SLAB TREATMENTS

- A. Slip-Resistive Emery Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive, 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 with 100 percent passing [**3/8-inch**] [**No. 4**] [**No. 8**] **<Insert size or gradation>** sieve.
 1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
- B. Slip-Resistive Aluminum Granule Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of not less than 95 percent fused aluminum-oxide granules.
 1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
- C. Emery Dry-Shake Floor Hardener: [**Pigmented**] [**Unpigmented**], factory-packaged, dry combination of portland cement, graded emery aggregate, and plasticizing admixture; with emery aggregate consisting of no less than 60 percent of total aggregate content.
 1. Color: [**As indicated by manufacturer's designation**] [**Match Architect's sample**] [**As selected by Architect from manufacturer's full range**].
- D. Metallic Dry-Shake Floor Hardener: [**Pigmented**] [**Unpigmented**], factory-packaged, dry combination of portland cement, graded metallic aggregate, rust inhibitors, and plasticizing admixture; with metallic aggregate consisting of no less than 65 percent of total aggregate content.
 1. Color: [**As indicated by manufacturer's designation**] [**Match Architect's sample**] [**As selected by Architect from manufacturer's full range**].
- E. Unpigmented Mineral Dry-Shake Floor Hardener: Factory-packaged dry combination of portland cement, graded quartz aggregate, and plasticizing admixture.

1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)

F. Pigmented Mineral Dry-Shake Floor Hardener: Factory-packaged, dry combination of portland cement, graded quartz aggregate, color pigments, and plasticizing admixture. Use color pigments that are finely ground, nonfading mineral oxides interground with cement.

1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
2. Color: **[As indicated by manufacturer's designation] [Match Architect's sample] [As selected by Architect from manufacturer's full range].**

2.10 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.

1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
2. [Products shall comply with the](#) requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.11 CURING MATERIALS

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

1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)

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

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

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)

- F. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, nondissipating[, **certified by curing compound manufacturer to not interfere with bonding of floor covering**].
1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
- G. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, 18 to 25 percent solids, nondissipating[, **certified by curing compound manufacturer to not interfere with bonding of floor covering**].
1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
- H. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
 2. [Products shall comply with the](#) requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- I. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)

2.12 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: [**ASTM D 1751, asphalt-saturated cellulosic fiber**] [or] [**ASTM D 1752, cork or self-expanding cork**].
- B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, [**epoxy resin with a Type A shore durometer hardness of 80**] [**aromatic polyurea with a Type A shore durometer hardness range of 90 to 95**] according to ASTM D 2240.
- C. Bonding Agent: ASTM C 1059/C 1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.
- D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
1. [**Types I and II, nonload bearing**] [**Types IV and V, load bearing**], for bonding hardened or freshly mixed concrete to hardened concrete.

- E. Reglets: Fabricate reglets of not less than 0.022-inch- thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.
- F. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.13 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/C 150M, 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 **[4100 psi]** **<Insert strength>** at 28 days when tested according to ASTM C 109/C 109M.
- B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C 150/C 150M, 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]** **<Insert strength>** at 28 days when tested according to ASTM C 109/C 109M.

2.14 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
 - 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
 - 1. Fly Ash: 25 percent.

2. Combined Fly Ash and Pozzolan: 25 percent.
 3. Slag Cement: 50 percent.
 4. Combined Fly Ash or Pozzolan and Slag Cement: 50 percent portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.
 5. Silica Fume: 10 percent.
 6. Combined Fly Ash, Pozzolans, and Silica Fume: 35 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
 7. Combined Fly Ash or Pozzolans, Slag Cement, and Silica Fume: 50 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
- C. Limit water-soluble, chloride-ion content in hardened concrete to **[0.06] [0.15] [0.30] [1.00]** percent by weight of cement.
- D. 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.
 2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
- E. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

2.15 FABRICATING REINFORCEMENT

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

2.16 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M **[and ASTM C 1116/C 1116M]**, and furnish batch ticket information.
1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, 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 mixer capacity of 1 cu. yd. 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 mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd..

3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 FORMWORK INSTALLATION

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
 1. **[Class A, 1/8 inch]** <Insert dimension> for smooth-formed finished surfaces.
 2. **[Class B, 1/4 inch]** **[Class C, 1/2 inch]** **[Class D, 1 inch]** <Insert dimension> for rough-formed finished surfaces.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Construct forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 1. Install keyways, reglets, recesses, and the like, for easy removal.
 2. Do not use rust-stained steel form-facing material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Provide temporary openings for cleanouts and inspection ports where interior 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.
- H. Chamfer exterior corners and edges of permanently exposed concrete.
- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEM INSTALLATION

- 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 303.
 - 2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
 - 3. Install dovetail anchor slots in concrete structures as indicated.

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 50 deg F for [24] <Insert number> hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.
 - 1. Leave formwork for beam soffits, joists, slabs, and other structural elements that support 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 are not 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 Architect.

3.4 VAPOR-BARRIER INSTALLATION

- A. Sheet Vapor Barrier: Place, protect, and repair sheet vapor barrier according to ASTM E 1643 and manufacturer's written instructions. Contact Stego Industries to schedule a pre-construction meeting and to coordinate a review, in-person or digital, of the vapor barrier installation.
1. Lap joints 6 inches and seal with manufacturer's recommended tape.
 2. Extend vapor barrier to perimeter of slab. If practical, terminate vapor barrier at the top of slab, otherwise (a) at point acceptable to structural engineer, or (b) where obstructed by impediments, such as dowels, rebar, etc. At point of termination seal vapor barrier to the foundation wall, grade beam, or slab itself.
 3. When sealing to foundation wall, utilize StegoTack Tape; double-sided perimeter sealing tape.
 4. When sealing to placed slab itself, utilize Stego Crete Claw Tape; textured tape with surface that creates a mechanical seal to freshly-placed concrete, per manufacturer's instructions.
 5. Seal all penetrations per manufacturer's instructions.
 6. Avoid the use of non-permanent stakes driven through the vapor barrier by utilizing screed and forming systems that will not leave punctures in vapor barrier.
 7. Repair damaged areas with vapor barrier material and manufacturers tape.
- B. Bituminous Vapor Barriers: Place, protect, and repair bituminous vapor barrier according to manufacturer's written instructions.

3.5 STEEL REINFORCEMENT INSTALLATION

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
1. Do not cut or puncture vapor barrier. Repair damage and reseal vapor barrier before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that 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.
1. Weld reinforcing bars according to AWS D1.4/D 1.4M, where indicated.
- 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 one mesh spacing. 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 Architect.
 - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
 - 2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
 - 3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
 - 4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
 - 5. Space vertical joints in walls [**as indicated**] <**Insert spacing**>. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
 - 6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
 - 7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least [**one-fourth**] <**Insert depth**> of concrete thickness as follows:
 - 1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 - 2. Sawed Joints: 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 does 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, grade beams, and other locations, as indicated.
 - 1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
 - 2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Section 079200 "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 WATERSTOP INSTALLATION

- A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of the Work. Field fabricate joints in waterstops according to manufacturer's written instructions.
- B. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.

3.8 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.
- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.
- C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
 - 1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is 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 not to 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.

- E. 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.

3.9 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] <Insert locations>**.
- 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,] [to receive a rubbed finish,] [or to be covered with a coating or covering material applied directly to concrete] <Insert locations>**.
- 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.
 2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix 1 part portland cement to 1-1/2 parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
 3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix 1 part portland cement and 1 part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.

- 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.

3.10 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in one direction.
1. Apply scratch finish to surfaces **[indicated] [and] [to receive concrete floor toppings] [to receive mortar setting beds for bonded cementitious floor finishes] <Insert locations>**.
- C. 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 restraighening until surface is left with a uniform, smooth, granular texture.
1. Apply float finish to surfaces **[indicated] [to receive trowel finish] [and] [to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo] <Insert locations>**.
- D. 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 **[indicated] [exposed to view] [or] [to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system] <Insert locations>**.
 2. Finish surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:
 - a. Specified overall values of flatness, F(F) 25; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and of levelness, F(L) 15.
 - b. Specified overall values of flatness, 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.
 - c. Specified overall values of flatness, F(F) 30; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 15; for suspended slabs.
 - d. Specified overall values of flatness, F(F) 45; and of levelness, F(L) 35; with minimum local values of flatness, F(F) 30; and of levelness, F(L) 24.

3. Finish and measure surface, so gap at any point between concrete surface and an unlevelled, freestanding, 10-ft.- long straightedge resting on two high spots and placed anywhere on the surface does not exceed **[1/4 inch] [3/16 inch] [1/8 inch]**.
- E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces **[indicated] [where ceramic or quarry tile is to be installed by either thickset or thinset 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.
- F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, 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 Architect before application.
- G. Slip-Resistive Finish: Before final floating, apply slip-resistive **[aggregate] [aluminum granule]** finish where indicated and to concrete stair treads, platforms, and ramps. Apply according to manufacturer's written instructions and as follows:
 1. Uniformly spread **[25 lb/100 sq. ft.] <Insert rate>** of dampened slip-resistive **[aggregate] [aluminum granules]** over surface in one or two applications. Tamp aggregate flush with surface, but do not force below surface.
 2. After broadcasting and tamping, apply float finish.
 3. After curing, lightly work surface with a steel wire brush or an abrasive stone and water to expose slip-resistive **[aggregate] [aluminum granules]**.
- H. Dry-Shake Floor Hardener Finish: After initial floating, apply dry-shake floor hardener to surfaces according to manufacturer's written instructions and as follows:
 1. Uniformly apply dry-shake floor hardener at a rate of **[100 lb/100 sq. ft.] <Insert rate>** unless greater amount is recommended by manufacturer.
 2. Uniformly distribute approximately two-thirds of dry-shake floor hardener over surface by hand or with mechanical spreader, and embed by power floating. Follow power floating with a second dry-shake floor hardener application, uniformly distributing remainder of material, and embed by power floating.
 3. After final floating, apply a trowel finish. Cure concrete with curing compound recommended by dry-shake floor hardener manufacturer and apply immediately after final finishing.

3.11 MISCELLANEOUS CONCRETE ITEM INSTALLATION

- A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. 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:
1. Coordinate sizes and locations of concrete bases with actual equipment provided.
 2. Construct concrete bases **[4 inches] [6 inches] [8 inches] <Insert dimension>** high unless otherwise indicated, and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated or unless required for seismic anchor support.
 3. Minimum Compressive Strength: **[5000 psi] [4500 psi] [4000 psi] [3500 psi] [3000 psi] <Insert value>** at 28 days.
 4. 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 concrete base.
 5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete substrate.
 6. Prior to pouring concrete, place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 7. Cast anchor-bolt insert into bases. Install anchor bolts to elevations required for proper attachment to supported 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.

3.12 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 305.1 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h 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 remainder of 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.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
 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.
 - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
 - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
 - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies does not interfere with bonding of floor covering used on Project.
 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.
 - a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer[**unless manufacturer certifies curing compound does not interfere with bonding of floor covering used on Project**].
 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.

3.13 LIQUID FLOOR TREATMENT APPLICATION

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

1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
 2. Do not apply to concrete that is less than **[three] [seven] [14] [28]** days' old.
 3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.
- 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.

3.14 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] [six]** 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 joints clean and dry.
- C. Install semirigid 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.

3.15 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 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 to solid concrete. Limit cut depth to 3/4 inch. 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 matches 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 Architect.
- 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 1 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 Architect's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.16 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
- C. Inspections:
 - 1. Steel reinforcement placement.
 - 2. Steel reinforcement welding.
 - 3. Headed bolts and studs.
 - 4. Verification of use of required design mixture.
 - 5. Concrete placement, including conveying and depositing.
 - 6. Curing procedures and maintenance of curing temperature.
 - 7. Verification of concrete strength before removal of shores and forms from beams and slabs.
- D. Concrete Formwork Inspection:
 - 1. Inspect formwork for size, shape, profile, condition of surfaces and joints and for attachment of accessories and embedded items before concrete is placed.
- E. Steel Reinforcement Inspection:
 - 1. Reinforcing shall be inspected prior to placing of concrete. Inspect all reinforcing for conformance with Contract requirements with regard to bar size, grade, placement, splice lengths, clearance from soil or formwork, supports, and attachment of accessories and embedded items. Inspection shall be according to ACI 318 and IBC, chapter 19. Inspect all reinforcing steel that is welded according to AWS D1.4 , IBC chapter 10, and ACI 318.
 - 2. Inspect all bolts and embedded items that will be cast into concrete. Verify size, spacing, embedment length, and location according to IBC chapter 19.
- F. Concrete Tests: Testing 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. or fraction thereof of each concrete mixture placed each day.
 - a. When frequency of testing provides 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, for normal-weight concrete; **[ASTM C 173/C 173M, volumetric method, for structural lightweight**

- concrete;** one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.
 5. Unit Weight: ASTM C 567/C 567M, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 6. Compression Test Specimens: ASTM C 31/C 31M.
 - a. Cast and field cure four 6x12 or five 4x8 cylinder specimens for each composite sample.
 7. Compressive-Strength Tests: ASTM C 39/C 39M; test one 6x12 or 4x8 laboratory-cured specimens at 7 days and one set of two 6x12 or three 4x8 specimens at 28 days. One specimen will be retained in reserve for later testing if required.
 - a. A compressive-strength test shall be the average compressive strength from a set of specimens obtained from same composite sample and tested at age indicated.
 8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
 9. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
 10. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
 11. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
 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 Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
 13. Additional testing and inspecting, at Contractor'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 inspections indicate do not comply with the Contract Documents.
- G. Measure floor and slab flatness and levelness according to ASTM E 1155 within [24] [48] <Insert number> hours of finishing.

3.17 PROTECTION OF LIQUID FLOOR TREATMENTS

- A. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

END OF SECTION 033000

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SECTION 042200 - CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

1. Concrete masonry units.
2. Decorative concrete masonry units.
3. Pre-faced concrete masonry units.
4. Mortar and grout.
5. Steel reinforcing bars.
6. Masonry-joint reinforcement.
7. Embedded flashing.
8. Miscellaneous masonry accessories.
9. Masonry-cell fill.

- B. Products Installed but not Furnished under This Section:

1. Cast-stone trim in concrete unit masonry.

- C. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for dovetail slots for masonry anchors.
2. Section 051200 "Structural Steel Framing" for installing anchor sections of adjustable masonry anchors for connecting to structural steel frame.
3. Section 071900 "Water Repellents" for water repellents applied to unit masonry assemblies.
4. Section 076200 "Sheet Metal Flashing and Trim" for sheet metal flashing and for furnishing manufactured reglets installed in masonry joints.
5. Section 089516 "Wall Vents" for wall vents (brick vents).
6. Section 323223 "Segmental Retaining Walls" for dry-laid, concrete unit retaining walls.

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 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
 - 1. Product Certificates: For materials manufactured within 100 miles of Project, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each raw material.
- C. 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. Show elevations of reinforced walls at $\frac{1}{4}" = 1'-0"$ scale, minimum.
 - 3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

1.6 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.
 - 2. Integral water repellant used in CMUs.
 - 3. Cementitious materials. Include name of manufacturer, brand name, and type.
 - 4. Mortar admixtures.
 - 5. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
 - 6. Grout mixes. Include description of type and proportions of ingredients.
 - 7. Reinforcing bars.
 - 8. Joint reinforcement.

9. Anchors, ties, and metal accessories.

- 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.

1.7 QUALITY ASSURANCE

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

1.8 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. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. 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.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.9 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 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 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 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 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.

2.3 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: 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 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 authorities having jurisdiction.

2.4 CONCRETE MASONRY UNITS

- A. Regional Materials: CMUs shall be manufactured within 100 miles of Project site from aggregates that have been extracted, harvested, or recovered, as well as manufactured, within 100 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]** **[bullnose]** units for outside corners unless otherwise indicated.
- C. Integral Water Repellent: Provide units made with integral water repellent **[for exposed units]** **[and]** **[where indicated]**.
 - 1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested according to ASTM E 514/E 514M as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive, with test period extended to 24 hours, shall show no visible water or leaks on the back of test specimen.

- D. Insulated CMUs: Where indicated, units shall contain rigid, specially shaped, cellular thermal insulation units complying with ASTM C 578, Type I, designed for installing in cores of masonry units.
- E. CMUs: ASTM C 90.
1. Density Classification: Lightweight.
 2. Size (Width): Manufactured to dimensions 3/8 inch less-than-nominal dimensions.
 3. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.
 4. Faces to Receive Plaster: Where units are indicated to receive a direct application of plaster, provide textured-face units made with gap-graded aggregates.
- F. Concrete Building Brick: ASTM C 55.
1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of **[2800 psi] [3050 psi] [3750 psi] [4050 psi] <Insert value>**.
 2. Density Classification: **[Lightweight] [Medium weight] [Normal weight]**.
 3. Size (Actual Dimensions): 3-5/8 inches wide by **[2-1/4 inches] [2-3/4 inches] [3-5/8 inches]** high by 7-5/8 inches long.
- G. Decorative CMUs: ASTM C 90.
1. Density Classification: Lightweight.
 2. Size (Width): Manufactured to dimensions specified in "CMUs" Paragraph.
 3. Pattern and Texture:
 - a. Standard pattern, ground-face finish. **[Match Architect's samples.]**
 - b. Standard pattern, split-face finish. **[Match Architect's samples.]**
 - c. Standard pattern, split-ribbed finish. **[Match Architect's samples.]**
 - d. Scored vertically so units laid in running bond appear as square units laid in stacked bond, standard finish. **[Match Architect's samples.]**
 - e. Triple scored vertically so units laid in running bond appear as vertical units laid in stacked bond (soldier courses), standard finish. **[Match Architect's samples.]**
 4. Colors: **[As indicated by manufacturer's designations] [Match Architect's samples] [As selected by Architect from manufacturer's full range]**.
 5. Special Aggregate: Provide units made with aggregate matching aggregate in Architect's sample.
- H. Pre-faced CMUs: Lightweight **[hollow] [solid]** concrete units complying with ASTM C 90, with manufacturer's standard smooth resinous facing complying with ASTM C 744.
1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of **[2150 psi] [2800 psi] [3050 psi] <Insert value>**.
 2. Size: Manufactured to dimensions specified in "CMUs" Paragraph but with pre-faced surfaces having 1/16-inch- wide returns of facing to create 1/4-inch- wide mortar joints with modular coursing.

3. Colors and Patterns: **[As indicated by manufacturer's designations] [Match Architect's samples] [As selected by Architect from manufacturer's full range]**.

2.5 MORTAR AND GROUT MATERIALS

- A. **Regional Materials:** Aggregate for mortar and grout[, **cement, and lime**] shall be manufactured within 100 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 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. Masonry Cement: ASTM C 91/C 91M.
- F. Mortar Cement: ASTM C 1329/C 1329M.
- G. 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.
- H. Colored Cement Products: Packaged blend made from **[portland cement and hydrated lime] [masonry cement] [or] [mortar cement]** and mortar pigments, all complying with specified requirements, and containing no other ingredients.
 1. Colored Portland Cement-Lime Mix:
 2. Colored Masonry Cement:
 3. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
 4. Pigments shall not exceed 10 percent of portland cement by weight.
 5. Pigments shall not exceed 5 percent of **[masonry cement] [or] [mortar cement]** by weight.
- I. 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.
- J. Aggregate for Grout: ASTM C 404.
- K. Epoxy Pointing Mortar: ASTM C 395, epoxy-resin-based material formulated for use as pointing mortar for glazed or pre-faced masonry units (and approved for such use by manufacturer of units); in color indicated or, if not otherwise indicated, as selected by Architect from manufacturer's colors.
- L. 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.
- M. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent from same manufacturer.
- N. Water: Potable.

2.6 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.
- C. Masonry-Joint Reinforcement, General: Ladder type complying with ASTM A 951/A 951M.
1. Interior Walls: **[Mill-] [Hot-dip]** galvanized carbon steel.
 2. Exterior Walls: **[Hot-dip galvanized carbon] [Stainless]** steel.
 3. Wire Size for Side Rods: **[0.148-inch] [0.187-inch]** diameter.
 4. Wire Size for Cross Rods: **[0.148-inch] [0.187-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**].

2.7 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. Mill-Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M, with ASTM A 641/A 641M, Class 1 coating.
 - 2. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M, with ASTM A 153/A 153M, Class B-2 coating.
 - 3. Galvanized-Steel Sheet: ASTM A 653/A 653M, Commercial Steel, G60 zinc coating.
 - 4. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, with ASTM A 153/A 153M, Class B coating.
 - 5. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
 - 1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch- diameter, hot-dip galvanized steel wire.
 - 2. Tie Section: Triangular-shaped wire tie made from 0.187-inch- diameter, hot-dip galvanized steel wire.
- D. Adjustable Anchors for Connecting to Concrete: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
 - 1. Connector Section: Dovetail tabs for inserting into dovetail slots in concrete and attached to tie section; formed from 0.060-inch- thick steel sheet, galvanized after fabrication.
 - a. 0.064-inch- thick, galvanized-steel sheet may be used at interior walls unless otherwise indicated.
 - 2. Tie Section: Triangular-shaped wire tie made from 0.187-inch- diameter, hot-dip galvanized steel wire.
 - 3. Corrugated-Metal Ties: Metal strips not less than 7/8 inch wide with corrugations having a wavelength of 0.3 to 0.5 inch and an amplitude of 0.06 to 0.10 inch made from 0.060-inch- thick steel sheet, galvanized after fabrication with dovetail tabs for inserting into dovetail slots in concrete.
 - a. 0.064-inch- thick, galvanized sheet may be used at interior walls unless otherwise indicated.
- E. Partition Top Anchors: 0.105-inch- thick metal plate with a 3/8-inch- diameter metal rod 6 inches long welded to plate and with closed-end plastic tube fitted over rod that

allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.

- F. Rigid Anchors: Fabricate from steel bars 1-1/2 inches wide by 1/4 inch thick by 24 inches long, with ends turned up 2 inches or with cross pins unless otherwise indicated.

- 1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A 153/A 153M.

2.8 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. 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).

2.9 MASONRY-CELL FILL

- A. Loose-Fill Insulation: Perlite complying with ASTM C 549, Type II (surface treated for water repellency and limited moisture absorption) or Type IV (surface treated for water repellency and to limit dust generation).
- B. Lightweight-Aggregate Fill: ASTM C 331/C 331M.

2.10 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 masonry cement or mortar 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. 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.
1. For masonry below grade or in contact with earth, use Type M.
 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 and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions; and for other applications where another type is not indicated, use Type N.
 5. For interior nonload-bearing partitions, Type O may be used instead of Type N.
- D. 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. Mix to match Architect's sample.
 4. Application: Use pigmented mortar for exposed mortar joints with the following units:
 - a. Decorative CMUs.
 - b. Pre-faced CMUs.
 - c. 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 Architect's sample.
 2. Application: Use colored-aggregate mortar for exposed mortar joints with the following units:
 - a. Decorative CMUs.
 - b. Pre-faced CMUs.
 - c. 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.
- G. Epoxy Pointing Mortar: Mix epoxy pointing mortar to comply with mortar manufacturer's written instructions.

1. Application: Use epoxy pointing mortar for exposed mortar joints with pre-faced CMUs.

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 1/2 inch or minus 1/4 inch.
 2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
 3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet, or 1/2-inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2-inch maximum.
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; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.
- 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 with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.
- 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. Wedge nonload-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.
 - 4. 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 in mortar in all courses of piers, columns, and pilasters.
 - 3. Bed webs 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. Rake out mortar joints at pre-faced CMUs to a uniform depth of 1/4 inch and point with epoxy mortar to comply with epoxy-mortar manufacturer's written instructions.
- E. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
- F. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.
- G. Cut joints flush where indicated to receive waterproofing unless otherwise indicated.

3.6 MASONRY-CELL FILL

- A. Pour loose-fill insulation into cavities to fill void spaces. Maintain inspection ports to show presence of fill at extremities of each pour area. Close the ports after filling has been confirmed. Limit the fall of fill to one story high, but not more than 20 feet.
- B. Install molded-polystyrene insulation units into masonry unit cells before laying units.

3.7 MASONRY-JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
1. Space reinforcement not more than 16 inches o.c.
 2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
 3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings in addition to continuous reinforcement.
- B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.
- C. Provide continuity at wall intersections by using prefabricated T-shaped units.
- D. Provide continuity at corners by using prefabricated L-shaped units.
- E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.8 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 1/2 inch wide 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, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.9 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 using one of the following methods:
1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout, and rake out joints in exposed faces for application of sealant.
 2. Install preformed control-joint gaskets designed to fit standard sash block.
 3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar, or rake out joint for application of sealant.
 4. Install temporary foam-plastic filler in head joints, and remove filler when unit masonry is complete for application of sealant.

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 into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
 3. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches 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 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 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**] [**12.67 ft.**] **<Insert height>**.

3.12 FIELD QUALITY CONTROL

- A. Testing and Inspecting: 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 Contractor's expense.
- B. Inspections: Special inspections according to Level **[B]** **[C]** in TMS 402/ACI 530/ASCE 5.
 - 1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
 - 2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
 - 3. Place grout only after inspectors have verified proportions of site-prepared grout.
- C. Testing Prior to Construction: One set of tests.
- D. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.
- E. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.
- F. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.
- G. Mortar Test (Property Specification): For each mix provided, according to ASTM C 780. Test mortar for **[mortar air content]** **[and]** **[compressive strength]**.
- H. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.
- I. Prism Test: For each type of construction provided, according to ASTM C 1314 at **[7 days and at]28 days**.

3.13 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 Architect's approval of sample cleaning before proceeding with cleaning of masonry.
 - 3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
 - 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
 - 5. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.

3.15 MASONRY WASTE DISPOSAL

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

END OF SECTION 042200

SECTION 042000 - UNIT MASONRY

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Concrete block.
- B. Common brick.
- C. Mortar and grout.
- D. Reinforcement and anchorage.
- E. Flashings.
- F. Lintels.
- G. Accessories.

1.2 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete: Installation of dovetail slots for masonry anchors.
- B. Section 040511 - Mortar and Masonry Grout.
- C. Section 061000 - Rough Carpentry: Nailing strips built into masonry.
- D. Section 072100 - Thermal Insulation: Insulation for cavity spaces.
- E. Section 072500 - Weather Barriers: Water-resistive barriers or air barriers applied to the exterior face of the backing sheathing or masonry.
- F. Section 079200 - Joint Sealants: Sealing control and expansion joints.

1.3 REFERENCE STANDARDS

- A. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement 2018, with Editorial Revision.
- B. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire 2019.

- C. ASTM A951/A951M - Standard Specification for Steel Wire for Masonry Joint Reinforcement 2016, with Editorial Revision (2018).
- D. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete 2018a.
- E. ASTM C62 - Standard Specification for Building Brick (Solid Masonry Units Made From Clay or Shale) 2017.
- F. ASTM C91/C91M - Standard Specification for Masonry Cement 2018.
- G. ASTM C129 - Standard Specification for Nonloadbearing Concrete Masonry Units 2017.
- H. ASTM C140/C140M - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units 2018a.
- I. ASTM C150/C150M - Standard Specification for Portland Cement 2019a.
- J. ASTM C404 - Standard Specification for Aggregates for Masonry Grout 2018.
- K. BIA Technical Notes No. 7 - Water Penetration Resistance – Design and Detailing 2017.
- L. BIA Technical Notes No. 13 - Ceramic Glazed Brick Exterior Walls 2017.
- M. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures 2016.

1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar and masonry accessories.
- C. Shop Drawings: Indicate pertinent dimensions, materials, anchorage, size and type of fasteners, and accessories for brickwork support system.
- D. Samples: Submit four samples of decorative block units to illustrate color, texture, and extremes of color range.
- E. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

- F. Test Reports: Concrete masonry manufacturer's test reports for units with integral water repellent admixture.
- G. Designer's Qualification Statement.
- H. Manufacturer's Qualification Statement.
- I. Installer's Qualification Statement.
- J. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

PART 2 PRODUCTS

2.1 CONCRETE MASONRY UNITS

- A. Concrete Block: Comply with referenced standards and as follows:
 - 1. Size: Standard units with nominal face dimensions of 16 by 8 inches and nominal depth of 8 inches.
 - 2. Non-Loadbearing Units: ASTM C129.
 - a. Hollow block, as indicated.
 - b. Lightweight.

2.2 BRICK UNITS

- A. Manufacturers:

1. [].
 2. [].
 3. Substitutions: See section 016000 - Product Requirements.
- B. Building (Common) Brick: ASTM C62, Grade SW; solid units.
1. Nominal size: To Match Existing - Common Brick Size.

2.3 MORTAR AND GROUT MATERIALS

- A. Mortar and Grout: As specified in Section 040511.
- B. Masonry Cement: ASTM C91/C91M, Type N.
1. Manufacturers:
 - a. [].
 - b. [].
 - c. Substitutions: See Section 016000 - Product Requirements.
- C. Portland Cement: ASTM C150/C150M, Type I; color as required to produce approved color sample.
- D. Grout Aggregate: ASTM C404.

2.4 REINFORCEMENT AND ANCHORAGE

- A. Manufacturers:
1. Blok-Lok Limited: www.blok-lok.com/#sle.
 2. WIRE-BOND www.wirebond.com/#sle.
- B. Reinforcing Steel: ASTM A615/A615M, Grade 40 (40,000 psi), deformed billet bars; galvanized.
- C. Joint Reinforcement: Use ladder type joint reinforcement where vertical reinforcement is involved and truss type elsewhere, unless otherwise indicated.
- D. Single Wythe Joint Reinforcement: ASTM A951/A951M.
1. Type: Truss or ladder.

2. Material: ASTM A1064/A1064M steel wire, mill galvanized to ASTM A641/A641M Class 3.
3. Size: 0.1483 inch side rods with 0.1483 inch cross rods; width as required to provide not less than 5/8 inch of mortar coverage on each exposure.

2.5 FLASHINGS

A. Metal Flashing Materials:

1. Prefabricated Metal Flashing: Smooth fabricated 12 oz/sq ft copper flashing for surface mounted conditions.

2.6 ACCESSORIES

A. Preformed Control Joints: Rubber material. Provide with corner and tee accessories, fused joints.

1. Manufacturers:

- a. Blok-Lok Limited: www.blok-lok.com/#sle.
- b. WIRE-BOND: www.wirebond.com/#sle.

B. Joint Filler: Closed cell polyvinyl chloride; oversized 50 percent to joint width; self expanding; in maximum lengths available.

C. Cavity Mortar Control: Semi-rigid polyethylene or polyester mesh panels, sized to thickness of wall cavity, and designed to prevent mortar droppings from clogging weeps and cavity vents and allow proper cavity drainage.

1. Full-Height Airspace Maintenance and Drainage Material: Mesh panels, fitted between masonry ties.

a. Manufacturers:

- 1) Advanced Building Products, Inc; Mortairvent-CW: www.advancedbuildingproducts.com/#sle.
- 2) CavClear/Archovations, Inc; CavClear Masonry Mat: www.cavclear.com/#sle.
- 3) CavClear/Archovations, Inc; CavClear Polyisocyanurate Insulation System: www.cavclear.com/#sle.

D. Weeps:

1. Type: Polyester mesh.
2. Manufacturers:
 - a. Advanced Building Products, Inc: www.advancedbuildingproducts.com/#sle.
 - b. Blok-Lok Limited: www.blok-lok.com/#sle.
 - c. CavClear/Archovations, Inc: www.cavclear.com/#sle.

E. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive masonry.
- B. Verify that related items provided under other sections are properly sized and located.
- C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.2 PREPARATION

- A. Direct and coordinate placement of metal anchors supplied for installation under other sections.
- B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.3 COLD AND HOT WEATHER REQUIREMENTS

- A. Comply with requirements of ACI 530/530.1/ERTA or applicable building code, whichever is more stringent.

3.4 COURSING

- A. Establish lines, levels, and coursing indicated. Protect from displacement.
- B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
- C. Concrete Masonry Units:
 1. Bond: Running.

2. Coursing: One unit and one mortar joint to equal 8 inches.

3. Mortar Joints: Concave.

D. Brick Units:

1. Bond: Running.

2. Coursing: Three units and three mortar joints to equal 8 inches.

3. Mortar Joints: Concave.

3.5 PLACING AND BONDING

A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.

B. Remove excess mortar and mortar smears as work progresses.

C. Remove excess mortar with water repellent admixture promptly. Do not use acids, sandblasting or high pressure cleaning methods.

D. Interlock intersections and external corners, except for units laid in stack bond.

E. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

F. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

G. Cut mortar joints flush where wall tile is scheduled or resilient base is scheduled.

3.6 WEEPS/CAVITY VENTS

A. Install weeps in veneer and cavity walls at 24 inches on center horizontally on top of through-wall flashing above shelf angles and lintels and at bottom of walls.

3.7 CAVITY MORTAR CONTROL

A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.

3.8 REINFORCEMENT AND ANCHORAGE - GENERAL, SINGLE WYTHE MASONRY AND CAVITY WALL MASONRY

- A. Unless otherwise indicated on drawings or specified under specific wall type, install horizontal joint reinforcement 16 inches on center.
- B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.
- C. Place continuous joint reinforcement in first and second joint below top of walls.

3.9 MASONRY FLASHINGS

- A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.
- B. Terminate flashing up 8 inches minimum on vertical surface of backing:
 - 1. Install vertical leg of flashing over fluid-applied or self-adhered air/vapor barriers over backing or per manufacturer's directions.

3.10 LINTELS

- A. Install loose steel lintels over openings.

3.11 CONTROL AND EXPANSION JOINTS

- A. Do not continue horizontal joint reinforcement through control or expansion joints.
- B. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.

3.12 TOLERANCES

- A. Install masonry within the site tolerances found in TMS 402/602.
- B. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.
- C. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.
- D. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.
- E. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.

3.13 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 014000 - Quality Requirements.
- B. Concrete Masonry Unit Tests: Test each variety of concrete unit masonry in accordance with ASTM C140/C140M for compliance with requirements of this specification.

3.14 CLEANING

- A. Remove excess mortar and mortar droppings.
- B. Replace defective mortar. Match adjacent work.
- C. Clean soiled surfaces with cleaning solution.
- D. Use non-metallic tools in cleaning operations.

3.15 PROTECTION

- A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

END OF SECTION

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SECTION 042001 - MASONRY VENEER

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Clay facing brick.
- B. Mortar and grout.
- C. Reinforcement and anchorage.
- D. Flashings.
- E. Installation of lintels.

1.2 RELATED REQUIREMENTS

- A. Section 079200 - Joint Sealants: Sealing control and expansion joints.

1.3 REFERENCE STANDARDS

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- B. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement 2018, with Editorial Revision.
- C. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire 2019.
- D. ASTM A951/A951M - Standard Specification for Steel Wire for Masonry Joint Reinforcement 2016, with Editorial Revision (2018).
- E. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete 2018a.
- F. ASTM C91/C91M - Standard Specification for Masonry Cement 2018.
- G. ASTM C150/C150M - Standard Specification for Portland Cement 2019a.
- H. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made From Clay or Shale) 2019.
- I. ASTM C270 - Standard Specification for Mortar for Unit Masonry 2019.

- J. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures 2016.

1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data for masonry units, fabricated wire reinforcement and mortar.
- C. Samples: Submit 2 samples of decorative block units to illustrate color, texture, and extremes of color range.
- D. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

- A. Comply with provisions of ACI 530/530.1/ERTA, except where exceeded by requirements of Contract Documents.
- B. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section with minimum three years of documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

1.7 FIELD CONDITIONS

- A. Cold and Hot Weather Requirements: Comply with requirements of ACI 530/530.1/ERTA or applicable building code, whichever is more stringent.

PART 2 PRODUCTS

2.1 UNIT MASONRY - GENERAL

2.2 BRICK UNITS

- A. Manufacturers:

1. [_____].

- B. Facing Brick: ASTM C216, Type FBS Smooth, Grade SW.

1. Color and Texture: To Match Existing.

2.3 MORTAR AND GROUT MATERIALS

- A. Masonry Cement: ASTM C91/C91M Type N.
- B. Portland Cement: ASTM C150/C150M, Type I; color as required to produce approved color sample.
- C. Water: Clean and potable.

2.4 REINFORCEMENT AND ANCHORAGE

- A. Reinforcing Steel: ASTM A615/A615M, Grade 40 (40,000 psi) yield strength, deformed billet bars; galvanized.
- B. Joint Reinforcement Standard: ASTM A951/A951M.
 1. Type: Truss or ladder.
 2. Material: ASTM A1064/A1064M steel wire, mill galvanized to ASTM A641/A641M Class 3.
 3. Size: 0.1483 inch side rods with 0.1483 inch cross rods; width as required to provide not less than 5/8 inch of mortar coverage on each exposure.
- C. Masonry Veneer Anchors: 2-piece anchors that permit differential movement between masonry veneer and structural backup, hot dip galvanized to ASTM A 153/A 153M, Class B.
 1. Anchor plates: Not less than 0.075 inch thick, designed for fastening to structural backup through sheathing by two fasteners; provide design with legs that penetrate sheathing and insulation to provide positive anchorage.
 2. Wire ties: Manufacturer's standard shape, 0.1875 inch thick.
 3. Vertical adjustment: Not less than 3-1/2 inches.

2.5 FLASHINGS

- A. Metal Flashing Materials:

2.6 MORTAR AND GROUT MIXING

- A. Mortar for Unit Masonry: ASTM C270, Proportion Specification.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive masonry.
- B. Verify that related items provided under other sections are properly sized and located.
- C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.2 COURSING

- A. Establish lines, levels, and coursing indicated. Protect from displacement.
- B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
- C. Brick Units:
 - 1. Bond: Running.
 - 2. Coursing: Three units and three mortar joints to equal 8 inches.
 - 3. Mortar Joints: Concave.

3.3 PLACING AND BONDING

- A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.

3.4 WEEPS/CAVITY VENTS

- A. Install weeps in veneer walls at 24 inches on center horizontally on top of through-wall flashing above shelf angles and lintels and at bottom of walls.
- B. Install cavity vents in veneer walls at 32 inches on center horizontally below shelf angles and lintels and at top of walls.

3.5 CAVITY MORTAR CONTROL

- A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.
- B. For cavity walls, build inner wythe ahead of outer wythe to accommodate accessories.

- C. Install cavity mortar control panels continuously throughout full height of exterior masonry cavities during construction of exterior wythe, complying with manufacturer's installation instructions.

- 1. Verify that airspace width is no more than 3/8 inch greater than panel thickness.

3.6 REINFORCEMENT AND ANCHORAGE - MASONRY VENEER

- A. Install horizontal joint reinforcement 16 inches on center.
- B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.
- C. Embed longitudinal wires of joint reinforcement in mortar joint with at least 5/8 inch mortar cover on each side.
- D. Lap joint reinforcement ends minimum 6 inches.
- E. Stud back-Up: Secure veneer anchors to stud framed back-up and embed into masonry veneer at maximum 1.77 sq ft of wall surface per anchor. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches on center.

3.7 MASONRY FLASHINGS

- A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.
- B. Terminate flashing up 8 inches minimum on vertical surface of backing:

3.8 LINTELS

- A. Install loose steel lintels over openings.
- B. Maintain minimum 8 inch bearing on each side of opening.

3.9 CONTROL AND EXPANSION JOINTS

- A. Do not continue horizontal joint reinforcement through control or expansion joints.
- B. Form control joint with a sheet building paper bond breaker fitted to one side of the hollow contour end of the block unit. Fill the resultant core with grout fill. Rake joint at exposed unit faces for placement of backer rod and sealant.
- C. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.

- D. Size control joints as indicated on drawings; if not indicated, 3/4 inch wide and deep.
- E. Form expansion joint as detailed on drawings.

3.10 TOLERANCES

- A. Install masonry within the site tolerances found in TMS 402/602.

3.11 CUTTING AND FITTING

- A. Cut and fit for pipes and conduit. Coordinate with other sections of work to provide correct size, shape, and location.

3.12 CLEANING

- A. Remove excess mortar and mortar smears as work progresses.
- B. Replace defective mortar. Match adjacent work.
- C. Clean soiled surfaces with cleaning solution.
- D. Use non-metallic tools in cleaning operations.

3.13 PROTECTION

- A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

END OF SECTION

SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

1. Structural steel.
2. Prefabricated building columns.
3. Field-installed shear connectors.
4. Grout.

- B. Related Requirements:

1. Section 051213 "Architecturally Exposed Structural Steel Framing" for additional requirements for architecturally exposed structural steel.
2. Section 053100 "Steel Decking" for field installation of shear connectors through deck.
3. Section 055000 "Metal Fabrications" for steel lintels and shelf angles not attached to structural-steel frame miscellaneous steel fabrications and other steel items not defined as structural steel.

DEFINITIONS

- C. Structural Steel: Elements of the structural frame indicated on Drawings and as described in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."
- D. Architecturally Exposed Structural Steel: Structural steel designated as architecturally exposed structural steel in the Contract Documents.

1.3 COORDINATION

- A. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

1.4 PREINSTALLATION MEETINGS

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

1.5 ACTION SUBMITTALS

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

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and fabricator.
- B. Welding certificates.
- C. Mill test reports for structural steel, including chemical and physical properties.
- D. Product Test Reports: For the following:
 - 1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
 - 2. Direct-tension indicators.
 - 3. Tension-control, high-strength, bolt-nut-washer assemblies.
 - 4. Shear stud connectors.
 - 5. Shop primers.
 - 6. Nonshrink grout.
- E. Source quality-control reports.
- F. Field quality-control and special inspection reports.

1.7 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.
 - 1. If a fabricator is not AISC-Certified, additional documentation and shop inspection according to AISC 360 Chapter N, and as determined by the structural engineer of record will be required.
- B. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.
- C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- D. Comply with applicable provisions of the following specifications and documents:
 - 1. AISC 303.
 - 2. AISC 341 and AISC 341s1.
 - 3. AISC 360.
 - 4. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
 - 1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
- B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
 - 1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
 - 2. Clean and relubricate bolts and nuts that become dry or rusty before use.
 - 3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator to withstand loads indicated and comply with other information and restrictions indicated.

1. Select and complete connections using schematic details indicated and AISC 360.
 2. Use Load and Resistance Factor Design; data are given at factored-load level.
- B. Moment Connections: Type FR, fully restrained.
- C. Construction: Combined system of braced frame and shear walls.

2.2 STRUCTURAL-STEEL MATERIALS

- A. **Recycled Content of Steel Products:** Postconsumer recycled content plus one-half of preconsumer recycled content not less than [25] [50] <Insert value> percent.
- B. W-Shapes: ASTM A 992/A 992M ASTM or A 572/A 572M, Grade 50.
- C. Channels, Angles-Shapes: ASTM A 36/A 36M.
- D. Plate and Bar: ASTM A 36/A 36M.
- E. Cold-Formed Hollow Structural Sections: ASTM A 500/A 500M, Grade C (50 ksi), structural tubing.
- F. Steel Pipe: ASTM A 53/A 53M, Type E or Type S, Grade B.
- G. Welding Electrodes: Comply with AWS requirements.

2.3 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers; all with plain finish.
1. Direct-Tension Indicators: ASTM F 959, Type 325, compressible-washer type with plain finish.
- B. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, heavy-hex head assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.
1. Finish: Plain.
- C. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.
- D. Unheaded Anchor Rods: ASTM F 1554, Grade 36 or ASTM F 1554, Grade 55, weldable.
1. Configuration: Straight.
 2. Nuts: ASTM A 563 heavy-hex carbon steel.
 3. Plate Washers: ASTM A 36/A 36M carbon steel.

4. Washers: ASTM F 436, Type 1, hardened carbon steel.
 5. Finish: Plain or Hot-dip zinc coating, ASTM A 153/A 153M, Class C.
- E. Headed Anchor Rods: ASTM F 1554, Grade 36 or ASTM F 1554, Grade 55, weldable, straight.
1. Nuts: ASTM A 563 heavy-hex carbon steel.
 2. Plate Washers: ASTM A 36/A 36M carbon steel.
 3. Washers: ASTM F 436, Type 1, hardened carbon steel.
 4. Finish: Plain or Hot-dip zinc coating, ASTM A 153/A 153M, Class C.
- F. Threaded Rods: ASTM A 36/A 36M.
1. Nuts: ASTM A 563 heavy-hex carbon steel.
 2. Washers: ASTM F 436, Type 1, hardened carbon steel.
 3. Finish: Plain or Hot-dip zinc coating, ASTM A 153/A 153M, Class C.
- G. Clevises and Turnbuckles: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1035.

2.4 PRIMER

- A. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.
- B. Galvanizing Repair Paint: ASTM A 780/A 780M.

2.5 GROUT

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

2.6 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," and to AISC 360.
1. Camber structural-steel members where indicated.
 2. Fabricate beams with rolling camber up.
 3. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
 4. Mark and match-mark materials for field assembly.
 5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

- B. Architecturally Exposed Structural Steel: Comply with fabrication requirements, including tolerance limits, of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for structural steel identified as architecturally exposed structural steel.
 - 1. Fabricate with exposed surfaces smooth, square, and free of surface blemishes including pitting, rust, scale, seam marks, roller marks, rolled trade names, and roughness.
 - 2. Remove blemishes by filling or grinding or by welding and grinding, before cleaning, treating, and shop priming.
- C. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
 - 1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.
- D. Bolt Holes: Cut, drill, mechanically thermal cut, or punch standard bolt holes perpendicular to metal surfaces.
- E. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- F. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 2, "Hand Tool Cleaning."
- G. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.
- H. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.
 - 1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
 - 2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
 - 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.7 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened.
- B. Weld Connections: Comply with AWS D1.1/D1.1M[and **AWS D1.8/D1.8M**] for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

2.8 SHOP PRIMING

A. Shop prime steel surfaces except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
2. Surfaces to be field welded.
3. Surfaces of high-strength bolted, slip-critical connections.
4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
5. Galvanized surfaces.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:

1. SSPC-SP 2, "Hand Tool Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

(0.038 mm) (0.025 mm) Painting: Prepare steel and apply a one-coat, nonasphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 1.5 mils.

2.9 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.

1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.
2. Galvanize lintels and shelf angles attached to structural-steel frame and located in exterior walls.

2.10 SOURCE QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform shop tests and inspections.

1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
- B. Bolted Connections: Inspect shop-bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- C. Welded Connections: Visually inspect shop-welded connections according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 1. Liquid Penetrant Inspection: ASTM E 165.
 2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
 3. Ultrasonic Inspection: ASTM E 164.
 4. Radiographic Inspection: ASTM E 94.
- D. In addition to visual inspection, test and inspect shop-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
 1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
 2. Conduct tests according to requirements in AWS D1.1/D1.1M on additional shear connectors if weld fracture occurs on shear connectors already tested.
- E. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

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

3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
- B. Baseplates and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Weld plate washers to top of baseplate.
 - 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 - 4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- C. Maintain erection tolerances of structural steel **[and architecturally exposed structural steel]** within AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."
- D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of structure.
 - 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- E. Splice members only where indicated.
- F. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.
- G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.
- H. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened.

- B. Weld Connections: Comply with AWS D1.1/D1.1M[**and AWS D1.8/D1.8M**] for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
 2. Remove backing bars or runoff tabs[**where indicated**], back gouge, and grind steel smooth.
 3. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," for mill material.

3.5 PREFABRICATED BUILDING COLUMNS

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

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Bolted Connections: Inspect bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- C. Welded Connections: Visually inspect field welds according to AWS D1.1/D1.1M.
1. In addition to visual inspection, test and inspect field welds according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 - a. Liquid Penetrant Inspection: ASTM E 165.
 - b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
 - c. Ultrasonic Inspection: ASTM E 164.
 - d. Radiographic Inspection: ASTM E 94.
 2. Inspect joint geometry for fit-up prior to welding.
 3. Full penetration groove welds shall be ultrasonically tested.
 4. Inspect pre-heat, post-heat and surface preparation between passes. Verify size and length of fillet welds.
- D. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.

2. Conduct tests according to requirements in AWS D1.1/D1.1M on additional shear connectors if weld fracture occurs on shear connectors already tested.

3.7 REPAIRS AND PROTECTION

- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780/A 780M.
- B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
- C. Touchup Priming: Cleaning and touchup priming are specified in Section 099600 "High-Performance Coatings."

END OF SECTION 051200

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SECTION 052100 - STEEL JOIST FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

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

- B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for installing bearing plates in concrete.
2. Section 042000 "Unit Masonry" for installing bearing plates in unit masonry.

1.3 DEFINITIONS

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

1.4 ACTION SUBMITTALS

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

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

1.5 INFORMATIONAL SUBMITTALS

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

1.6 QUALITY ASSURANCE

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

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle joists as recommended in SJI's "Specifications."
- B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

1.8 SEQUENCING

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide special joists and connections capable of withstanding design loads indicated.
 - 1. Design special joists to withstand design loads with live-load deflections no greater than the following:
 - a. Floor Joists: Vertical deflection of 1/360 of the span.
 - b. Roof Joists: Vertical deflection of 1/240 of the span.

2.2 K-SERIES STEEL JOISTS

- A. Manufacture steel joists of type indicated according to "Standard Specification for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members, underslung ends, and parallel top chord.
 - 1. Joist Type: K-series steel joists and KCS-type K-series steel joists.
- B. Steel Joist Substitutes: Manufacture according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle or -channel members.
- C. Provide holes in chord members for connecting and securing other construction to joists.
- D. Top-Chord Extensions: Extend top chords of joists with SJI's Type S top-chord extensions where indicated, complying with SJI's "Specifications."
- E. Extended Ends: Extend bearing ends of joists with SJI's Type R extended ends where indicated, complying with SJI's "Specifications."
- F. Camber joists according to SJI's "Specifications."
- G. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds **1/4 inch per 12 inches (1:48)**.

2.3 LONG-SPAN STEEL JOISTS

- A. Manufacture steel joists according to "Standard Specification for Longspan Steel Joists, LH-Series and Deep Longspan Steel Joists, DLH-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members; of joist type and end and top-chord arrangements as follows:
 - 1. Joist Type: LH-series steel joists.
 - 2. End Arrangement: Underslung.

3. Top-Chord Arrangement: **[Parallel]** **[Pitched 1/8 inch per 12 inches (1:96), one way]** **[Pitched 1/8 inch per 12 inches (1:96), two ways]** <Insert pitch>.

- B. Provide holes in chord members for connecting and securing other construction to joists.
- C. Camber long-span steel joists according to SJI's "Specifications." unless otherwise noted.
- D. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds **1/4 inch per 12 inches (1:48)**.

2.4 PRIMERS

- A. Primer: SSPC-Paint 15, or manufacturer's standard shop primer complying with performance requirements in SSPC-Paint 15.

2.5 JOIST ACCESSORIES

- A. Bridging: Schematically indicated. Detail and fabricate according to SJI's "Specifications." Furnish additional erection bridging if required for stability.
- B. Fabricate steel bearing plates from ASTM A 36/A 36M steel with integral anchorages of sizes and thicknesses indicated. Shop prime paint.
- C. Furnish ceiling extensions, either extended bottom-chord elements or a separate extension unit of enough strength to support ceiling construction. Extend ends to within **1/2 inch (13 mm)** of finished wall surface unless otherwise indicated.
- D. High-Strength Bolts, Nuts, and Washers: **ASTM A 325 (ASTM A 325M)**, Type 1, heavy hex steel structural bolts; **ASTM A 563 (ASTM A 563M)** heavy hex carbon-steel nuts; and **ASTM F 436 (ASTM F 436M)** hardened carbon-steel washers.

- 1. Finish: Plain.

- E. Welding Electrodes: Comply with AWS standards.
- F. Furnish miscellaneous accessories including splice plates and bolts required by joist manufacturer to complete joist assembly.

2.6 CLEANING AND SHOP PAINTING

- A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories by hand-tool cleaning, SSPC-SP 2 or power-tool cleaning, SSPC-SP 3.
- B. Do not prime paint joists and accessories to receive sprayed fire-resistive materials.

- C. Apply one coat of shop primer to joists and joist accessories to be primed to provide a continuous, dry paint film not less than 1 mil (0.025 mm) thick.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION

- A. Do not install joists until supporting construction is in place and secured.
- B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications," joist manufacturer's written instructions, and requirements in this Section.
 - 1. Before installation, splice joists delivered to Project site in more than one piece.
 - 2. Space, adjust, and align joists accurately in location before permanently fastening.
 - 3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.
 - 4. Do not rigidly connect bottom-chord extensions to columns or supports.
- C. Field weld joists to supporting steel bearing plates and framework. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
- D. Bolt joists to supporting steel framework using high-strength structural bolts. Comply with RCSC's "Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts" for high-strength structural bolt installation and tightening requirements.
- E. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

- B. Visually inspect field welds according to AWS D1.1/D1.1M.
 - 1. In addition to visual inspection, test field welds according to AWS D1.1/D1.1M and the following procedures, at testing agency's option:
 - a. Liquid Penetrant Inspection: ASTM E 165/E 165M.
 - b. Magnetic Particle Inspection: ASTM E 709.
 - c. Ultrasonic Testing: ASTM E 164.
 - d. Radiographic Testing: ASTM E 94.
- C. Visually inspect bolted connections.
- D. Prepare test and inspection reports.

3.4 PROTECTION

- A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780/A 780M and manufacturer's written instructions.
- B. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists, bearing plates, abutting structural steel, and accessories.
 - 1. Clean and prepare surfaces by hand-tool cleaning according to SSPC-SP 2 or power-tool cleaning according to SSPC-SP 3.
 - 2. Apply a compatible primer of same type as primer used on adjacent surfaces.

END OF SECTION 052100

SECTION 053100 - STEEL DECKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Roof deck.
 - 2. Acoustical roof deck.
 - 3. Acoustical cellular roof deck.
 - 4. Composite floor deck.
 - 5. Noncomposite form deck.

- B. Related Requirements:

- 1. Section 033000 "Cast-in-Place Concrete" for normal-weight and lightweight structural concrete fill over steel deck.
 - 2. Section 035216 "Lightweight Insulating Concrete" for lightweight insulating concrete fill over steel deck.
 - 3. Section 051200 "Structural Steel Framing" for shop- and field-welded shear connectors.
 - 4. Section 055000 "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.
 - 5. Section 099113 "Exterior Painting" for repair painting of primed deck and finish painting of deck.
 - 6. Section 099123 "Interior Painting" for repair painting of primed deck and finish painting of deck.

1.3 ACTION SUBMITTALS

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

- B. Sustainable Design Submittals:

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

- C. Shop Drawings:

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

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Product Certificates: For each type of steel deck.
- C. Product Test Reports: For tests performed by a qualified testing agency, indicating that each of the following complies with requirements:
 1. Power-actuated mechanical fasteners.
 2. Acoustical roof deck.
- D. Evaluation Reports: For steel deck, from ICC-ES.
- E. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.
 1. Protect and ventilate acoustical cellular roof deck with factory-installed insulation to maintain insulation free of moisture.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

- B. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.
- C. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

2.2 ROOF DECK

- A. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:
 - 1. Prime-Painted Steel Sheet: ASTM A 1008/A 1008M, Structural Steel (SS), Grade 33 minimum, shop primed with manufacturer's standard baked-on, rust-inhibitive primer.
 - a. Color: **[Manufacturer's standard] [Gray] [White] [Gray top surface with white underside]**.
 - 2. Deck Profile: As indicated.
 - 3. Cellular Deck Profile: As indicated, with bottom plate.
 - 4. Profile Depth: As indicated.
 - 5. Design Uncoated-Steel Thickness: As indicated.
 - 6. Design Uncoated-Steel Thicknesses; Deck Unit/Bottom Plate: As indicated.
 - 7. Span Condition: As indicated.
 - 8. Side Laps: Overlapped or interlocking seam at Contractor's option.

2.3 ACOUSTICAL ROOF DECK

- A. Acoustical Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:
 - 1. Prime-Painted Steel Sheet: ASTM A 1008/A 1008M, Structural Steel (SS), Grade 33 minimum, shop primed with manufacturer's standard baked-on, rust-inhibitive primer.
 - a. Color: **[Manufacturer's standard] [Gray] [White] [Gray top surface with white underside]**.
 - 2. Deck Profile: As indicated.
 - 3. Cellular Deck Profile: As indicated, with bottom plate.
 - 4. Profile Depth: As indicated.
 - 5. Design Uncoated-Steel Thickness: As indicated.
 - 6. Design Uncoated-Steel Thicknesses; Deck Unit/Bottom Plate: As indicated.
 - 7. Span Condition: As indicated.
 - 8. Side Laps: Overlapped or interlocking seam at Contractor's option.

9. Acoustical Perforations: **[Deck units with manufacturer's standard perforated vertical webs] [Cellular deck units with manufacturer's standard perforated flat-bottom plate welded to ribbed deck].**
10. Sound-Absorbing Insulation: Manufacturer's standard premolded roll or strip of glass or mineral fiber..
 - a. Factory install sound-absorbing insulation into cells of cellular deck.
11. Acoustical Performance: NRC **[0.65] [0.75] [0.80] [0.85] [0.90]**, tested according to ASTM C 423.

2.4 COMPOSITE FLOOR DECK

- A. Composite Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 31, with the minimum section properties indicated, and with the following:
 1. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33, G30 zinc coating.
 2. Profile Depth: As indicated.
 3. Design Uncoated-Steel Thickness: As indicated.
 4. Span Condition: As indicated.

2.5 ACCESSORIES

- A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.
- C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.
- D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.
- E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
- F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi, of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 31 for overhang and slab depth.
- G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.

- H. Piercing Hanger Tabs: Piercing steel sheet hanger attachment devices for use with floor deck.
- I. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, **[0.0598 inch] [0.0747 inch]** thick, with factory-punched hole of 3/8-inch minimum diameter.
- J. Flat Sump Plates: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck. For drains, cut holes in the field.
- K. 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] [sloped]** recessed pans of 1-1/2-inch minimum depth. For drains, cut holes in the field.
- L. Galvanizing Repair Paint: SSPC-Paint 20 or MIL-P-21035B, with dry film containing a minimum of 94 percent zinc dust by weight.
- M. 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 of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.
- B. Install temporary shoring before placing deck panels if required to meet deflection limitations.
- C. Locate deck bundles to prevent overloading of supporting members.
- D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
 - 1. Align cellular deck panels over full length of cell runs and align cells at ends of abutting panels.
- E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

- F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
- H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
- I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.3 ROOF-DECK INSTALLATION

- A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches long, and as follows:
 - 1. Weld Diameter: 3/4 inch, nominal.
 - 2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds as indicated.
 - 3. Weld Washers: Install weld washers at each weld location.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of one-half of the span or 18 inches, and as follows:
 - 1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
 - 2. Mechanically clinch or button punch.
 - 3. Fasten with a minimum of 1-1/2-inch- long welds.
- 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 or butted at Contractor's option.
- D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and mechanically fasten flanges to top of deck. Space mechanical fasteners not more than 12 inches apart with at least one fastener at each corner.
 - 1. Install reinforcing channels or zees in ribs to span between supports and mechanically fasten.
- E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. mechanically fasten to substrate to provide a complete deck installation.

1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.

- F. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

3.4 FLOOR-DECK INSTALLATION

- A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:
 1. Weld Diameter: 3/4 inch, nominal.
 2. Weld Spacing: Weld edge ribs of panels at each support. Space additional welds an average of 12 inches apart, but not more than 18 inches apart.
 3. Weld Spacing: Space and locate welds as indicated.
 4. Weld Washers: Install weld washers at each weld location.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of one-half of the span or 36 inches, and as follows:
 1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
 2. Mechanically clinch or button punch.
 3. Fasten with a minimum of 1-1/2-inch- long welds.
- 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: Butted.
- D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations unless otherwise indicated.
- E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.
- F. Install piercing hanger tabs at 14 inches apart in both directions, within 9 inches of walls at ends, and not more than 12 inches from walls at sides unless otherwise indicated.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

- B. Field welds will be subject to inspection.
- C. Prepare test and inspection reports.

3.6 PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780/A 780M 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.
 - 2. Wire brushing, cleaning, and repair painting of bottom deck surfaces are included in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
- C. Repair Painting: Wire brushing, cleaning, and repair painting of rust spots, welds, and abraded areas of both deck surfaces are included in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

END OF SECTION 053100

SECTION 054000 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Exterior non-load-bearing wall framing.
 - 2. Floor joist framing.
 - 3. Roof rafter framing.
 - 4. Ceiling joist framing.
 - 5. Soffit framing.
- B. Related Requirements:
 - 1. Section 055000 "Metal Fabrications" for miscellaneous steel shapes, masonry shelf angles, and connections used with cold-formed metal framing.
 - 2. Section 092116.23 "Gypsum Board Shaft Wall Assemblies" for interior non-load-bearing, metal-stud-framed, shaft-wall assemblies, with height limitations.
 - 3. Section 092216 "Non-Structural Metal Framing" for standard, interior non-load-bearing, metal-stud framing, with height limitations and ceiling-suspension assemblies.

1.3 PREINSTALLATION MEETINGS

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

1.4 ACTION SUBMITTALS

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

1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

D. Delegated-Design Submittal: For cold-formed steel framing.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Welding certificates.
- C. Product Certificates: For each type of code-compliance certification for studs and tracks.
- D. Product Test Reports: For each listed product, for tests performed by a qualified testing agency.
 1. Steel sheet.
 2. Expansion anchors.
 3. Power-actuated anchors.
 4. Mechanical fasteners.
 5. Vertical deflection clips.
 6. Horizontal drift deflection clips
 7. Miscellaneous structural clips and accessories.
- E. Evaluation Reports: For nonstandard cold-formed steel framing post-installed anchors and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- B. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.
- C. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.
- D. Product Tests: Mill certificates or data from a qualified independent testing agency, or in-house testing with calibrated test equipment, indicating steel sheet complies with

requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.

- E. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association the Steel Framing Industry Association or the Steel Stud Manufacturers Association.
- F. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."
- G. Comply with AISI S230 "Standard for Cold-Formed Steel Framing - Prescriptive Method for One and Two Family Dwellings."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design cold-formed steel framing.
- B. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.
 - 1. Design Loads: As indicated on Drawings.
 - 2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
 - a. Exterior Non-Load-Bearing Framing: Horizontal deflection of 1/360 of the wall height.
 - 1) Any walls that support brick or stone shall be designed for horizontal deflections not to exceed 1/600 of the wall height.
 - b. Interior Non-Load-Bearing Framing: Horizontal deflection of 1/360 of the wall height under a horizontal load of 5 lbf/sq. ft..
 - c. Floor Joist Framing: Vertical deflection of 1/360 for live loads and 1/240 for total loads of the span.
 - d. Roof Rafter Framing: Vertical deflection of 1/240 of the horizontally projected span for live loads.
 - e. Ceiling Joist Framing: Vertical deflection of 1/360 of the span for live loads and 1/240 for total loads of the span.
 - 3. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.

4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
 - a. Upward and downward movement of 1 inch.
 5. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.
- C. Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing shall comply with AISI S100, AISI S200, and the following:
1. Floor and Roof Systems: AISI S210.
 2. Wall Studs: AISI S211.
 3. Headers: AISI S212.
 4. Lateral Design: AISI S213.
- D. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency acceptable to authorities having jurisdiction.

2.2 COLD-FORMED STEEL FRAMING MATERIALS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:
1. Grade: As required by structural performance.
 2. Coating: G90 or equivalent.
- C. Steel Sheet for Vertical Deflection Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:
1. Grade: 50, Class 1.
 2. Coating: G90.
- D. EXTERIOR NON-LOAD-BEARING WALL FRAMING
- E. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: As required by structural performance.
 2. Flange Width: As required by structural performance.
 3. Section Properties: As required by structural performance.

- F. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: To match stud base-metal thickness.
 - 2. Flange Width: 1-1/4 inches.
- G. Vertical Deflection Clips: Manufacturer's standard bypass or head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
- H. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
 - 1. Minimum Base-Metal Thickness: To match stud base-metal thickness.
 - 2. Flange Width: 1 inch plus the design gap for one-story structures and 1 inch plus twice the design gap for other applications.

2.3 INTERIOR NON-LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges.
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges.
- C. Vertical Deflection Clips: Manufacturer's standard bypass or head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
- D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure.

2.4 FLOOR JOIST FRAMING

- A. Steel Joists: Manufacturer's standard C-shaped steel joists, of web depths indicated, unpunched, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: As indicated.
 - 2. Flange Width: As indicated.
 - 3. Section Properties: As indicated and per the Steel Stud Manufacturers Association Product Technical Information.
- B. Steel Joist Track: Manufacturer's standard U-shaped steel joist track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: To match stud base-metal thickness.
2. Flange Width: 1-1/2 inches, minimum.

2.5 ROOF-RAFTER FRAMING

- A. Steel Rafters: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: As indicated.
 2. Flange Width: As indicated.
 3. Section Properties: As indicated and per the Steel Stud Manufacturers Association Product Technical Information.

2.6 CEILING JOIST FRAMING

- A. Steel Ceiling Joists: Manufacturer's standard C-shaped steel sections, of web depths indicated, unpunched, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: 0.0329 inch.
 2. Flange Width: 1-5/8 inches, minimum.

2.7 SOFFIT FRAMING

- A. Exterior Soffit Frame: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: 0.0329 inch.
 2. Flange Width: 1-5/8 inches, minimum.

2.8 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for framing members.
- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
1. Supplementary framing.
 2. Bracing, bridging, and solid blocking.
 3. Web stiffeners.
 4. Anchor clips.
 5. End clips.
 6. Foundation clips.
 7. Gusset plates.
 8. Stud kickers and knee braces.

9. Joist hangers and end closures.
10. Hole-reinforcing plates.
11. Backer plates.

2.9 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.
- B. Anchor Bolts: ASTM F 1554, Grade as indicated, threaded carbon-steel carbon-steel nuts, and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.
- C. Post-Installed Anchors: Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 ICC-ES AC193 ICC-ES AC58 or ICC-ES AC308 as appropriate for the substrate.
 1. Uses: Securing cold-formed steel framing to structure.
 2. Type: Torque-controlled expansion anchor Torque-controlled adhesive anchor or adhesive anchor.
 3. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
 4. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy Group 2 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.
- D. Power-Actuated Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.
 1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.
- F. Welding Electrodes: Comply with AWS standards.

2.10 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: ASTM A 780/A 780M.
- B. Nonmetallic, Nonshrink Grout: Factory-packaged, nonmetallic, noncorrosive, nonstaining grout, complying with ASTM C 1107/C 1107M, and with a fluid consistency and 30-minute working time.

- C. Shims: Load-bearing, high-density, multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as framing members supported by shims.
- D. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members as required.

2.11 FABRICATION

- A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
 - 1. Fabricate framing assemblies using jigs or templates.
 - 2. Cut framing members by sawing or shearing; do not torch cut.
 - 3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Shop Drawings, with screws penetrating joined members by no fewer than three exposed screw threads.
 - 4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies by means that prevent damage or permanent distortion.
- C. Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable variation of 1/8 inch in 10 feet and as follows:
 - 1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
 - 2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, conditions, and abutting structural framing 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. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.
- B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that required to obtain fire-resistance ratings indicated. Protect remaining fire-resistive materials from damage.
- C. Install load-bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch to ensure a uniform bearing surface on supporting concrete or masonry construction.
- D. Install sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

- A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed steel framing according to AISI S200, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.
- C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
 - 1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.
- D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.
 - 1. Cut framing members by sawing or shearing; do not torch cut.

2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners, install according to Shop Drawings, and comply with requirements for spacing, edge distances, and screw penetration.
- E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
- F. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.
- H. Install insulation, specified in Section 072100 "Thermal Insulation," in framing-assembly members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
- I. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

3.4 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.
- B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:
 1. Stud Spacing: As indicated on Drawings.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
 1. Install single deep-leg deflection tracks and anchor to building structure.
 2. Connect vertical deflection clips to bypassing and infill studs and anchor to building structure.
 3. Connect drift clips to cold-formed steel framing and anchor to building structure.

- E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.
 - 1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
 - 2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
 - 3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 18 inches of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.
 - 1. Install solid blocking at centers indicated on Shop Drawings.
- G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 INTERIOR NON-LOAD-BEARING WALL INSTALLATION

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.
- B. Fasten both flanges of studs to bottom track unless otherwise indicated. Space studs as follows:
 - 1. Stud Spacing: As indicated on Drawings.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
 - 1. Install single deep-leg deflection tracks and anchor to building structure.
 - 2. Connect vertical deflection clips to studs and anchor to building structure.
 - 3. Connect drift clips to cold-formed steel metal framing and anchor to building structure.
- E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.
 - 1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.

2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
 3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 18 inches of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.
1. Install solid blocking at centers indicated on Shop Drawings.
- G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.6 JOIST INSTALLATION

- A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated.
- B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.
1. Install joists over supporting frame with a minimum end bearing of 1-1/2 inches.
 2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections.
- C. Space joists not more than 2 inches from abutting walls, and as follows:
1. Joist Spacing: As indicated on Drawings.
- D. Frame openings with built-up joist headers, consisting of joist and joist track or another combination of connected joists if indicated.
- E. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement.
1. Install web stiffeners to transfer axial loads of walls above.
- F. Install bridging at intervals indicated. Fasten bridging at each joist intersection as follows:
1. Joist-Track Solid Bridging: Joist-track solid blocking of width and thickness indicated, secured to joist webs.
 2. Combination Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and joist-track solid blocking of width and thickness indicated.

Fasten flat straps to bottom flange of joists and secure solid blocking to joist webs.

- G. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.
- H. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

3.7 ERECTION TOLERANCES

- A. Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
 - 1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.8 FIELD QUALITY CONTROL

- A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field and shop welds will be subject to testing and inspecting.
- C. Testing agency will report test results promptly and in writing to Contractor and Architect.
- D. Cold-formed steel framing will be considered defective if it does not pass tests and inspections.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.9 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A 780/A 780M and manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 054000

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SECTION 054000 - COLD-FORMED METAL FRAMING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Formed steel stud exterior wall and interior wall framing.

1.2 RELATED REQUIREMENTS

- A. Section 092116 - Gypsum Board Assemblies: Lightweight, non-load bearing metal stud framing.
- B. Section 092216 - Non-Structural Metal Framing.
- C. Section 095100 - Acoustical Ceilings: Ceiling suspension system.

1.3 REFERENCE STANDARDS

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- B. ASTM C955 - Standard Specification for Cold-Formed Steel Structural Framing Members 2018, with Editorial Revision.
- C. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories 2011a (Reapproved 2015).

1.4 SUBMITTALS

- A. Product Data: Provide manufacturer's data on factory-made framing connectors, showing compliance with requirements.
- B. Manufacturer's Installation Instructions: Indicate special procedures, conditions requiring special attention .

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, and with minimum three years of documented experience.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Metal Framing:

1. ClarkDietrich: www.clarkdietrich.com/#sle.
2. Jaimes Industries: www.jaimesind.com/#sle.
3. SCAFCO Corporation: www.scafco.com/#sle.
4. Steel Construction Systems: www.steelconsystems.com/#sle.
5. The Steel Network, Inc: www.SteelNetwork.com/#sle.

2.2 FRAMING SYSTEM

- ### A. Provide primary and secondary framing members, bridging, bracing, plates, gussets, clips, fittings, reinforcement, and fastenings as required to provide a complete framing system.

2.3 FRAMING MATERIALS

- ### A. Studs and Track: ASTM C955; studs formed to channel, C- or Sigma-shaped with punched web; U-shaped track in matching nominal width and compatible height.
1. Gage and Depth: As required to meet specified performance levels.

2.4 FASTENERS

- ### A. Self-Drilling, Self-Tapping Screws, Bolts, Nuts and Washers: Hot dip galvanized per ASTM A153/A153M.
- ### B. Anchorage Devices: Powder actuated.

PART 3 EXECUTION

3.1 EXAMINATION

- #### A. Verify that substrate surfaces are ready to receive work.
- #### B. Verify field measurements and adjust installation as required.

3.2 INSTALLATION OF STUDS

- A. Install components in accordance with manufacturers' instructions and ASTM C1007 requirements.
- B. Align floor and ceiling tracks; locate to wall layout. Secure in place with fasteners at maximum 24 inches on center. Coordinate installation of sealant with floor and ceiling tracks.
- C. Construct corners using minimum of three studs. Install double studs at wall openings, door and window jambs.

END OF SECTION

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SECTION 055000 - METAL FABRICATIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Shop fabricated steel items.

1.2 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete: Placement of metal fabrications in concrete.
- B. Section 042000 - Unit Masonry: Placement of metal fabrications in masonry.
- C. Section 055100 - Metal Stairs.
- D. Section 055213 - Pipe and Tube Railings.
- E. Section 099113 - Exterior Painting: Paint finish.
- F. Section 099123 - Interior Painting: Paint finish.

1.3 REFERENCE STANDARDS

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2014.
- B. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2018.
- C. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates 2018.
- D. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength 2014, with Editorial Revision (2017).
- E. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing 2014.
- F. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination 2012.
- G. AWS D1.1/D1.1M - Structural Welding Code - Steel 2015, with Errata (2016).
- H. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel 2018.

- I. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer 1999 (Ed. 2004).
- J. SSPC-SP 2 - Hand Tool Cleaning 2018.

1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
 - 1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
 - 2. Design data: Submit drawings and supporting calculations, signed and sealed by a qualified professional structural engineer.
- C. Welders' Certificates: Submit certification for welders employed on the project, verifying AWS qualification within the previous 12 months.
- D. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.

PART 2 PRODUCTS

2.1 MATERIALS - STEEL

- A. Steel Sections: ASTM A36/A36M.
- B. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.
- C. Plates: ASTM A283/A283M.
- D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.
- E. Mechanical Fasteners: Same material as or compatible with materials being fastened; type consistent with design and specified quality level.
- F. Bolts, Nuts, and Washers: ASTM A307, Grade A, plain.
- G. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- H. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.2 FINISHES - STEEL

- A. Prime paint steel items.
- B. Prepare surfaces to be primed in accordance with SSPC-SP2.
- C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- D. Prime Painting: One coat.

2.3 FABRICATION TOLERANCES

- A. Squareness: 1/8 inch maximum difference in diagonal measurements.
- B. Maximum Offset Between Faces: 1/16 inch.
- C. Maximum Misalignment of Adjacent Members: 1/16 inch.
- D. Maximum Bow: 1/8 inch in 48 inches.
- E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.

3.2 PREPARATION

- A. Clean and strip primed steel items to bare metal where site welding is required.

3.3 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Obtain approval prior to site cutting or making adjustments not scheduled.

3.4 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

SECTION 055213 - PIPE AND TUBE RAILINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Wall mounted handrails.
- B. Stair railings and guardrails.

1.2 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete: Placement of anchors in concrete.
- B. Section 092116 - Gypsum Board Assemblies: Placement of backing plates in stud wall construction.
- C. Section 099113 - Exterior Painting: Paint finish.

1.3 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.
- B. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2018.
- C. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes 2018.
- D. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings 2013, with Editorial Revision.
- E. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination 2012.
- F. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer 1999 (Ed. 2004).

1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.

1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

C. Fabricator's Qualification Statement.

1.5 QUALITY ASSURANCE

- A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in Colorado, or personnel under direct supervision of such an engineer.

PART 2 PRODUCTS

2.1 RAILINGS - GENERAL REQUIREMENTS

- A. Design, fabricate, and test railing assemblies in accordance with the most stringent requirements of applicable local code.
- B. Distributed Loads: Design railing assembly, wall rails, and attachments to resist distributed force of 75 pounds per linear foot applied to the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E935
- C. Concentrated Loads: Design railing assembly, wall rails, and attachments to resist a concentrated force of 200 pounds applied at any point on the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E935
- D. Allow for expansion and contraction of members and building movement without damage to connections or members.
- E. Dimensions: See drawings for configurations and heights.
1. Top Rails and Wall Rails: 1-1/2 inches diameter, round.
 2. Posts: 1-1/2 inches diameter, round.
- F. Provide anchors and other components as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.
1. For anchorage to concrete, provide inserts to be cast into concrete, for bolting anchors.
 2. For anchorage to stud walls, provide backing plates, for bolting anchors.

- G. Provide slip-on non-weld mechanical fittings to join lengths, seal open ends, and conceal exposed mounting bolts and nuts, including but not limited to elbows, T-shapes, splice connectors, flanges, escutcheons, and wall brackets.

2.2 STEEL RAILING SYSTEM

- A. Steel Tube: ASTM A500/A500M Grade B cold-formed structural tubing.
- B. Steel Pipe: ASTM A53/A53M Grade B Schedule 80, black finish.
- C. Welding Fittings: Factory- or shop-welded from matching pipe or tube; seams continuously welded; joints and seams ground smooth.
- D. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.3 FABRICATION

- A. Accurately form components to suit specific project conditions and for proper connection to building structure.
- B. Fit and shop assemble components in largest practical sizes for delivery to site.
- C. Fabricate components with joints tightly fitted and secured. Provide spigots and sleeves to accommodate site assembly and installation.
- D. Welded Joints:
 - 1. Exterior Components: Continuously seal joined pieces by intermittent welds and plastic filler. Drill condensate drainage holes at bottom of members at locations that will not encourage water intrusion.
 - 2. Interior Components: Continuously seal joined pieces by intermittent welds and plastic filler.
 - 3. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.

3.2 PREPARATION

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Supply items required to be cast into concrete or embedded in masonry with setting templates, for installation as work of other sections.
- C. Apply one coat of bituminous paint to concealed aluminum surfaces that will be in contact with cementitious or dissimilar materials.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install components plumb and level, accurately fitted, free from distortion or defects, with tight joints.
- C. Install railings in compliance with ADA Standards for accessible design at applicable locations.
- D. Anchor railings securely to structure.
- E. Conceal anchor bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

3.4 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch per floor level, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch.
- C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

SECTION 061000 - ROUGH CARPENTRY

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Underlayment.
- B. Roofing nailers.
- C. Concealed wood blocking, nailers, and supports.

1.2 REFERENCE STANDARDS

- A. ASTM C557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing 2003 (Reapproved 2017).
- B. ASTM D3498 - Standard Specification for Adhesives for Field-Gluing Wood Structural Panels (Plywood or Oriented Strand Board) to Wood Based Floor System Framing 2019a.
- C. PS 20 - American Softwood Lumber Standard 2020.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
 - 1. If no species is specified, provide any species graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.
 - 2. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

2.2 ACCESSORIES

- A. Construction Adhesives: Adhesives complying with ASTM C557 or ASTM D3498.

PART 3 EXECUTION

3.1 INSTALLATION - GENERAL

- A. Select material sizes to minimize waste.
- B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

3.2 BLOCKING, NAILERS, AND SUPPORTS

- A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.
- B. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.
- C. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.
- D. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.
- E. Provide the following specific non-structural framing and blocking:
 - 1. Cabinets and shelf supports.
 - 2. Wall brackets.
 - 3. Handrails.
 - 4. Grab bars.
 - 5. Towel and bath accessories.
 - 6. Wall-mounted door stops.
 - 7. Chalkboards and marker boards.
 - 8. Wall paneling and trim.
 - 9. Joints of rigid wall coverings that occur between studs.

END OF SECTION

SECTION 064100 - ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Specially fabricated cabinet units.
- B. Countertops.
- C. Hardware.

1.2 RELATED REQUIREMENTS

- A. Section 061000 - Rough Carpentry: Support framing, grounds, and concealed blocking.
- B. Section 099123 - Interior Painting: Field finishing of cabinet exterior.
- C. Section 123600 - Countertops.

1.3 REFERENCE STANDARDS

- A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards 2014, with Errata (2018).
- B. AWI (QCP) - Quality Certification Program Current Edition.
- C. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.1 2017, with Errata (2019).
- D. BHMA A156.9 - American National Standard for Cabinet Hardware 2015.
- E. NEMA LD 3 - High-Pressure Decorative Laminates 2005.

1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
 - 1. Scale of Drawings: 1-1/2 inch to 1 foot, minimum.

2. Provide the information required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).
- C. Certificate: Submit labels and certificates required by quality assurance and quality control programs.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.
1. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.
 2. Single Source Responsibility: Provide and install this work from single fabricator.
- B. Quality Certification:
1. Comply with AWI (QCP) woodwork association quality certification service/program in accordance with requirements for work specified in this section: www.awiqcp.org/#sle.
 2. Provide labels or certificates indicating that the installed work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.
 3. Provide designated labels on shop drawings as required by certification program.
 4. Provide designated labels on installed products as required by certification program.
 5. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.
 6. Replace, repair, or rework all work for which certification is refused.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect units from moisture damage.

1.7 FIELD CONDITIONS

- A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

PART 2 PRODUCTS

2.1 CABINETS

- A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
- B. Plastic Laminate Faced Cabinets: Custom grade.

2.2 LAMINATE MATERIALS

- A. Manufacturers:
 - 1. Wilsonart LLC; [____]: www.wilsonart.com/#sle.
 - 2. Substitutions: See Section 016000 - Product Requirements.
- B. Thermally Fused Laminate (TFL): Melamine resin, NEMA LD 3, Type VGL laminate panels.
 - 1. Manufacturers:
 - a. Wilsonart LLC; [____]: www.wilsonart.com/#sle.
 - b. Substitutions: See Section 016000 - Product Requirements.

2.3 COUNTERTOPS

2.4 ACCESSORIES

- A. Adhesive: Type recommended by fabricator to suit application.
- B. Plastic Edge Banding: Extruded PVC, convex shaped; smooth finish; self locking serrated tongue; of width to match component thickness.
 - 1. Color: As selected by Architect from manufacturer's standard range.
 - 2. Use at all exposed plywood edges.
 - 3. Use at all exposed shelf edges.
- C. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.

- D. Grommets: Standard plastic, painted metal or rubber grommets for cut-outs, in color to match adjacent surface.

2.5 HARDWARE

- A. Hardware: BHMA A156.9, types as recommended by fabricator for quality grade specified.
- B. Adjustable Shelf Supports: Standard side-mounted system using recessed metal shelf standards or multiple holes for pin supports and coordinated self rests, polished chrome finish, for nominal 1 inch spacing adjustments.
- C. Countertop Supports:
 - 1. Material: Aluminum
 - 2. Finish/Color: Clear anodized.
- D. Drawer and Door Pulls: Recessed Plastic Pull.
 - 1. Product: Min 4" curved .
- E. Cabinet Locks: Keyed cylinder, two keys per lock, master keyed, steel with chrome finish.
- F. Catches: Magnetic.
- G. Drawer Slides:
 - 1. Type: Extension types as indicated.
 - 2. Static Load Capacity: Commercial grade.
 - 3. Mounting: Side mounted.
 - 4. Stops: Integral type.
- H. Drawer Systems: Integrated drawer slide and side.
 - 1. Side Type: Single Wall.
 - 2. Drawer Side Height: 3-1/2 inches.
 - 3. Mounting: Side mounted.

- I. Hinges: European style concealed self-closing type, steel with polished finish.

2.6 FABRICATION

- A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.
- B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.
- C. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify adequacy of backing and support framing.
- B. Verify location and sizes of utility rough-in associated with work of this section.

3.2 INSTALLATION

- A. Install work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.
- B. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.
- C. Use fixture attachments in concealed locations for wall mounted components.
- D. Use concealed joint fasteners to align and secure adjoining cabinet units.
- E. Secure cabinets to floor using appropriate angles and anchorages.

3.3 ADJUSTING

- A. Adjust installed work.
- B. Adjust moving or operating parts to function smoothly and correctly.

3.4 CLEANING

- A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

END OF SECTION

SECTION 071113 - BITUMINOUS DAMPPROOFING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Bituminous dampproofing.
- B. Protection boards.

1.2 RELATED REQUIREMENTS

- A. Section 072100 - Thermal Insulation: Rigid insulation board used as protection board.

1.3 REFERENCE STANDARDS

- A. ASTM D1187/D1187M - Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal 1997 (Reapproved 2018).
- B. ASTM D1227 - Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing 2013.

1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide properties of primer, bitumen, and mastics.
- C. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing the work of this section with at least three years of documented experience.

1.6 FIELD CONDITIONS

- A. Maintain ambient temperatures above 40 degrees F for 24 hours before and during application until dampproofing has cured.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: []; [].
- B. Other Acceptable Bituminous Dampproofing Manufacturers:
 - 1. W. R. Meadows, Inc; []: www.wrmeadows.com/#sle.

2.2 BITUMINOUS DAMPPROOFING

- A. Bituminous Dampproofing: Cold-applied water-based emulsion; asphalt with mineral colloid or chemical emulsifying agent; with or without fiber reinforcement; asbestos-free; suitable for application on vertical and horizontal surfaces.
 - 1. Composition - Vertical Application: ASTM D1227 Type III or ASTM D1187/D1187M Type I.
 - 2. Composition - Horizontal and Low-Slope Application: ASTM D1227 Type II or III.
 - 3. VOC Content: Not more than permitted by local, State, and federal regulations.
 - 4. Applied Thickness: 1/16 inch, minimum, wet film.
 - 5. Products:
 - a. W. R. Meadows, Inc; Sealastic Emulsion Type I (spray-grade): www.wrmeadows.com/#sle.
- B. Primers, Mastics, and Related Materials: Type as recommended by dampproofing manufacturer.

2.3 ACCESSORIES

- A. Protection Board: Rigid insulation specified in Section 072100.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions are acceptable prior to starting this work.
- B. Verify substrate surfaces are durable, free of matter detrimental to adhesion or application of dampproofing system.
- C. Verify that items penetrating surfaces to receive dampproofing are securely installed.

3.2 PREPARATION

- A. Protect adjacent surfaces not designated to receive dampproofing.
- B. Clean and prepare surfaces to receive dampproofing in accordance with manufacturer's instructions.
- C. Do not apply dampproofing to surfaces unacceptable to manufacturer.
- D. Apply mastic to seal penetrations, small cracks, or minor honeycombs in substrate.

3.3 APPLICATION

- A. Foundation Walls: Apply two coats of asphalt dampproofing.
- B. Perform this work in accordance with manufacturer's instructions and NRCA (WM) applicable requirements.
- C. Apply bitumen with mop.
- D. Seal items watertight with mastic, that project through dampproofing surface.
- E. Place protection board directly over dampproofing, butt joints, and adhere to tacky dampproofing.
- F. Scribe and cut boards around projections, penetrations, and interruptions.

END OF SECTION

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SECTION 071400 - FLUID-APPLIED WATERPROOFING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Fluid-Applied Waterproofing:
 - 1. Cold-applied rubberized asphalt waterproofing.

1.2 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete: Concrete substrate.
- B. Section 042000 - Unit Masonry: Masonry joints prepared to receive flashings.
- C. Section 072100 - Thermal Insulation: Insulation used for protective cover.
- D. Section 076200 - Sheet Metal Flashing and Trim: Metal parapet covers, copings and counterflashings.
- E. Section 079200 - Joint Sealants: Sealing moving joints in waterproofed surfaces that are not part of work in this section.

1.3 REFERENCE STANDARDS

- A. ASTM C836/C836M - Standard Specification for High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course 2018.
- B. ASTM C1306/C1306M - Standard Test Method for Hydrostatic Pressure Resistance of a Liquid-Applied Waterproofing Membrane 2008, with Editorial Revision (2016).
- C. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension 2016.
- D. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials 2016.
- E. ASTM E154/E154M - Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover 2008a, with Editorial Revision (2013).

- F. ICC-ES AC29 - Acceptance Criteria for Cold, Liquid-Applied, Below-Grade, Exterior Dampproofing and Waterproofing Materials 2011, with Editorial Revision (2014).
- G. NRCA (WM) - The NRCA Waterproofing Manual 2005.

1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data for membrane, surface conditioner, flexible flashings, joint cover sheet and joint and crack sealants.
- C. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention and acceptable installation temperatures.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.6 FIELD CONDITIONS

- A. Maintain ambient temperatures above 40 degrees F for 24 hours before and during application and until cured.

1.7 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Contractor shall correct defective Work within a five year period after Date of Substantial Completion; remove and replace materials concealing waterproofing at no cost to Owner.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Cold-Applied Rubberized Asphalt Waterproofing:
 - 1. AVM Industries, Inc; AVM System 500 (Aussie Membrane):
www.avmindustries.com/#sle.

2. Epro Waterproofing Systems; ECOLINE-S: www.eproserv.com/#sle.

2.2 FLUID APPLIED WATERPROOFING MATERIALS

- A. Cold-Applied Rubberized Asphalt Waterproofing: Rubberized asphaltic compound, suitable for installation on concrete and concrete masonry.
 1. Cured Thickness: 60 mils, 0.060 inch, minimum.
 2. Complying with ICC-ES AC29; evidence of compliance includes current ICC-ES evaluation report citing ICC-ES AC29.
 3. Hydrostatic Pressure Resistance: When tested in accordance with ASTM C1306/C1306M, at least 50 pounds per square inch by the rapid test and at least 35 pounds per square inch by the long term test.
 4. Low Temperature Resistance: No cracking, loss of adhesion, splitting or pinholes when tested at minus 15 degrees F in accordance with ASTM C836/C836M.
 5. Adhesion: No separation when tested in accordance with ASTM C836/C836M.
 6. Decay Resistance: No decay when tested in accordance with ASTM E154/E154M.
 7. Wet Film Sag Resistance: No sag or sag within plus/minus 5 mils when tested in accordance with ASTM C836/C836M.
 8. Water Vapor Permeance: Less than 1 perm, when tested in accordance with ASTM E96/E96M.
 9. Heat Aging Resistance: No cracking, splitting, or pinholes when tested in accordance with ASTM C836/C836M.
 10. Elongation at Break: 1000 percent, minimum, when tested in accordance with ASTM D412.
 11. Manufacturers:
 - a. AVM Industries, Inc: www.avmindustries.com/#sle.
 - b. Epro Waterproofing Systems; ECOLINE-S: www.eproserv.com/#sle.

2.3 ACCESSORIES

- A. Sealant for Joints and Cracks in Substrate: Type compatible with waterproofing material and as recommended by waterproofing manufacturer.
- B. Reinforcing Fabric for Between Liquid Applied Membranes (LAM): Polyester fabric, unsaturated spun bond and nonwoven, used as reinforcement between LAM waterproofing systems.
 - 1. Thickness: 9.5 mils, 0.0095 inch, minimum.
 - 2. Manufacturers:
- C. Protection Board: Rigid insulation specified in Section 072100.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify substrate surfaces are free of frozen matter, dampness, loose particles, cracks, pits, projections, penetrations, or foreign matter detrimental to adhesion or application of waterproofing system.
- C. Verify that substrate surfaces are smooth, free of honeycomb or pitting, and not detrimental to full contact bond of waterproofing materials.
- D. Verify items that penetrate surfaces to receive waterproofing are securely installed.

3.2 PREPARATION

- A. Protect adjacent surfaces from damage not designated to receive waterproofing.
- B. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions; vacuum substrate clean.
- C. Do not apply waterproofing to surfaces unacceptable to waterproofing manufacturer.
- D. Fill non-moving joints and cracks with a filler compatible with waterproofing materials.
- E. Seal moving cracks with sealant and non-rigid filler, using procedures recommended by sealant and waterproofing manufacturers.
- F. Prepare building expansion joints at locations as indicated on drawings.

- G. Install cant strips at inside corners.

3.3 INSTALLATION

- A. Install waterproofing to specified minimum thickness in accordance with manufacturers instructions and NRCA (WM) applicable requirements.
- B. At joints and cracks less than 1/2 inch in width including joints between horizontal and vertical surfaces, apply 12 inch wide strip of joint cover sheet.
- C. Seal membrane and flashings to adjoining surfaces.

3.4 INSTALLATION - DRAINAGE PANEL AND PROTECTION BOARD

- A. After membrane has cooled, but before it becomes dusty, apply separation sheet and lap joints to ensure complete coverage.
- B. Place protection board directly against drainage panel; butt joints, and scribe and cut boards around projections, penetrations, and interruptions.

3.5 PROTECTION

- A. Do not permit traffic over unprotected or uncovered membrane.

END OF SECTION

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SECTION 072100 - THERMAL INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Board insulation and integral vapor retarder at perimeter foundation wall, underside of floor slabs and exterior wall behind Final wall finish.
- B. Batt insulation and vapor retarder in exterior wall, ceiling and roof construction.
- C. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.

1.2 RELATED REQUIREMENTS

1.3 REFERENCE STANDARDS

- A. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing 2017.
- B. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board 2019.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2019b.
- D. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials 2016.
- E. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750°C 2019a.
- F. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components 2019.

1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on product characteristics, performance criteria and product limitations.

- C. ABAA Field Quality Control Submittals: Submit third-party reports of testing and inspection required by ABAA QAP.
- D. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.
- E. ABAA Manufacturer Qualification: Submit documentation of current evaluation of proposed manufacturer and materials.
- F. ABAA Installer Qualification: Submit documentation of current contractor accreditation and current installer certification. Keep copies of contractor accreditation and installer certification on site during and after installation. Present on-site documentation upon request.

1.5 QUALITY ASSURANCE

- A. Air Barrier Association of America (ABAA) Quality Assurance Program (QAP); www.airbarrier.org/#sle:
 - 1. Installer Qualification: Use accredited contractor, certified installers, evaluated materials, and third-party field quality control audit.
 - 2. Manufacturer Qualification: Use evaluated materials from a single manufacturer regularly engaged in air barrier material manufacture. Use secondary materials approved in writing by primary material manufacturer.

1.6 FIELD CONDITIONS

- A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

PART 2 PRODUCTS

2.1 APPLICATIONS

- A. Insulation Over Metal Stud Framed Walls, Continuous: Polyisocyanurate board.
- B. Insulation in Wood Framed Walls: Batt insulation with separate vapor retarder.

2.2 FOAM BOARD INSULATION MATERIALS

- A. Polyisocyanurate (ISO) Board Insulation: Rigid cellular foam, complying with ASTM C1289.
 - 1. Classifications:

- a. Type I: Faced with aluminum foil on both major surfaces of the core foam.
 - 1) Class 1 - Non-reinforced core foam.
 - 2) Compressive Strength: 16 psi, minimum.
 - 3) Thermal Resistance, R-value: At 1-1/2 inch thick; 9.0 at 75 degrees F.
2. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
3. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
4. Water Vapor Permeance: 1.2 perm, maximum, at 1 inch thickness, and when tested in accordance with ASTM E96/E96M, desiccant method.
5. Complies with fire resistance requirements indicated on drawings as part of an exterior non-load-bearing exterior wall assembly when tested in accordance with NFPA 285.
6. Board Size: 48 inch by 96 inch.
7. Board Thickness: 1.5 inch.

2.3 BATT INSULATION MATERIALS

- A. Where batt insulation is indicated, either glass fiber or mineral fiber batt insulation may be used, at Contractor's option.
- B. Glass Fiber Batt Insulation: Flexible preformed batt or blanket, complying with ASTM C665; friction fit.
 1. Flame Spread Index: 75 or less, when tested in accordance with ASTM E84.
 2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
 3. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.
 4. Thermal Resistance: R-value of As noted in Drawings.
 5. Manufacturers:
- C. Mineral Fiber Batt Insulation: Flexible or semi-rigid preformed batt or blanket, complying with ASTM C665; friction fit; unfaced flame spread index of 0 (zero) when tested in accordance with ASTM E84.

1. Smoke Developed Index: 0 (zero), when tested in accordance with ASTM E84.

END OF SECTION

SECTION 072100 - THERMAL INSULATION

END OF SECTION

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SECTION 074113 - METAL ROOF PANELS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Architectural roofing system of preformed aluminum panels.

1.2 RELATED REQUIREMENTS

- A. Section 051200 - Structural Steel Framing: Roof framing and purlins.
- B. Section 061000 - Rough Carpentry: Roof sheathing.
- C. Section 074213 - Metal Wall Panels: Preformed wall panels.

1.3 REFERENCE STANDARDS

- A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2017a.
- B. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.
- C. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) 2014.
- D. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection 2019.
- E. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials 2016.
- F. IAS AC472 - Accreditation Criteria for Inspection Programs for Manufacturers of Metal Building Systems 2018.
- G. ICC-ES AC188 - Acceptance Criteria for Roof Underlayments 2012, with Editorial Revision (2015).

1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.

- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Storage and handling requirements and recommendations.
 - 2. Installation methods.
 - 3. Specimen warranty.
- C. Shop Drawings: Include layouts of roof panels, details of edge and penetration conditions, spacing and type of connections, flashings, underlayments, and special conditions.
 - 1. Show work to be field-fabricated or field-assembled.
- D. Selection Samples: For each roofing system specified, submit color chips representing manufacturer's full range of available colors and patterns.
- E. Manufacturer Qualification Statement: Provide documentation showing metal roof panel fabricator is accredited under IAS AC472.
- F. Warranty: Submit specified manufacturer's warranty and ensure that forms have been completed in Owner's name and are registered with manufacturer.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.
 - 1. Accredited by IAS in accordance with IAS AC472.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store roofing panels on project site as recommended by manufacturer to minimize damage to panels prior to installation.

1.7 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Finish Warranty: Provide manufacturer's special warranty covering failure of factory-applied exterior finish on metal roof panels and agreeing to repair or replace panels that show evidence of finish degradation, including significant fading, chalking, cracking, or peeling within specified warranty period of five years from Date of Substantial Completion.

PART 2 PRODUCTS

METAL ROOF PANELS

2.1 MANUFACTURERS

A. Basis of Design:

1. Metal Roof Panels: Snap Clad manufactured by Pac-Clad.

2.2 ARCHITECTURAL METAL ROOF PANELS

- A. Architectural Metal Roofing: Provide complete engineered system complying with specified requirements and capable of remaining weathertight while withstanding anticipated movement of substrate and thermally induced movement of roofing system.

B. Metal Panels: Factory-formed panels with factory-applied finish.

1. Aluminum Panels:

- a. Alloy and Temper: Aluminum complying with ASTM B209 (ASTM B209M); temper as required for forming.

- b. Thickness: Minimum 22 gage.

2. Profile: Standing seam, with minimum 1.75 inch seam height; concealed fastener system for field seaming with special tool.

3. Texture: Smooth.

4. Length: Full length of roof slope, without lapped horizontal joints.

5. Width: Maximum panel coverage of 12 inches.

2.3 ATTACHMENT SYSTEM

- A. Concealed System: Provide manufacturer's standard stainless steel or nylon-coated aluminum concealed anchor clips designed for specific roofing system and engineered to meet performance requirements, including anticipated thermal movement.

2.4 FABRICATION

- A. Panels: Provide factory or field fabricated panels with applied finish and accessory items, using manufacturer's standard processes as required to achieve specified appearance and performance requirements.

- B. Joints: Provide captive gaskets, sealants, or separator strips at panel joints to ensure weathertight seals, eliminate metal-to-metal contact, and minimize noise from panel movements.

2.5 FINISHES

- A. Fluoropolymer Coil Coating System: Polyvinylidene fluoride (PVDF) multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent PVDF resin, and at least 80 percent of coil coated aluminum surfaces having minimum total dry film thickness (DFT) of 0.9 mil, 0.0009 inch; color and gloss as selected by Architect from manufacturer's standard line.

2.6 ACCESSORIES

- A. Miscellaneous Sheet Metal Items: Provide flashings, gutters, downspouts, trim, moldings, closure strips, preformed crickets, caps and equipment curbs of the same material, thickness, and finish as used for the roofing panels. Items completely concealed after installation may optionally be made of stainless steel.
- B. Rib and Ridge Closures: Provide prefabricated, close-fitting components of steel with corrosion resistant finish or combination steel and closed-cell foam.
- C. Sealants:
 - 1. Exposed Sealant: Elastomeric; silicone, polyurethane, or silyl-terminated polyether/polyurethane.
 - 2. Concealed Sealant: Non-curing butyl sealant or tape sealant.
 - 3. Seam Sealant: Factory-applied, non-skinning, non-drying type.
- D. Underlayment: Self-adhering rubber-modified asphalt sheet complying with ASTM D1970/D1970M; 40 mil total thickness; with strippable release film and woven polypropylene sheet top surface.
 - 1. Minimum Requirements: Comply with requirements of ICC-ES AC188 for non-self-adhesive sheet.
 - 2. Sheet Thickness: 40 mil, 0.040 inch minimum total thickness.
 - 3. Self Sealability: Passing nail sealability test specified in ASTM D1970/D1970M.
 - 4. Low Temperature Flexibility: Passing test specified in ASTM D1970/D1970M.
 - 5. Water Vapor Permeance: 0.1 perm, maximum, when tested in accordance with ASTM E96/E96M Procedure A (desiccant method).
 - 6. Manufacturers:

- a. Grace Ice and Water Shield HT.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin installation of preformed metal roof panels until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Broom clean wood sheathing prior to installation of roofing system.
- B. Coordinate roofing work with provisions for roof drainage, flashing, trim, penetrations, and other adjoining work to assure that the completed roof will be free of leaks.
- C. Remove protective film from surface of roof panels immediately prior to installation. Strip film carefully, to avoid damage to prefinished surfaces.
- D. Separate dissimilar metals by applying a bituminous coating, self-adhering rubberized asphalt sheet, or other permanent method approved by roof panel manufacturer.
- E. Where metal will be in contact with wood or other absorbent material subject to wetting, seal joints with sealing compound and apply one coat of heavy-bodied bituminous paint.

3.3 INSTALLATION

- A. Overall: Install roofing system in accordance with approved shop drawings and panel manufacturer's instructions and recommendations, as applicable to specific project conditions. Anchor all components of roofing system securely in place while allowing for thermal and structural movement.
 - 1. Install roofing system with concealed clips and fasteners, except as otherwise recommended by manufacturer for specific circumstances.
 - 2. Minimize field cutting of panels. Where field cutting is absolutely required, use methods that will not distort panel profiles. Use of torches for field cutting is absolutely prohibited.
- B. Accessories: Install all components required for a complete roofing assembly, including flashings, gutters, downspouts, trim, moldings, closure strips, preformed crickets, caps,

equipment curbs, rib closures, ridge closures and similar roof accessory items.

- C. Roof Panels: Install panels in strict accordance with manufacturer's instructions, minimizing transverse joints except at junction with penetrations.

1. Install sealant or sealant tape, as recommended by panel manufacturer, at end laps and side joints.

3.4 CLEANING

- A. Clean exposed sheet metal work at completion of installation. Remove grease and oil films, excess joint sealer, handling marks, and debris from installation, leaving the work clean and unmarked, free from dents, creases, waves, scratch marks, or other damage to the finish.

3.5 PROTECTION

- A. Do not permit storage of materials or roof traffic on installed roof panels. Provide temporary walkways or planks as necessary to avoid damage to completed work. Protect roofing until completion of project.
- B. Touch-up, repair, or replace damaged roof panels or accessories before Date of Substantial Completion.

END OF SECTION

SECTION 074213 - METAL WALL PANELS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Manufactured metal panels for exterior wall panels, with related flashings and accessory components.

1.2 RELATED REQUIREMENTS

1.3 REFERENCE STANDARDS

- A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2017a.
- B. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document) 2015.
- C. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.
- D. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) 2014.

1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate dimensions, layout, joints, construction details, and methods of anchorage.
- C. Samples: Submit two samples of wall panel and soffit panel, 12 inch by 12 inch in size illustrating finish color, sheen, and texture.
- D. Manufacturer's Qualification Statement.
- E. Installer's Qualification Statement.
- F. Warranty Documentation for Installation of Building Rainscreen Assembly: Submit installer warranty and ensure that forms have been completed in Owner's name and registered with installer.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap.
- B. Store prefinished material off the ground and protected from weather; prevent twisting, bending, or abrasion; provide ventilation; slope metal sheets to ensure proper drainage.
- C. Prevent contact with materials that may cause discoloration or staining of products.

1.6 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective work within a five year period after Date of Substantial Completion for degradation of panel finish, including color fading caused by exposure to weather.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design:
 - 1. Metal Wall Panels - Concealed Fasteners: HWP manufactured by Pac-Clad.

2.2 MANUFACTURED METAL PANELS

- A. Wall Panel System: Factory fabricated prefinished metal panel system, site assembled.
 - 1. Provide exterior wall panels, interior liner panels, soffit panels and subgirt framing assembly.
 - 2. Design and size components to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of wall.
 - 3. Maximum Allowable Deflection of Panel: $L/180$ for length(L) of span.
 - 4. Movement: Accommodate movement within system without damage to components or deterioration of seals, movement between system and perimeter components when subject to seasonal temperature cycling; dynamic loading and release of loads; and deflection of structural support framing.
 - 5. Drainage: Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.

6. Fabrication: Formed true to shape, accurate in size, square, and free from distortion or defects; pieces of longest practical lengths.
7. Corners: Factory-fabricated in one continuous piece with minimum 2 inch returns.

B. Exterior Wall Panels:

1. Profile: Vertical; style as indicated.
2. Side Seams: Double-interlocked, tight-fitting, sealed with continuous gaskets.
3. Material: Precoated aluminum sheet, 22 gage, .040 inch minimum thickness.
4. Panel Width: 12" inches.
5. Color: As selected by Architect from manufacturer's standard line.

C. Subgirt Framing Assembly:

- D. Internal and External Corners: Same material, thickness, and finish as exterior sheets; profile to suit system; shop cut and factory mitered to required angles.
- E. Trim: Same material, thickness and finish as exterior sheets; brake formed to required profiles.
- F. Anchors: Galvanized steel.

2.3 MATERIALS

- A. Precoated Aluminum Sheet: ASTM B209 (ASTM B209M), 3105 alloy, O temper, smooth surface texture; continuous-coil-coated on exposed surfaces with specified finish coating and on panel back with specified panel back coating.

2.4 FINISHES

- A. Fluoropolymer Coil Coating System: Polyvinylidene fluoride (PVDF) multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent PVDF resin, and at least 80 percent of coil coated aluminum surfaces having minimum total dry film thickness (DFT) of 0.9 mil, 0.0009 inch; color and gloss as selected by Architect from manufacturer's standard line.

2.5 ACCESSORIES

- A. Concealed Sealants: Non-curing butyl sealant or tape sealant.

- B. Fasteners: Manufacturer's standard type to suit application; with soft neoprene washers, steel, hot dip galvanized. Fastener cap same color as exterior panel.
- C. Field Touch-up Paint: As recommended by panel manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that building framing members are ready to receive panels.
- B. Verify that water-resistive barrier has been installed over substrate completely and correctly.

3.2 PREPARATION

3.3 INSTALLATION

- A. Install panels on walls and soffits in accordance with manufacturer's instructions.
- B. Protect surfaces in contact with cementitious materials and dissimilar metals with bituminous paint. Allow to dry prior to installation.
- C. Fasten panels to structural supports; aligned, level, and plumb.
- D. Locate joints over supports.
- E. Lap panel ends minimum 2 inches.
- F. Seal and place gaskets to prevent weather penetration. Maintain neat appearance.

3.4 TOLERANCES

- A. Maximum Offset From True Alignment Between Adjacent Members Butting or In Line: 1/16 inch.
- B. Maximum Variation from Plane or Location Indicated on Drawings: 1/4 inch.

3.5 CLEANING

- A. Remove site cuttings from finish surfaces.
- B. Remove protective material from wall panel surfaces.
- C. Clean and wash prefinished surfaces with mild soap and water; rinse with clean water.

- D. Upon completion of installation, thoroughly clean prefinished aluminum surfaces in accordance with AAMA 609 & 610.

END OF SECTION

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SECTION 075323 - ETHYLENE-PROPYLENE-DIENE-MONOMER ROOFING (EPDM)

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. EPDM membrane roofing system, including all components specified.
- B. Comply with the published recommendations and instructions of the roofing membrane manufacturer, at <http://manual.fsbp.com>.
- C. Commencement of work by Contractor shall constitute acknowledgement by Contractor that this specification can be satisfactorily executed, under the project conditions and with all necessary prerequisites for warranty acceptance by roofing membrane manufacturer. No modification of the Contract Sum will be made for failure to adequately examine the Contract Documents or the project conditions.

1.2 RELATED REQUIREMENTS

- A. Section 061000 - Rough Carpentry: Wood nailers associated with roofing and roof insulation.
- B. Section 076200 - Sheet Metal Flashing and Trim: Formed metal flashing and trim items associated with roofing.
- C. Section 077200 - Roof Accessories: Roof hatches, vents, and manufactured curbs.

1.3 DEFINITIONS

- A. Roofing Terminology: Refer to ASTM D1079 for definition of terms related to roofing work not otherwise defined in the section.

1.4 REFERENCE STANDARDS

- A. ANSI/SPRI/FM 4435/ES-1 - Test Standard for Edge Systems Used with Low Slope Roofing Systems 2017.
- B. ASTM C473 - Standard Test Methods for Physical Testing of Gypsum Panel Products 2019.
- C. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing 2017.

- D. ASTM D2178/D2178M - Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing 2015a.
- E. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber 2016.
- F. ASTM D4601/D4601M - Standard Specification for Asphalt-Coated Glass Fiber Base Sheet Used in Roofing 2004, with Editorial Revision (2012).
- G. ASTM D4637/D4637M - Standard Specification for EPDM Sheet Used in Single-Ply Roof Membrane 2015.
- H. ASTM D4811/D4811M - Standard Specification for Nonvulcanized (Uncured) Rubber Sheet Used as Roof Flashing 2016.
- I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2019b.
- J. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750°C 2019a.
- K. FM (AG) - FM Approval Guide current edition.
- L. FM 4470 - Approval Standard for Single-Ply, Polymer-Modified Bitumen Sheet, Built-Up Roof (BUR) and Liquid Applied Roof Assemblies for use in Class 1 and Noncombustible Roof Deck Construction 2016.
- M. PS 1 - Structural Plywood 2009.

1.5 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data:
 - 1. Provide membrane manufacturer's printed data sufficient to show that all components of roofing system, including insulation and fasteners, comply with the specified requirements and with the membrane manufacturer's requirements and recommendations for the system type specified; include data for each product used in conjunction with roofing membrane.
- C. Samples: Submit samples of each product to be used.

D. Shop Drawings: Provide:

1. The roof membrane manufacturer's standard details customized for this project for all relevant conditions, including flashings, base tie-ins, roof edges, terminations, expansion joints, penetrations, and drains.
2. For tapered insulation, provide project-specific layout and dimensions for each board.

E. Installer Qualifications: Letter from manufacturer attesting that the roofing installer meets the specified qualifications.

F. Executed Warranty.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Roofing installer shall have the following:

1.7 DELIVERY, STORAGE AND HANDLING

- A. Deliver products in manufacturer's original containers, dry and undamaged, with seals and labels intact and legible.
- B. Store materials clear of ground and moisture with weather protective covering.
- C. Keep combustible materials away from ignition sources.

1.8 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Comply with all warranty procedures required by manufacturer, including notifications, scheduling, and inspections.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer - Roofing System: Firestone Building Products LLC, Carmel, IN: www.firestonebpco.com/#sle.
 1. Roofing systems manufactured by others are acceptable provided the roofing system is completely equivalent in materials and warranty conditions and the

manufacturer meets the following qualifications:

- a. Specializing in manufacturing the roofing system to be provided.
- B. Manufacturer of Insulation and Cover Boards: Same manufacturer as roof membrane.
- C. Manufacturer of Metal Roof Edging: Same manufacturer as roof membrane.
 - 1. Metal roof edging products by other manufacturers are not acceptable.
 - 2. Field- or shop-fabricated metal roof edgings are not acceptable.
- D. Substitutions: See Section 016000 - Product Requirements.

2.2 ROOFING SYSTEM DESCRIPTION

- A. Roofing System: Ethylene-propylene-diene-monomer (EPDM) single-ply membrane.
 - 1. Warranty: Full system warranty; Firestone 30 year Limited Warranty covering membrane, roof insulation , and membrane accessories.
 - 2. Provide assembly having Underwriters Laboratories, Inc. (UL) Class A Fire Hazard Classification.
- B. Roofing System Components: Listed in order from the top of the roof down:
 - 1. Membrane: Thickness as specified.
 - 2. Insulation Cover Board: Gypsum-based board, 1/2 inch thick; loose-laid, no attachment.
 - 3. Insulation:
 - a. Maximum Board Thickness: 3 inches; use as many layers as necessary; stagger joints in adjacent layers.
 - b. Tapered: Slope as indicated; provide minimum R-value at thinnest point; place tapered layer on bottom.
 - c. Total R-value: 35, minimum.
 - d. Crickets: Tapered insulation of same type as specified for top layer; slope as indicated.

4. Vapor Retarder: Asphalt felt over modified bitumen base sheet; base layer mechanically fastened, top layer asphalt attached.

2.3 EPDM MEMBRANE MATERIALS

- A. Roofing and Flashing Membrane: Black, cured synthetic single-ply membrane composed of ethylene propylene diene monomer (EPDM) with the following properties:
 1. Reinforcement: Polyester weft inserted scrim; membrane complying with ASTM D4637/D4637M Type II.
 2. Thickness: 0.090 inch.
 3. Nominal Thickness Tolerance: Plus/minus 10 percent.
 4. Sheet Width: Provide the widest available sheets to minimize field seaming.
- B. Membrane Fasteners: Type and size as required by roof membrane manufacturer for roofing system and warranty to be provided; use only fasteners furnished by roof membrane manufacturer.
- C. Flashing Membrane: Self-curing, non-reinforced membrane composed of nonvulcanized EPDM rubber, complying with ASTM D4811/D4811M Type II, and with the following properties:
 1. Thickness: 0.055 inch.
 2. Acceptable Product: RubberGard EPDM FormFlash by Firestone.
- D. Self-Adhesive Flashing Membrane: Semi-cured 45 mil EPDM membrane laminated to 35 mil EPDM tape adhesive; QuickSeam Flashing by Firestone.
- E. Pre-Molded Pipe Flashings: EPDM, molded for quick adaptation to different sized pipes; Firestone EPDM Pipe Flashing.
- F. Self-Adhesive Lap Splice Tape: 35 mil EPDM-based, formulated for compatibility with EPDM membrane and high-solids primer; QuickSeam Splice Tape by Firestone.
- G. Splice Adhesive: Synthetic polymer-based, formulated for compatibility with EPDM membrane and metal surfaces; SA-1065 Splice Adhesive by Firestone.
- H. Adhesive Primer: Synthetic rubber based primer formulated for compatibility with EPDM membrane and tape adhesive, with VOC content less than 2.1 lb/gal;

QuickPrime Plus LVOC by Firestone.

- I. Seam Edge Treatment: EPDM rubber-based sealant, formulated for sealing exposed edges of membrane at seams; Lap Sealant HS by Firestone.
- J. Pourable Sealer: Two-part polyurethane, two-color for reliable mixing; Pourable Sealer by Firestone.
- K. Water Block Seal: Butyl rubber sealant for use between two surfaces, not exposed; Water Block Seal by Firestone.
- L. Metal Plates and Strips Used for Fastening Membrane and Insulation: Steel with Galvalume coating; corrosion-resistance meeting FM 4470 criteria.
- M. Termination Bars: Aluminum bars with integral caulk ledge; 1.3 inches wide by 0.10 inch thick; Firestone Termination Bar by Firestone.
- N. Roof Walkway Pads: EPDM, 0.30 inch thick by 30 by 30 inches with EPDM tape adhesive strips laminated to the bottom; QuickSeam Walkway Pads by Firestone.

2.4 VAPOR RETARDER MATERIALS

- A. Base Sheet: Firestone MB Base Sheet; high-performance, asphalt coated, fiberglass reinforced, roofing base sheet complying with ASTM D4601/D4601M Type II.
- B. Asphalt Felt: Asphalt impregnated, glass fiber mat reinforced roofing sheet, complying with ASTM D2178/D2178M, Type IV or VI.
- C. Asphalt: As recommended by roofing membrane manufacturer.

2.5 ROOF INSULATION AND COVER BOARDS

- A. Gypsum-Based Cover Board: Non-combustible, water resistant gypsum core with embedded glass mat facers, complying with ASTM C1177/C1177M, and with the following additional characteristics:
 - 1. Size: 48 inches by 96 inches, nominal.
 - a. Exception: Board to be attached using adhesive or asphalt may be no larger than 48 inches by 48 inches, nominal.
 - 2. Thickness: As indicated elsewhere.

3. Surface Water Absorption: 2.5 g, maximum, when tested in accordance with ASTM C473.
 4. Spanning Capability: Recommended by manufacturer for following minimum flute spans:
 5. Surface Burning Characteristics: Flame spread index of 0 (zero), smoke developed index of 0 (zero), when tested in accordance with ASTM E84.
 6. Combustibility: Non-combustible, when tested in accordance with ASTM E136.
 7. Factory Mutual approved for use with FM 1-60 and 1-90 rated roofing assemblies.
 8. Mold Growth Resistance: Zero growth, when tested in accordance with ASTM D3273 for minimum of 4 weeks.
- B. Adhesive for Insulation Attachment: Type as required by roof membrane manufacturer for roofing system and warranty to be provided; use only adhesives furnished by roof membrane manufacturer.

2.6 METAL ACCESSORIES

- A. Parapet Copings: Formed metal coping with galvanized steel anchor/support cleats for capping any parapet wall; watertight, maintenance free, without exposed fasteners; butt type joints with concealed splice plates; mechanically fastened as indicated; Firestone PTCF.
1. Wind Performance:
 - a. At least minimum required when tested in accordance with ANSI/SPRI/FM 4435/ES-1 using test method RE-3.
 - b. Provide product listed in FM (AG) with at least FM 1-90 rating.
 2. Description: Coping sections allowed to expand and contract freely while locked in place on anchor cleats by mechanical pressure from hardened stainless steel springs factory attached to anchor cleats; 8 inch wide splice plates with factory applied dual non-curing sealant strips capable of providing watertight seal.
 3. Material and Finish: 24 gage, 0.024 inch thick galvanized steel with Kynar 500 finish in manufacturer's standard color; matching concealed joint splice plates; factory-installed protective plastic film.

4. Dimensions:
 - a. Wall Width: As indicated on the drawings.
 - b. Piece Length: Minimum 144 inches.
 - c. Curved Application: Factory fabricated in true radius.
5. Anchor/Support Cleats: 20 gage, 0.036 inch thick prepunched galvanized cleat with 12 inch wide stainless steel spring mechanically locked to cleat at 72 inches on center.
6. Special Shaped Components: Provide factory-fabricated pieces necessary for complete installation, including miters, corners, intersections, curves, pier caps, and end caps; minimum 14 inch long legs on corner, intersection, and end pieces.
7. Fasteners: Factory-furnished; electrolytically compatible; minimum pull out resistance of 240 pounds for actual substrate used; no exposed fasteners.

2.7 ACCESSORY MATERIALS

- A. Wood Nailers: PS 20 dimension lumber, Structural Grade No. 2 or better Southern Pine, Douglas Fir; or PS 1, APA Exterior Grade plywood; pressure preservative treated.
 1. Width: 3-1/2 inches, nominal minimum, or as wide as the nailing flange of the roof accessory to be attached to it.
 2. Thickness: Same as thickness of roof insulation.
- B. Cant Strips and Tapered Edge Strips: 45 degree face slope and minimum 5 inch face dimension; provide at all angle changes between vertical and horizontal planes that exceed 45 degrees.
 1. Install using hot asphalt (Type IV), roofing mastic, or mechanically fastened using fasteners and plates approved by roofing manufacturer.

PART 3 INSTALLATION

3.1 GENERAL

- A. Install roofing, insulation, flashings, and accessories in accordance with roofing manufacturer's published instructions and recommendations for the specified roofing

system. Where manufacturer provides no instructions or recommendations, follow good roofing practices and industry standards. Comply with federal, state, and local regulations.

- B. Obtain all relevant instructions and maintain copies at project site for duration of installation period.
- C. Do not start work until Pre-Installation Notice has been submitted to manufacturer as notification that this project requires a manufacturer's warranty.
- D. Perform work using competent and properly equipped personnel.
- E. Temporary closures, which ensure that moisture does not damage any completed section of the new roofing system, are the responsibility of the applicator. Completion of flashings, terminations, and temporary closures shall be completed as required to provide a watertight condition.
- F. Install roofing membrane only when surfaces are clean, dry, smooth and free of snow or ice; do not apply roofing membrane during inclement weather or when ambient conditions will not allow proper application; consult manufacturer for recommended procedures during cold weather. Do not work with sealants and adhesives when material temperature is outside the range of 60 to 80 degrees F.
- G. Protect adjacent construction, property, vehicles, and persons from damage related to roofing work; repair or restore damage caused by roofing work.
 - 1. Protect from spills and overspray from bitumen, adhesives, sealants and coatings.
 - 2. Particularly protect metal, glass, plastic, and painted surfaces from bitumen, adhesives, and sealants within the range of wind-borne overspray.
 - 3. Protect finished areas of the roofing system from roofing related work traffic and traffic by other trades.
- H. Until ready for use, keep materials in their original containers as labeled by the manufacturer.
- I. Consult membrane manufacturer's instructions, container labels, and Material Safety Data Sheets (MSDS) for specific safety instructions. Keep all adhesives, sealants, primers and cleaning materials away from all sources of ignition.

3.2 EXAMINATION

- A. Examine roof deck to determine that it is sufficiently rigid to support installers and their mechanical equipment and that deflection will not strain or rupture roof components or deform deck.
- B. Verify that surfaces and site conditions are ready to receive work. Correct defects in the substrate before commencing with roofing work.
- C. Examine roof substrate to verify that it is properly sloped to drains.
- D. Verify that the specifications and drawing details are workable and not in conflict with the roofing manufacturer's recommendations and instructions; start of work constitutes acceptable of project conditions and requirements.

3.3 PREPARATION

- A. Take appropriate measures to ensure that fumes from adhesive solvents are not drawn into the building through air intakes.
- B. Prior to proceeding, prepare roof surface so that it is clean, dry, and smooth, and free of sharp edges, fins, roughened surfaces, loose or foreign materials, oil, grease and other materials that may damage the membrane.
- C. Fill all surface voids in the immediate substrate that are greater than 1/4 inch wide with fill material acceptable insulation to membrane manufacturer.
- D. Seal, grout, or tape deck joints, where needed, to prevent bitumen seepage into building.
- E. Wood Nailers: Provide wood nailers at all perimeters and other locations where indicated on the drawings, of total height matching the total thickness of insulation being used.

3.4 VAPOR RETARDER

- A. Before installing insulation install vapor retarder directly over the deck.
- B. Ensure that all penetrations and edge conditions are sealed to prevent moisture and air drive into the roofing system.

3.5 INSULATION AND COVER BOARD INSTALLATION

- A. Install insulation in configuration and with attachment method(s) specified in PART 2, under Roofing System.

- B. Install insulation in a manner that will not compromise the vapor retarder integrity.
- C. Install only as much insulation as can be covered with the completed roofing system before the end of the day's work or before the onset of inclement weather.
- D. Lay roof insulation in courses parallel to roof edges.
- E. Neatly and tightly fit insulation to all penetrations, projections, and nailers, with gaps not greater than 1/4 inch. Fill gaps greater than 1/4 inch with acceptable insulation. Do not leave the roofing membrane unsupported over a space greater than 1/4 inch.
- F. Cold Adhesive Attachment: Apply in accordance with membrane manufacturer's instructions and recommendations; "walk-in" individual roof insulation boards to obtain maximum adhesive contact.

3.6 SINGLE-PLY MEMBRANE INSTALLATION

- A. Beginning at low point of roof, place membrane without stretching over substrate and allow to relax at least 30 minutes before attachment or splicing; in colder weather allow for longer relax time.
- B. Lay out the membrane pieces so that field and flashing splices are installed to shed water.
- C. Install membrane without wrinkles and without gaps or fishmouths in seams; bond and test seams and laps in accordance with membrane manufacturer's instructions and details.
- D. Edge Securement: Secure membrane at all locations where membrane terminates or goes through an angle change greater than 2 in 12 inches using mechanically fastened reinforced perimeter fastening strips, plates, or metal edging as indicated or as recommended by roofing manufacturer.
 - 1. Exceptions: Round pipe penetrations less than 18 inches in diameter and square penetrations less than 4 inches square.
 - 2. Metal edging is not merely decorative; ensure anchorage of membrane as intended by roofing manufacturer.

3.7 FLASHING AND ACCESSORIES INSTALLATION

- A. Install flashings, including laps, splices, joints, bonding, adhesion, and attachment, as required by membrane manufacturer's recommendations and details.

- B. Metal Accessories: Install metal edgings, gravel stops, and copings in locations indicated on the drawings, with horizontal leg of edge member over membrane and flashing over metal onto membrane.
1. Follow roofing manufacturer's instructions.
 2. Remove protective plastic surface film immediately before installation.
 3. Install water block sealant under the membrane anchorage leg.
 4. Flash with manufacturer's recommended flashing sheet unless otherwise indicated.
 5. Where single application of flashing will not completely cover the metal flange, install additional piece of flashing to cover the metal edge.
 6. If the roof edge includes a gravel stop and sealant is not applied between the laps in the metal edging, install an additional piece of self-adhesive flashing membrane over the metal lap to the top of the gravel stop; apply seam edge treatment at the intersections of the two flashing sections.
 7. When the roof slope is greater than 1:12, apply seam edge treatment along the back edge of the flashing.
- C. Flashing at Walls, Curbs, and Other Vertical and Sloped Surfaces: Install weathertight flashing at all walls, curbs, parapets, curbs, skylights, and other vertical and sloped surfaces that the roofing membrane abuts to; extend flashing at least 8 inches high above membrane surface.
1. Use the longest practical flashing pieces.
 2. Evaluate the substrate and overlay and adjust installation procedure in accordance with membrane manufacturer's recommendations.
 3. Complete the splice between flashing and the main roof sheet with specified splice adhesive before adhering flashing to the vertical surface.
 4. Provide termination directly to the vertical substrate as shown on roof drawings.
- D. Roof Drains:
1. Taper insulation around drain to provide smooth transition from roof surface to drain. Use specified pre-manufactured tapered insulation with facer or suitable

bonding surface to achieve slope; slope not to exceed manufacturer's recommendations.

2. Position membrane, then cut a hole for roof drain to allow 1/2 to 3/4 inch of membrane to extend inside clamping ring past drain bolts.
 3. Make round holes in membrane to align with clamping bolts; do not cut membrane back to bolt holes.
 4. Apply sealant on top of drain bowl where clamping ring seats below the membrane
 5. Install roof drain clamping ring and clamping bolts; tighten clamping bolts to achieve constant compression.
- E. Flashing at Penetrations: Flash all penetrations passing through the membrane; make flashing seals directly to the penetration.
1. Pipes, Round Supports, and Similar Items: Flash with specified pre-molded pipe flashings wherever practical; otherwise use specified self-curing elastomeric flashing.
 2. Structural Steel Tubing: If corner radii are greater than 1/4 inch and longest side of tube does not exceed 12 inches, flash as for pipes; otherwise, provide a standard curb with flashing.

3.8 FINISHING AND WALKWAY INSTALLATION

- A. Install walkways at access points to the roof, around rooftop equipment that may require maintenance, and where indicated on the drawings.
- B. Walkway Pads: Adhere to the roofing membrane, spacing each pad at minimum of 1.0 inch and maximum of 3.0 inches from each other to allow for drainage.
1. If installation of walkway pads over field fabricated splices or within 6 inches of a splice edge cannot be avoided, adhere another layer of flashing over the splice and extending beyond the walkway pad a minimum of 6 inches on either side.
 2. Prime the membrane, remove the release paper on the pad, press in place, and walk on pad to ensure proper adhesion.

3.9 FIELD QUALITY CONTROL

- A. Inspection by Manufacturer: Provide final inspection of the roofing system by a Technical Representative employed by roofing system manufacturer specifically to inspect installation for warranty purposes (i.e. not a sales person).
- B. Perform all corrections necessary for issuance of warranty.

3.10 CLEANING

- A. Clean all contaminants generated by roofing work from building and surrounding areas, including bitumen, adhesives, sealants, and coatings.
- B. Repair or replace building components and finished surfaces damaged or defaced due to the work of this section; comply with recommendations of manufacturers of components and surfaces.
- C. Remove leftover materials, trash, debris, equipment from project site and surrounding areas.

3.11 PROTECTION

- A. Where construction traffic must continue over finished roof membrane, provide durable protection and replace or repair damaged roofing to original condition.

END OF SECTION

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Fabricated sheet metal items, including flashings, counterflashings, sheet metal roofing and exterior penetrations.
- B. Sealants for joints within sheet metal fabrications.

1.2 RELATED REQUIREMENTS

- A. Section 031000 - Concrete Forming and Accessories: Placement of recessed reglets in formwork.
- B. Section 061000 - Rough Carpentry: Wood nailers for sheet metal work.
- C. Section 077200 - Roof Accessories: Manufactured metal roof curbs.
- D. Section 079200 - Joint Sealants: Sealing non-lap joints between sheet metal fabrications and adjacent construction.

1.3 REFERENCE STANDARDS

- A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2017a.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2019a.
- C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.
- D. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free 2007 (Reapproved 2018).
- E. CDA A4050 - Copper in Architecture - Handbook current edition.
- F. SMACNA (ASMM) - Architectural Sheet Metal Manual 2012.

1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.

- B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

1.5 QUALITY ASSURANCE

- A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- B. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS

2.1 SHEET MATERIALS

- A. Pre-Finished Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24 gage, (0.0239) inch thick base metal, shop pre-coated with PVDF coating.
 - 1. PVDF (Polyvinylidene Fluoride) Coating: Superior Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system.
 - 2. Color: As selected by Architect from manufacturer's standard colors.

2.2 FABRICATION

- A. Form sections true to shape, accurate in size, square, and free from distortion or defects.
- B. Form pieces in longest possible lengths.
- C. Hem exposed edges on underside 1/2 inch; miter and seam corners.
- D. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.
- E. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.
- F. Fabricate flashings to allow toe to extend 2 inches over roofing gravel. Return and brake edges.

2.3 EXTERIOR PENETRATION FLASHING PANELS

- A. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for conduits and facade materials to be installed.

2.4 ACCESSORIES

- A. Fasteners: Galvanized steel, with soft neoprene washers.
- B. Primer: Zinc chromate type.
- C. Concealed Sealants: Non-curing butyl sealant.
- D. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.
- E. Plastic Cement: ASTM D4586/D4586M, Type I.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.
- B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.2 PREPARATION

- A. Install starter and edge strips, and cleats before starting installation.
- B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil.

3.3 INSTALLATION

- A. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted..
- B. Apply plastic cement compound between metal flashings and felt flashings.

- C. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.

3.4 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for field inspection requirements.
- B. Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements.

END OF SECTION

SECTION 077200 - ROOF ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Curbs.
- B. Roof penetrations mounting curbs.
- C. Roof hatches.

1.2 RELATED REQUIREMENTS

- A. Section 053100 - Steel Decking.

1.3 REFERENCE STANDARDS

1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used.
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
 - 4. Maintenance requirements.
- C. Shop Drawings: Submit detailed layout developed for this project and provide dimensioned location and number for each type of roof accessory.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store products under cover and elevated above grade.

PART 2 PRODUCTS

2.1 ROOF CURBS

- A. Roof Curbs Mounting Assemblies: Factory fabricated hollow sheet metal construction, internally reinforced, and capable of supporting superimposed live and dead loads and designated equipment load with fully mitered and sealed corner joints welded or mechanically fastened, and integral counterflashing with top and edges formed to shed water.
 - 1. Roof Curb Mounting Substrate: Curb substrate consists of flat roof deck sheathing with insulation.
 - 2. Sheet Metal Material:
 - 3. Provide layouts and configurations indicated on drawings.

2.2 ROOF HATCHES AND VENTS

- A. Roof Hatch Manufacturers:
 - 1. Babcock-Davis; Personnel II (Ladder Access): www.babcockdavis.com/#sle.
 - 2. Bilco Company; Type E (ladder access, 3 ft square, solid cover): www.bilco.com/#sle.
 - 3. LMCurbs; Roof Hatch: www.lmcurbs.com/#sle.
 - 4. Nystrom, Inc: www.nystrom.com/#sle.
- B. Frames and Curbs: One-piece curb and frame with integral cap flashing to receive roof flashings; extended bottom flange to suit mounting.
 - 1. Material: Mill finished aluminum, 11 gage, 0.0907 inch thick.
 - 2. Insulation: Manufacturer's standard; 1 inch rigid glass fiber, located on outside face of curb.
 - 3. Curb Height: 12 inches from finished surface of roof, minimum.
- C. Hardware: Steel, zinc coated and chromate sealed, unless otherwise indicated or required by manufacturer.
 - 1. Lifting Mechanisms: Compression or torsion spring operator with shock absorbers that automatically opens upon release of latch; capable of lifting covers despite 10 psf load.
 - 2. Hinges: Heavy duty pintle type.
 - 3. Hold open arm with vinyl-coated handle for manual release.

4. Latch: Upon closing, engage latch automatically and reset manual release.
5. Manual Release: Pull handle on interior.
6. Locking: Padlock hasp on interior.

2.3 ACCESSORIES

- A. Ladder Up Safety Post: Bilco Co., Steel Powder coat.

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 Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using methods recommended by manufacturer for achieving acceptable results for applicable substrate under project conditions.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions, in manner that maintains roofing system weather-tight integrity.

3.4 CLEANING

- A. Clean installed work to like-new condition.

3.5 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

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SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Non-fire-rated hollow metal doors and frames.
- B. Hollow metal frames for wood doors.
- C. Fire-rated hollow metal doors and frames.
- D. Hollow metal borrowed lites glazing frames.
- E. Accessories, including glazing, louvers and matching panels.

1.2 RELATED REQUIREMENTS

- A. Section 087100 - Door Hardware.
- B. Section 088000 - Glazing: Glass for doors and borrowed lites.
- C. Section 099123 - Interior Painting: Field painting.

1.3 ABBREVIATIONS AND ACRONYMS

- A. ANSI: American National Standards Institute.
- B. HMMA: Hollow Metal Manufacturers Association.
- C. NAAMM: National Association of Architectural Metal Manufacturers.
- D. NFPA: National Fire Protection Association.
- E. SDI: Steel Door Institute.
- F. UL: Underwriters Laboratories.

1.4 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.

- B. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors 2011.
- C. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames 2003 (R2009).
- D. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100) 2017.
- E. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames 2011.
- F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2019a.
- G. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable 2018.
- H. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength 2018a.
- I. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames 2016.
- J. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.
- K. NAAMM HMMA 805 - Recommended Selection and Usage Guide for Hollow Metal Doors and Frames 2012.
- L. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames 2002.
- M. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames 2011.
- N. NAAMM HMMA 840 - Guide Specifications For Receipt, Storage and Installation of Hollow Metal Doors and Frames 2007.
- O. NAAMM HMMA 860 - Guide Specifications for Hollow Metal Doors and Frames 2018.
- P. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames 2014.
- Q. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames 2013.

1.5 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced standards/guidelines.
- C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.
- B. Maintain at project site copies of reference standards relating to installation of products specified.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
- B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Hollow Metal Doors and Frames:
 - 1. Curries, an Assa Abloy Group company: www.assaabloydss.com/#sle.
 - 2. Republic Doors, an Allegion brand: www.republicdoor.com/#sle.
 - 3. Steelcraft, an Allegion brand: www.allegion.com/#sle.

2.2 PERFORMANCE REQUIREMENTS

- A. Requirements for Hollow Metal Doors and Frames:

1. Steel Sheet: Comply with one or more of the following requirements; galvanized steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
 2. Accessibility: Comply with ICC A117.1 and ADA Standards.
 3. Door Edge Profile: Manufacturers standard for application indicated.
 4. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. Style: Manufacturers standard.
 5. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
- B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.3 HOLLOW METAL DOORS

- A. Door Finish: Factory primed and field finished.
- B. Interior Doors, Non-Fire-Rated:
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
 - a. Level 1 - Standard-duty.
 - b. Physical Performance Level C, 250,000 cycles; in accordance with ANSI/SDI A250.4.
 - c. Model 1 - Full Flush.
 - d. Door Face Metal Thickness: 20 gage, 0.032 inch, minimum.
 2. Door Core Material: Manufacturers standard core material/construction and in compliance with requirements.
 3. Door Thickness: 1-3/4 inch, nominal.

4. Door Face Sheets: Flush.
5. Door Finish: Factory primed and field finished.

2.4 HOLLOW METAL FRAMES

- A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.
- B. Frame Finish: Factory primed and field finished.
- C. Interior Door Frames, Non-Fire Rated: Full profile/continuously welded type.
 1. Terminated Stops: Provide at interior doors; closed end stop terminated 6 inch, maximum, above floor at 45 degree angle.
 2. Frame Metal Thickness: 18 gage, 0.042 inch, minimum.
 3. Frame Finish: Factory primed and field finished.
- D. Door Frames, Fire-Rated: Knock-down type.
 1. Fire Rating: Same as door, labeled.
- E. Frames for Wood Doors: Comply with frame requirements in accordance with corresponding door.
- F. Borrowed Lites Glazing Frames: Construction and face dimensions to match door frames, and as indicated on drawings.
- G. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inch high to fill opening without cutting masonry units.

2.5 FINISHES

- A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

2.6 ACCESSORIES

- A. Door Window Frames: Door window frames with glazing securely fastened within door opening.
 1. Glazing: 1/4 inch thick, tempered glass, in compliance with requirements of authorities having jurisdiction.

- B. Glazing: As specified in Section 088000, factory installed.
- C. Grout for Frames: Portland cement grout with maximum 4 inch slump for hand troweling; thinner pumpable grout is prohibited.
- D. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Verify that finished walls are in plane to ensure proper door alignment.

3.2 PREPARATION

- A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

3.3 INSTALLATION

- A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.
- B. Coordinate frame anchor placement with wall construction.
- C. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.
- D. Install door hardware as specified in Section 087100.
 - 1. Comply with recommended practice for hardware placement of doors and frames in accordance with ANSI/SDI A250.6 or NAAMM HMMA 861.

3.4 TOLERANCES

- A. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.5 ADJUSTING

- A. Adjust for smooth and balanced door movement.

3.6 SCHEDULE

- A. Refer to Door and Frame Schedule on the drawings.

END OF SECTION

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SECTION 081416 - FLUSH WOOD DOORS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Flush wood doors; flush and flush glazed configuration; .

1.2 RELATED REQUIREMENTS

- A. Section 081113 - Hollow Metal Doors and Frames.
- B. Section 087100 - Door Hardware.
- C. Section 088000 - Glazing.
- D. Section 092116 - Gypsum Board Assemblies: Bullet-resistant sheathing and wallboard for bullet-resistant partitions and walls.
- E. Section 099123 - Interior Painting: Field finishing of doors.
- F. Section 099300 - Staining and Transparent Finishing: Field finishing of doors.

1.3 REFERENCE STANDARDS

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials Current Edition.
- B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards 2014, with Errata (2018).
- C. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.1 2017, with Errata (2019).
- D. WDMA I.S. 1A - Interior Architectural Wood Flush Doors 2013.

1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.
- C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.

1. Provide information as required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).
- D. Samples: Submit two samples of door veneer, 3 by 4 inch in size illustrating wood grain, stain color, and sheen.
- E. Certificate: Submit labels and certificates required by quality assurance and quality control programs.
- F. Warranty, executed in Owner's name.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with not less than three years of documented experience.
 1. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.
- B. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.
- C. Quality Certification:
 1. Provide labels or certificates indicating that the installed work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.
 2. Provide designated labels on shop drawings as required by certification program.
 3. Provide designated labels on installed products as required by certification program.
 4. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Package, deliver and store doors in accordance with specified quality standard.
- B. Accept doors on site in manufacturer's packaging. Inspect for damage.
- C. Protect doors with resilient packaging sealed with heat shrunk plastic. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges with tinted sealer if stored more than one week. Break seal on site to

permit ventilation.

1.7 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Interior Doors: Provide manufacturer's warranty for the life of the installation.
- C. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials and telegraphing core construction.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Wood Veneer Faced Doors:
 - 1. Haley Brothers: www.haleybros.com/#sle.
 - 2. Krieger Specialty Products: www.kriegerproducts.com/#sle.
 - 3. Marshfield DoorSystems, Inc: www.marshfielddoors.com/#sle.
 - 4. VT Industries, Inc: www.vtindustries.com/#sle.

2.2 DOORS AND PANELS

- A. Doors: Refer to drawings for locations and additional requirements.
 - 1. Quality Standard: Custom Grade, Heavy Duty performance, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
 - 2. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.
- B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.
 - 1. Provide solid core doors at each location.
 - 2. Wood veneer facing for field transparent finish.

2.3 DOOR AND PANEL CORES

- A. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core (PC), plies and faces as indicated.

2.4 DOOR FACINGS

- A. Veneer Facing for Transparent Finish: Red oak, veneer grade in accordance with quality standard indicated, plain sliced (flat cut), with book match between leaves of veneer, running match of spliced veneer leaves assembled on door or panel face.

- 1. "Running Match" each pair of doors and doors in close proximity to each other.

2.5 DOOR CONSTRUCTION

- A. Fabricate doors in accordance with door quality standard specified.
- B. Cores Constructed with stiles and rails:
 - 1. Provide solid blocks at lock edge for hardware reinforcement.
 - 2. Provide solid blocking for other throughbolted hardware.
- C. Where supplementary protective edge trim is required, install trim after veneer facing has been applied full-width.
- D. Glazed Openings: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.
- E. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.
- F. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
- G. Provide edge clearances in accordance with the quality standard specified.

2.6 FACTORY FINISHING - WOOD VENEER DOORS

- A. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
 - 1. Transparent:
 - a. System - 1, Lacquer, Nitrocellulose.
 - b. Sheen: Flat.
- B. Factory finish doors in accordance with approved sample.
- C. Seal door top edge with color sealer to match door facing.

2.7 ACCESSORIES

- A. Hollow Metal Door Frames: As specified in Section 081113.
- B. Glazed Openings:
 - 1. Laminated Safety Glass: Comply with 16 CFR 1201 test requirements for Category II.
- C. Door Window Frames: Door window frames with glazing securely fastened within door opening.
 - 1. Frame Material: 18 gage, 0.0478 inch, galvanized steel.
- D. Glazing: As specified in Section 088000.
- E. Glazing Stops: Wood, of same species as door facing, butted corners; prepared for countersink style tamper proof screws.
- F. Door Hardware: As specified in Section 087100.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.2 INSTALLATION

- A. Install doors in accordance with manufacturer's instructions and specified quality standard.
- B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.
- C. Use machine tools to cut or drill for hardware.
- D. Coordinate installation of doors with installation of frames and hardware.
- E. Coordinate installation of glazing.

3.3 TOLERANCES

- A. Comply with specified quality standard for fit and clearance tolerances.
- B. Comply with specified quality standard for telegraphing, warp, and squareness.

3.4 ADJUSTING

- A. Adjust doors for smooth and balanced door movement.
- B. Adjust closers for full closure.

3.5 SCHEDULE

- A. Refer to Door and Frame schedule in drawings.

END OF SECTION

SECTION 084313 - ALUMINUM-FRAMED STOREFRONTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Aluminum-framed storefront, with vision glass.
- B. Infill panels of metal and glass.
- C. Aluminum doors and frames.
- D. Weatherstripping.

1.2 RELATED REQUIREMENTS

- A. Section 088000 - Glazing: Glass and glazing accessories.

1.3 REFERENCE STANDARDS

- A. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site 2015.
- B. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2014.
- C. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2013.
- D. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen 2004 (Reapproved 2012).
- E. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference 2014.
- F. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference 2000 (Reapproved 2016).

1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.

- B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, door hardware, and internal drainage details.
- C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and field welding required.
- D. Manufacturer's Certificate: Certify that the products supplied meet or exceed the specified requirements.
- E. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

- A. Designer Qualifications: Design structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in Colorado.
- B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Handle products of this section in accordance with AAMA CW-10.
- B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.7 FIELD CONDITIONS

- A. Do not install sealants when ambient temperature is less than 40 degrees F. Maintain this minimum temperature during and 48 hours after installation.

1.8 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.
- C. Provide five year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or

flaking.

PART 2 PRODUCTS

2.1 ALUMINUM-FRAMED STOREFRONT

- A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
1. Glazing Rabbet: For 1 inch insulating glazing.
 2. Glazing Position: Centered (front to back).
 3. Finish: Superior performing organic coatings.
 - a. Factory finish all surfaces that will be exposed in completed assemblies.
 - b. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.
 4. Finish Color: To match existing frame colors on site.
 5. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
 6. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
 7. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
 8. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
 9. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
 10. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.

B. Performance Requirements:

1. Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
 - a. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.
2. Water Penetration Resistance on Manufactured Assembly: No uncontrolled water on interior face, when tested in accordance with ASTM E331 at pressure differential of 8 psf.
3. Air Leakage Laboratory Test: Maximum of 0.06 cu ft/min sq ft of wall area, when tested in accordance with ASTM E283 at 6.27 psf pressure differential across assembly.

2.2 COMPONENTS

- A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
 1. Glazing Stops: Flush.
- B. Glazing: As specified in Section 088000.
- C. Swing Doors: Glazed aluminum.
 1. Thickness: 1-3/4 inches.
 2. Top Rail: 5" inches wide.

2.3 MATERIALS

- A. Extruded Aluminum: ASTM B221 (ASTM B221M).
- B. Fasteners: Stainless steel.
- C. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

2.4 HARDWARE

- A. Weatherstripping: Wool pile, continuous and replaceable; provide on all doors.

- B. Sill Sweep Strips: Resilient seal type, retracting, of neoprene; provide on all doors.

END OF SECTION

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SECTION 08 71 00 – DOOR HARDWARE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes:

- 1. Mechanical and electrified door hardware for:
 - a. Swinging doors.
- 2. Field verification, preparation and modification of existing doors and frames to receive new door hardware.
- 3. The intent of the hardware specification is to specify the hardware for interior and exterior doors, and to establish a type, continuity, and standard of quality. However, it is the door hardware supplier's responsibility to thoroughly review existing conditions, schedules, specifications, drawings, and other Contract Documents to verify the suitability of the hardware specified.

B. Exclusions: Unless specifically listed in hardware sets, hardware is not specified in this section for:

- 1. Windows
- 2. Cabinets (casework), including locks in cabinets
- 3. Signage
- 4. Toilet accessories
- 5. Overhead doors

C. Related Sections:

- 1. Division 01 Section "Alternates" for alternates affecting this section.
- 2. Division 07 Section "Joint Sealants" for sealant requirements applicable to threshold installation specified in this section.
- 3. Division 09 sections for touchup, finishing or refinishing of existing openings modified by this section.
- 4. Division 26 sections for connections to electrical power system and for low-voltage wiring.
- 5. Division 28 sections for coordination with other components of electronic access control system.

1.03 REFERENCES

- A. UL - Underwriters Laboratories

1. UL 305 - Panic Hardware
- B. DHI - Door and Hardware Institute
 1. Sequence and Format for the Hardware Schedule
 2. Recommended Locations for Builders Hardware
 3. Key Systems and Nomenclature
- C. ANSI - American National Standards Institute
 1. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties

1.04 SUBMITTALS

A. General:

1. Submit in accordance with Conditions of Contract and Division 01 requirements.
2. Highlight, encircle, or otherwise specifically identify on submittals deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.
3. Prior to forwarding submittal, comply with procedures for verifying existing door and frame compatibility for new hardware, as specified in PART 3, "EXAMINATION" article, herein.

B. Action Submittals:

1. Product Data: Technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
2. Riser and Wiring Diagrams: After final approval of hardware schedule, submit details of electrified door hardware, indicating:
 - a. Wiring Diagrams: For power, signal, and control wiring and including:
 - 1) Details of interface of electrified door hardware and building safety and security systems.
 - 2) Schematic diagram of systems that interface with electrified door hardware.
 - 3) Point-to-point wiring.
 - 4) Risers.
3. Door Hardware Schedule: Submit schedule with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule as published by the Door and Hardware Institute. Indicate complete designations of each item required for each door or opening, include:
 - a. Door Index; include door number, heading number, and Architects hardware set number.
 - b. Opening Lock Function Spreadsheet: List locking device and function for each opening.
 - c. Quantity, type, style, function, size, and finish of each hardware item.
 - d. Name and manufacturer of each item.
 - e. Fastenings and other pertinent information.
 - f. Location of each hardware set cross-referenced to indications on Drawings.
 - g. Explanation of all abbreviations, symbols, and codes contained in schedule.
 - h. Mounting locations for hardware.

- i. Door and frame sizes and materials.
- j. Name and phone number for local manufacturer's representative for each product.
- k. Operational Description of openings with any electrified hardware (locks, exits, electromagnetic locks, electric strikes, automatic operators, door position switches, magnetic holders or closer/holder units, and access control components).
Operational description should include operational descriptions for: egress, ingress (access), and fire/smoke alarm connections.

- 1) Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate fabrication of other work that is critical in Project construction schedule.

4. Key Schedule:

- a. After Keying Conference, provide keying schedule listing levels of keying as well as explanation of key system's function, key symbols used and door numbers controlled.
- b. Use ANSI/BHMA A156.28 "Recommended Practices for Keying Systems" as guideline for nomenclature, definitions, and approach for selecting optimal keying system.
- c. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
- d. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
- e. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion.
 - 1) Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.
- f. Prepare key schedule by or under supervision of supplier, detailing Owner's final keying instructions for locks.

5. Templates: After final approval of hardware schedule, provide templates for doors, frames and other work specified to be factory or shop prepared for door hardware installation.

C. Informational Submittals:

1. Product data for electrified door hardware:

- a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.

2. Warranty: Special warranty specified in this Section.

D. Closeout Submittals:

1. Operations and Maintenance Data: Provide in accordance with Division 01 and include:

- a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
- b. Catalog pages for each product.
- c. Factory order acknowledgement numbers (for warranty and service)
- d. Name, address, and phone number of local representative for each manufacturer.
- e. Parts list for each product.

- f. Final approved hardware schedule, edited to reflect conditions as-installed.
- g. Final keying schedule
- h. Copies of floor plans with keying nomenclature
- i. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.
- j. Copy of warranties including appropriate reference numbers for manufacturers to identify project.

1.05 QUALITY ASSURANCE

- A. Supplier Qualifications and Responsibilities: Recognized architectural hardware supplier with record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project and that provides certified Architectural Hardware Consultant (AHC) available to Owner, Architect, and Contractor, at reasonable times during the Work for consultation.
 - 1. Warehousing Facilities: In Project's vicinity.
 - 2. Scheduling Responsibility: Preparation of door hardware and keying schedules.
 - 3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
 - 4. Coordination Responsibility: Assist in coordinating installation of electronic security hardware with Architect and electrical engineers and provide installation and technical data to Architect and other related subcontractors.
 - a. Upon completion of electronic security hardware installation, inspect and verify that all components are working properly.
- B. Architectural Hardware Consultant Qualifications: Person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and meets these requirements:
 - 1. For door hardware, DHI-certified, Architectural Hardware Consultant (AHC).
 - 2. Can provide installation and technical data to Architect and other related subcontractors.
 - 3. Can inspect and verify components are in working order upon completion of installation.
 - 4. Capable of producing wiring diagrams.
 - 5. Capable of coordinating installation of electrified hardware with Architect and electrical engineers.
- C. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.
- D. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.
- E. Accessibility Requirements: For door hardware on doors in an accessible route, comply with governing accessibility regulations cited in "REFERENCES" article, herein.
- F. Keying Conference
 - 1. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including:
 - a. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.

- b. Preliminary key system schematic diagram.
- c. Requirements for key control system.
- d. Requirements for access control.
- e. Address for delivery of keys.

G. Pre-installation Conference

- 1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
- 2. Inspect and discuss preparatory work performed by other trades.
- 3. Inspect and discuss electrical roughing-in for electrified door hardware.
- 4. Review sequence of operation for each type of electrified door hardware.
- 5. Review required testing, inspecting, and certifying procedures.
- 6. Conference can be done remotely via web or conference call.

H. Coordination Conferences:

- 1. Installation Coordination Conference: Prior to hardware installation, schedule and hold meeting to review questions or concerns related to proper installation and adjustment of door hardware.
- 2. Electrified Hardware Coordination Conference: Prior to ordering electrified hardware, schedule and hold meeting to coordinate door hardware with security, electrical, doors and frames, and other related suppliers.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site.
- B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.
 - 1. Deliver each article of hardware in manufacturer's original packaging.
- C. Project Conditions:
 - 1. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.
 - 2. Provide secure lock-up for door hardware delivered to Project. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.
- D. Protection and Damage:
 - 1. Promptly replace products damaged during shipping.
 - 2. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work.
 - 3. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.
- E. Deliver keys and permanent cores to Owner by registered mail or overnight package service.

1.07 COORDINATION

- A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete.
- B. Installation Templates: Distribute for doors, frames, and other work specified to be factory or shop prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.
- D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.
- E. Existing Openings: Where existing doors, frames and/or hardware are to remain, field verify existing functions, conditions and preparations and coordinate to suit opening conditions and to provide proper door operation.

1.08 WARRANTY

- A. Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Beginning from date of Substantial Completion, for durations indicated.
 - a. Closers:
 - 1) Mechanical: 30 years.
 - b. Exit Devices:
 - 1) Mechanical: 3 years.
 - c. Locksets:
 - 1) Mechanical: 10 years.
 - d. Continuous Hinges: Lifetime warranty.
 - 2. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Approval of manufacturers and/or products other than those listed as "Scheduled Manufacturer" or "Acceptable Manufacturers" in the individual article for the product category shall be in accordance with QUALITY ASSURANCE article, herein.
- B. Approval of products from manufacturers indicated in "Acceptable Manufacturers" is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer's product.

- C. Where specified hardware is not adaptable to finished shape or size of members requiring hardware, furnish suitable types having same operation and quality as type specified, subject to Architect's approval.

2.02 MATERIALS

A. Fasteners

1. Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation.
2. Furnish screws for installation with each hardware item. Finish exposed (exposed under any condition) screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.
3. Provide concealed fasteners for hardware units exposed when door is closed except when no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work unless thru-bolts are required to fasten hardware securely. Review door specification and advise Architect if thru-bolts are required.
4. Install hardware with fasteners provided by hardware manufacturer.

- B. Modification and Preparation of Existing Doors: Where existing door hardware is indicated to be removed and reinstalled.

1. Provide necessary fillers, Dutchmen, reinforcements, and fasteners, compatible with existing materials, as required for mounting new opening hardware and to cover existing door and frame preparations.
2. Use materials which match materials of adjacent modified areas.
3. When modifying existing fire-rated openings, provide materials permitted by NFPA 80 as required to maintain fire-rating.

- C. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.

1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.

2.03 HINGES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Ives 5BB series.
2. Acceptable Manufacturers and Products: Hager BB series, McKinney TB/T4B series, Stanley FBB Series.

B. Requirements:

1. Provide hinges conforming to ANSI/BHMA A156.1.
2. 1-3/4 inch (44 mm) thick doors, up to and including 36 inches (914 mm) wide:
 - a. Exterior: Standard weight, bronze or stainless steel, 4-1/2 inches (114 mm) high
 - b. Interior: Standard weight, steel, 4-1/2 inches (114 mm) high
3. 1-3/4 inch (44 mm) thick doors over 36 inches (914 mm) wide:

- a. Exterior: Heavy weight, bronze/stainless steel, 5 inches (127 mm) high
 - b. Interior: Heavy weight, steel, 5 inches (127 mm) high
4. 2 inches or thicker doors:
- a. Exterior: Heavy weight, bronze or stainless steel, 5 inches (127 mm) high
 - b. Interior: Heavy weight, steel, 5 inches (127 mm) high
5. Provide three hinges per door leaf for doors 90 inches (2286 mm) or less in height, and one additional hinge for each 30 inches (762 mm) of additional door height.
6. Where new hinges are specified for existing doors or existing frames, provide new hinges of identical size to hinge preparation present in existing door or existing frame.
7. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
- a. Steel Hinges: Steel pins
 - b. Non-Ferrous Hinges: Stainless steel pins
 - c. Out-Swinging Exterior Doors: Non-removable pins
 - d. Out-Swinging Interior Lockable Doors: Non-removable pins
 - e. Interior Non-lockable Doors: Non-rising pins
8. Width of hinges: 4-1/2 inches (114 mm) at 1-3/4 inch (44 mm) thick doors, and 5 inches (127 mm) at 2 inches (51 mm) or thicker doors. Adjust hinge width as required for door, frame, and wall conditions to allow proper degree of opening.
9. All hinges to be ball bearing.

2.04 CONTINUOUS HINGES

A. Stainless Steel

1. Manufacturers:
- a. Scheduled Manufacturer: Ives.
 - b. Acceptable Manufacturers: Markar, Stanley.
2. Requirements:
- a. Provide pin and barrel continuous hinges conforming to ANSI/BHMA A156.26., Grade 1.
 - b. Provide pin and barrel continuous hinges fabricated from 14 gauge, type 304 stainless steel.
 - c. Provide twin self-lubricated nylon bearings at each hinge knuckle, with 0.25-inch (6 mm) diameter stainless steel pin.
 - d. Provide hinges capable of supporting door weights up to 600 pounds, and successfully tested for 1,500,000 cycles.
 - e. On fire-rated doors, provide pin and barrel continuous hinges that are classified for use on rated doors by testing agency acceptable to authority having jurisdiction.
 - f. Provide pin and barrel continuous hinges with electrified options as scheduled in the hardware sets. Provide with sufficient number and wire gage to accommodate electric function of specified hardware.
 - g. Install hinges with fasteners supplied by manufacturer.
 - h. Provide hinges 1 inch (25 mm) shorter in length than nominal height of door, unless otherwise noted or door details require shorter length and with symmetrical hole pattern.

2.05 BARN DOOR HARDWARE

A. Manufacturers:

1. Scheduled Manufacturer: KN Crowder.
2. Acceptable Manufacturers: Hager, Real Carriage Door, Richards-Wilcox.

B. Requirements:

1. Provide complete sets of sliding door hardware as recommended by manufacturer for door type and weight.
2. Include track, channels, brackets, hangers, fasteners, guides, pulls, stops, and other hardware as required for complete installation.

2.06 POCKET DOOR HARDWARE

A. Manufacturers:

1. Scheduled Manufacturer: KN Crowder.
2. Acceptable Manufacturers: Johnson Hardware, Stanley, Hager.

B. Requirements:

1. Provide complete sets of pocket door hardware as recommended by manufacturer for door type and weight.
2. Include track, hangers, fasteners, guides, stops, and other hardware as required for complete installation.

2.07 CYLINDRICAL LOCKS – GRADE 1

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Schlage ND series.
2. Acceptable Manufacturers and Products: None.

B. Requirements:

1. Provide cylindrical locks conforming to ANSI/BHMA A156.2 Series 4000, Grade 1, and UL Listed for 3 hour fire doors.
2. Cylinders: Refer to "KEYING" article, herein.
3. Provide locks with standard 2-3/4 inches (70 mm) backset, unless noted otherwise, with 1/2 inch latch throw. Provide proper latch throw for UL listing at pairs.
4. Provide locksets with separate anti-rotation thru-bolts, and no exposed screws.
5. Provide independently operating levers with two external return spring cassettes mounted under roses to prevent lever sag.
6. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
7. Provide electrified options as scheduled in the hardware sets.
8. Lever Trim: Solid cast levers without plastic inserts and wrought roses on both sides.
 - a. Tactile Warning (Knurling): Where required by authority having jurisdiction. Provide on levers on exterior (secure side) of doors serving rooms considered to be hazardous.

2.08 EXIT DEVICES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Von Duprin 98 Series.
2. Acceptable Manufacturers and Products: None.

B. Requirements:

1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1 and UL listed for Panic Exit or Fire Exit Hardware.
2. Provide touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
3. Touchpad must extend a minimum of one half of door width. No plastic inserts are allowed in touchpads.
4. Provide exit devices with deadlatching feature for security and for future addition of alarm kits and/or other electrified requirements.
5. Provide flush end caps for exit devices.
6. Provide exit devices with manufacturer's approved strikes.
7. Provide exit devices cut to door width and height. Install exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Architect.
8. Mount mechanism case flush on face of doors, or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
9. Provide cylinder or hex-key dogging as specified at non fire-rated openings.
10. Removable Mullions: 2 inches (51 mm) x 3 inches (76 mm) steel tube. Where scheduled as keyed removable mullion, provide type that can be removed by use of a keyed cylinder, which is self-locking when re-installed.

2.09 CYLINDERS

A. Manufacturers:

1. Scheduled Manufacturer: Schlage Everest 29 Restricted Keyway

B. Requirements:

1. Provide permanent cylinders/cores to match Owner's existing key system, compliant with ANSI/BHMA A156.5; latest revision; cylinder face finished to match lockset, manufacturer's series as indicated. Refer to "KEYING" article, herein.

C. Construction Keying:

1. Replaceable Construction Cores.
 - a. Provide temporary construction cores replaceable by permanent cores, furnished in accordance with the following requirements.
 - 1) 3 construction control keys
 - 2) 12 construction change (day) keys.
 - b. Owner or Owner's Representative will replace temporary construction cores with permanent cores.

2.10 KEYING

- A. Provide a factory registered keying system, complying with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.
- B. Provide cylinders/cores keyed into Owner's existing factory registered keying system.
- C. Comply with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.
- D. Requirements:
 - 1. Provide permanent cylinders/cores keyed by the manufacturer according to the following key system.
 - a. Master Keying system as directed by the Owner.
 - 2. Forward bitting list and keys separately from cylinders, by means as directed by Owner. Failure to comply with forwarding requirements will be cause for replacement of cylinders/cores involved at no additional cost to Owner.
 - 3. Provide keys with the following features:
 - a. Material: Nickel silver; minimum thickness of .107-inch (2.3mm)
 - 4. Identification:
 - a. Mark permanent cylinders/cores and keys with applicable blind code per DHI publication "Keying Systems and Nomenclature" for identification. Do not provide blind code marks with actual key cuts.
 - b. Identification stamping provisions must be approved by the Architect and Owner.
 - c. Stamp cylinders/cores and keys with Owner's unique key system facility code as established by the manufacturer; key symbol and embossed or stamped with "DO NOT DUPLICATE" along with the "PATENTED" or patent number to enforce the patent protection.
 - d. Failure to comply with stamping requirements will be cause for replacement of keys involved at no additional cost to Owner.
 - e. Forward permanent cylinders/cores to Owner, separately from keys, by means as directed by Owner.
 - 5. Quantity: Furnish in the following quantities.
 - a. Change (Day) Keys: 3 per cylinder/core.
 - b. Permanent Control Keys: 3.
 - c. Master Keys: 6.

2.11 DOOR CLOSERS

- A. Manufacturers and Products:
 - 1. Scheduled Manufacturer and Product: LCN 4040XP series.
 - 2. Acceptable Manufacturers and Products: None.
- B. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
3. Cylinder Body: 1-1/2 inch (38 mm) diameter with 3/4 inch (19 mm) diameter double heat-treated pinion journal.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck.
7. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers.
8. Pressure Relief Valve (PRV) Technology: Not permitted.
9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).
10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.12 DOOR TRIM

A. Manufacturers:

1. Scheduled Manufacturer: Ives.
2. Acceptable Manufacturers: Burns, Rockwood.

B. Requirements:

1. Provide push plates 6 inches (102 mm) wide by 16 inches (406 mm) high by 0.050 inch (1 mm) thick and beveled 4 edges.
2. Provide pull plates 6 inches (102 mm) wide by 16 inches (406 mm) high by 0.050 inch (1 mm) thick, beveled 4 edges, and prepped for pull.

2.13 PROTECTION PLATES

A. Manufacturers:

1. Scheduled Manufacturer: Ives.
2. Acceptable Manufacturers: Burns, Rockwood.

B. Requirements:

1. Provide kick plates minimum of 0.050 inch (1 mm) thick, beveled four edges as scheduled. Furnish with sheet metal or wood screws, finished to match plates.
2. Sizes of plates:
 - a. Kick Plates: 10 inches (254 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs

2.14 DOOR STOPS

A. Manufacturers:

1. Scheduled Manufacturer: Ives.
2. Acceptable Manufacturers: Burns, Rockwood.

B. Provide door stops at each door leaf:

1. Provide wall stops wherever possible. Provide convex type where mortise type locks are used and concave type where cylindrical type locks are used.
2. Where a wall stop cannot be used, provide universal floor stops for low or high rise options.
3. Where wall or floor stop cannot be used, provide medium duty surface mounted overhead stop.

2.15 THRESHOLDS, SEALS, DOOR SWEEPS, AND GASKETING

A. Manufacturers:

1. Scheduled Manufacturer: Zero International.
2. Acceptable Manufacturers: National Guard, Reese.

B. Requirements:

1. Provide thresholds, weather-stripping (including door sweeps, seals, and astragals) and gasketing systems (including smoke, sound, and light) as specified and per architectural details. Match finish of other items.
2. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
3. Size of thresholds:
 - a. Saddle Thresholds: 1/2 inch (13 mm) high by jamb width by door width
 - b. Bumper Seal Thresholds: 1/2 inch (13 mm) high by 5 inches (127 mm) wide by door width
4. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.

2.16 SILENCERS

A. Manufacturers:

1. Scheduled Manufacturer: Ives.
2. Acceptable Manufacturers: Burns, Rockwood.

B. Requirements:

1. Provide "push-in" type silencers for hollow metal or wood frames.
2. Provide one silencer per 30 inches (762 mm) of height on each single frame, and two for each pair frame.
3. Omit where gasketing is specified.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Field verify existing doors and frames receiving new hardware and existing conditions receiving new openings. Verify that new hardware is compatible with existing door and frame preparation and existing conditions.
- C. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Where on-site modification of doors and frames is required:
 - 1. Carefully remove existing door hardware and components being reused. Clean, protect, tag, and store in accordance with storage and handling requirements specified herein.
 - 2. Field modify and prepare existing door and frame for new hardware being installed.
 - 3. When modifications are exposed to view, use concealed fasteners, when possible.
 - 4. Prepare hardware locations and reinstall in accordance with installation requirements for new door hardware and with:
 - a. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
 - b. Wood Doors: DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."
 - c. Doors in rated assemblies: NFPA 80 for restrictions on on-site door hardware preparation.

3.03 INSTALLATION

- A. Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.
 - 1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
 - 2. Custom Steel Doors and Frames: HMMA 831.
 - 3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
- B. Install each hardware item in compliance with manufacturer's instructions and recommendations, using only fasteners provided by manufacturer.
- C. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.

- D. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.
- E. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- F. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.
- G. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
- H. Lock Cylinders: Install construction cores to secure building and areas during construction period.
 - 1. Replace construction cores with permanent cores as indicated in keying section.
- I. Wiring: Coordinate with Division 26, ELECTRICAL sections for:
 - 1. Conduit, junction boxes and wire pulls.
 - 2. Connections to and from power supplies to electrified hardware.
 - 3. Connections to fire/smoke alarm system and smoke evacuation system.
 - 4. Connection of wire to door position switches and wire runs to central room or area, as directed by Architect.
 - 5. Testing and labeling wires with Architect's opening number.
- J. Door Closers: Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Mount closers so they are not visible in corridors, lobbies and other public spaces unless approved by Architect.
- K. Closer/Holders: Mount closer/holders on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.
- L. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."
- M. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.
- N. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
- O. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- P. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.04 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.

1. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
 2. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
- B. Occupancy Adjustment: Approximately three to six months after date of Substantial Completion, Installer's Architectural Hardware Consultant must examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors and door hardware.

3.05 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items as necessary to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.06 DOOR HARDWARE SCHEDULE

- A. Hardware items are referenced in the following hardware. Refer to the above-specifications for special features, options, cylinders/keying, and other requirements.

B. Hardware Sets:

Hardware Group No. 01

For use on Door #(s):

A19C A19D A23A

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	SET	EXTERIOR HINGE	5BB1 (SIZE, QTY, WEIGHT, NRP AS REQ'D)	630	IVE
1	EA	PANIC HARDWARE	98-NL-SNB	626	VON
1	EA	SFIC EVEREST CORE	80-037	626	SCH
1	EA	SFIC RIM CYLINDER	80-159	626	SCH
1	EA	SURFACE CLOSER (W/ SPRING STOP)	4040XP SCUSH TBWMS	689	LCN
1	EA	RAIN DRIP	142AA	AA	ZER
1	EA	GASKETING	326AA @ HEAD & JAMBS	AA	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	568A-MSLA-10 - OR AS REQ'D BY SILL DETAIL	A	ZER

Hardware Group No. 02

For use on Door #(s):

A21A

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	SET	EXTERIOR HINGE	5BB1 (SIZE, QTY, WEIGHT, NRP AS REQ'D)	630	IVE
1	EA	POWER TRANSFER	EPT10	689	FAL
1	EA	ELEC LOCK	ND80HDEU RHO RX	626	SCH
1	EA	SFIC EVEREST CORE	80-037	626	SCH
1	EA	SURFACE CLOSER (W/ SPRING STOP)	4040XP SCUSH TBWMS	689	LCN
1	EA	RAIN DRIP	142AA	AA	ZER
1	EA	GASKETING	326AA @ HEAD & JAMBS	AA	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	568A-MSLA-10 - OR AS REQ'D BY SILL DETAIL	A	ZER
1	SET	WIRING, PT TO PT DIAGRAM & ELEVATION DIAGRAM	PROVIDED BY HARDWARE SUPPLIER		
1	EA	CARD READER	PROVIDED BY SECURITY VENDOR	BLK	SCE
1	EA	LOW VOLTAGE POWER	PROVIDED BY SECURITY VENDOR		
1	EA	DOOR CONTACT	679-05	BLK	SCE

FREE EGRESS AT ALL TIMES. AUTHORIZED CREDENTIAL MOMENTARILY RELEASES OUTSIDE LEVER, ALLOWING ENTRY. MECHANICAL KEY OVERRIDE. RX SWITCH (INTEGRAL TO LOCKING HARDWARE) WILL SHUNT THE DOOR CONTACT AND ALLOW FOR AUTHORIZED EGRESS. DOOR CONTACT MONITORS WHEN DOOR OPENS AND CLOSES. ON LOSS OF POWER, ELECTRIFIED HARDWARE IS DISABLED. DOOR IS LATCHED. TRIM REMAINS SECURE.

Hardware Group No. 03

For use on Door #(s):

A17B

A17C

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	SET	INTERIOR HINGE	5BB1 (SIZE, QTY, WEIGHT, NRP AS REQ'D)	652	IVE
1	EA	KEYED FIRE RATED REMOVABLE MULLION	KR9954-STAB-MT54	689	VON
2	EA	FIRE EXIT HARDWARE	98-L-F-06	626	VON
3	EA	SFIC EVEREST CORE	80-037	626	SCH
1	EA	SFIC MORTISE CYL.	80-132	626	SCH
2	EA	SFIC RIM CYLINDER	80-159	626	SCH
2	EA	SURFACE CLOSER (W/ SPRING STOP)	4040XP SCUSH TBWMS	689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	488S-BK @ HEAD & JAMBS	S-Bk	ZER
1	EA	MULLION SEAL	8780N	N	ZER

Hardware Group No. 04

For use on Door #(s):

A17E C19A

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	SET	INTERIOR HINGE	5BB1 (SIZE, QTY, WEIGHT, NRP AS REQ'D)	652	IVE
1	EA	FIRE EXIT HARDWARE	98-L-F-06	626	VON
1	EA	SFIC EVEREST CORE	80-037	626	SCH
1	EA	SFIC RIM CYLINDER	80-159	626	SCH
1	EA	SURFACE CLOSER	4040XP EDA TBWMS	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	626	IVE
1	EA	GASKETING	488S-BK @ HEAD & JAMBS	S-Bk	ZER

Hardware Group No. 05

For use on Door #(s):

A19A

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	SET	INTERIOR HINGE	5BB1 (SIZE, QTY, WEIGHT, NRP AS REQ'D)	652	IVE
1	EA	PANIC HARDWARE	98-L-06-SNB	626	VON
1	EA	SFIC EVEREST CORE	80-037	626	SCH
1	EA	SFIC RIM CYLINDER	80-159	626	SCH
1	EA	SURFACE CLOSER	4040XP EDA TBWMS	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	626	IVE
1	EA	GASKETING	488S-BK @ HEAD & JAMBS	S-Bk	ZER

Hardware Group No. 06

For use on Door #(s):

A19B

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	SET	INTERIOR HINGE	5BB1 (SIZE, QTY, WEIGHT, NRP AS REQ'D)	652	IVE
1	EA	CLASSROOM LOCK	ND70HD RHO	626	SCH
1	EA	SFIC EVEREST CORE	80-037	626	SCH
1	EA	SURFACE CLOSER	4040XP EDA TBWMS	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS436	626	IVE
1	EA	GASKETING	488S-BK @ HEAD & JAMBS	S-Bk	ZER

Hardware Group No. 07

For use on Door #(s):

A21B

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	SET	INTERIOR HINGE	5BB1 (SIZE, QTY, WEIGHT, NRP AS REQ'D)	652	IVE
1	EA	CLASSROOM LOCK	ND70HD RHO	626	SCH
1	EA	SFIC EVEREST CORE	80-037	626	SCH
1	EA	SURFACE CLOSER (W/ HOLD OPEN)	4040XP HEDA TBWMS	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	626	IVE
1	EA	SILENCER	SR64	GRY	IVE

Hardware Group No. 08

For use on Door #(s):

A23C

A24A

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	SET	INTERIOR HINGE	5BB1 (SIZE, QTY, WEIGHT, NRP AS REQ'D)	652	IVE
1	EA	CLASSROOM LOCK	ND70HD RHO	626	SCH
1	EA	SFIC EVEREST CORE	80-037	626	SCH
1	EA	OH STOP	90S	630	GLY
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	SILENCER	SR64	GRY	IVE

Hardware Group No. 09

For use on Door #(s):

A23B

C22A

C24A

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	SET	INTERIOR HINGE	5BB1 (SIZE, QTY, WEIGHT, NRP AS REQ'D)	652	IVE
1	EA	CLASSROOM SECURITY	ND75HD RHO XN12-035	626	SCH
2	EA	SFIC EVEREST CORE	80-037	626	SCH
1	EA	SURFACE CLOSER	4040XP EDA TBWMS	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	626	IVE
1	EA	SILENCER	SR64	GRY	IVE

Hardware Group No. 10

For use on Door #(s):

A22A C20A C21A

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	SET	INTERIOR HINGE	5BB1 (SIZE, QTY, WEIGHT, NRP AS REQ'D)	652	IVE
1	EA	STOREROOM LOCK	ND80HD RHO	626	SCH
1	EA	SFIC EVEREST CORE	80-037	626	SCH
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	626	IVE
1	EA	SILENCER	SR64	GRY	IVE

Hardware Group No. AL-01

For use on Door #(s):

A17D

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CONTINUOUS HINGE W/ EPT PREP	112HD EPT (MATCH STOREFRONT FINISH)	CPC	IVE
2	EA	POWER TRANSFER	EPT10	689	FAL
1	EA	KEYED REMOVABLE MULLION	KR4954-STAB-MT54	689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-98-DT-SNB	626	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-98-NL 24 VDC-SNB	626	VON
2	EA	SFIC EVEREST CORE	80-037	626	SCH
1	EA	SFIC MORTISE CYL.	80-132	626	SCH
1	EA	SFIC RIM CYLINDER	80-159	626	SCH
2	EA	SURFACE CLOSER (W/ SPRING STOP)	4040XP SCUSH TBWMS	689	LCN
2	SET	CLOSER BRACKET(S)	AS REQ'D TO INSTALL CLOSER	689	LCN
1	EA	MULLION SEAL	8780N	N	ZER
1	SET	SEALS	PROVIDED BY ALUM DOOR/FRAME MFG		
2	EA	DOOR SWEEP	PROVIDED BY ALUM DOOR/FRAME MFG		
1	EA	THRESHOLD	568A-MSLA-10 - OR AS REQ'D BY SILL DETAIL	A	ZER
1	SET	WIRING, PT TO PT DIAGRAM & ELEVATION DIAGRAM	PROVIDED BY HARDWARE SUPPLIER		
1	EA	CARD READER	PROVIDED BY SECURITY VENDOR	BLK	SCE
2	EA	DOOR CONTACT	7764	628	SCE
1	EA	POWER SUPPLY	PS902 900-KL 900-2RS 900-BBK 120/240 VAC		VON

FREE EGRESS AT ALL TIMES.

AUTHORIZED CREDENTIAL MOMENTARILY RETRACTS LATCHBOLT, ALLOWING ENTRY.

DURING OPEN HOURS, ACCESS CONTROL SYSTEM TIME CLOCK ELECTRICALLY KEEPS LATCH
RETRACTED, ALLOWING ENTRY.RX SWITCH (INTEGRAL TO LOCKING HARDWARE) WILL SHUNT THE DOOR CONTACT AND
ALLOW FOR AUTHORIZED EGRESS.

DOOR CONTACT MONITORS WHEN DOOR OPENS AND CLOSES.

ON LOSS OF POWER, ELECTRIFIED HARDWARE IS DISABLED. DOOR IS LATCHED. TRIM
REMAINS SECURE.

Hardware Group No. BD-01

For use on Door #(s):

C23A C25A

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	SET	FASCIA	C-110		KNC
2	EA	END CAP	C-110		KNC
1	SET	BARN DOOR TRACK	C-994 SERIES		KNC
1	EA	DOOR PULL, 3/4" RND	PR 8102HD 8" J (BACK TO BACK MOUNT) (BACK TO BACK MOUNT)	630	IVE

Hardware Group No. EX-01

For use on Door #(s):

EA17A EC22B EC24B

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	STOREROOM LOCK	ND80HD RHO	626	SCH
1	EA	SFIC EVEREST CORE	80-037	626	SCH
1			RE-USE BALANCE OF DOOR, FRAME & HARDWARE		

Hardware Group No. PD-01

For use on Door #(s):

C26A C26B

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	SET	POCKET DOOR TRACK & HARDWARE	CROWDERFRAME TYPE B (FOR 1 DOOR)		KNC
1	EA	ADA POCKET DOOR PULL (NON LOCKING)	1069	630	TRI

END OF SECTION

SECTION 088000 - GLAZING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Insulating glass units.
- B. Glazing units.
- C. Glazing compounds and accessories.

1.2 RELATED REQUIREMENTS

- A. Section 081113 - Hollow Metal Doors and Frames: Glazed lites in doors and borrowed lites.
- B. Section 081416 - Flush Wood Doors: Glazed lites in doors.
- C. Section 084313 - Aluminum-Framed Storefronts: Glazing furnished as part of storefront assembly.

1.3 REFERENCE STANDARDS

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials Current Edition.
- B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test 2015.
- C. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures Most Recent Edition Cited by Referring Code or Reference Standard.
- D. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers 2005 (Reapproved 2015).
- E. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.
- F. ASTM C1036 - Standard Specification for Flat Glass 2016.
- G. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass 2018.
- H. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass 2014.
- I. ASTM C1193 - Standard Guide for Use of Joint Sealants 2016.

- J. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass 2015.
- K. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings 2016.
- L. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation 2010.
- M. GANA (GM) - GANA Glazing Manual 2008.
- N. GANA (SM) - GANA Sealant Manual 2008.
- O. GANA (LGRM) - Laminated Glazing Reference Manual 2009.
- P. ICC (IBC) - International Building Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- Q. NFRC 100 - Procedure for Determining Fenestration Product U-factors 2017.
- R. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence 2014, with Errata (2017).
- S. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems 2017.

1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data on Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.
- C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.
- D. Certificate: Certify that products of this section meet or exceed specified requirements.
- E. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.6 FIELD CONDITIONS

- A. Do not install glazing when ambient temperature is less than 40 degrees F.
- B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.7 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Insulating Glass Units: Provide a five (5) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including providing products to replace failed units.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Glass Fabricators:
 - 1. GGI - General Glass International: www.generalglass.com/#sle.
 - 2. Standard Bent Glass Corp: www.standardbent.com/#sle.
 - 3. Trulite Glass & Aluminum Solutions, LLC: www.trulite.com/#sle.
 - 4. Viracon, Inc: www.viracon.com/#sle.
- B. Float Glass Manufacturers:
 - 1. AGC Glass North America, Inc: www.agcglass.com/#sle.
 - 2. Cardinal Glass Industries: www.cardinalcorp.com/#sle.
 - 3. Guardian Glass, LLC: www.guardianglass.com/#sle.
 - 4. Pilkington North America Inc: www.pilkington.com/na/#sle.
 - 5. Vitro Architectural Glass (formerly PPG Glass): www.vitroglazings.com/#sle.
- C. Fire-Resistance-Rated Glass: Provide products as required to achieve indicated fire-rating period.
 - 1. Manufacturers:

- a. SAFTIFIRST, a division of O'Keeffe's Inc; SuperLite II-XL:
www.safti.com/#sle.
 - b. Technical Glass Products; Pilkington Pyrostop: www.fireglass.com/#sle.
 - c. Vetrotech North America; Contraflam: www.vetrotechusa.com/#sle.
- D. Fire-Protection-Rated Glass: Provide products as required to achieve indicated fire-rating period.
1. Manufacturers:
 - a. SAFTIFIRST, a division of O'Keeffe's Inc; SuperClear 45-HS:
www.safti.com/#sle.
 - b. SCHOTT North America Inc; PYRAN Platinum: www.us.schott.com/#sle.
 - c. Technical Glass Products: www.fireglass.com/#sle.
 - d. Vetrotech North America; Contraflam 45: www.vetrotechusa.com/#sle.
- E. Mirrored Glass Manufacturers:
1. Pilkington North America Inc; Pilkington Mirropane Transparent Mirror:
www.pilkington.com/na/#sle.

2.2 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES

- A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.
1. Design Pressure: Calculated in accordance with ASCE 7.
 2. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
 3. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
 4. Glass thicknesses listed are minimum.
- B. Vapor Retarder and Air Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure vapor retarder and air barrier.

1. In conjunction with vapor retarder and joint sealer materials described in other sections.
- C. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:
1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
 2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
 3. Solar Optical Properties: Comply with NFRC 300 test method.

2.3 GLASS MATERIALS

- A. Float Glass: Provide float glass based glazing unless otherwise indicated.
1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality - Q3.
 2. Kind FT - Fully Tempered Type: Complies with ASTM C1048.
 3. Impact Resistant Safety Glass: Complies with ANSI Z97.1 - Class B, or 16 CFR 1201 - Category I criteria.
- B. Laminated Glass: Float glass laminated in accordance with ASTM C1172.
1. Laminated Safety Glass: Complies with ANSI Z97.1 - Class B or 16 CFR 1201 - Category I impact test requirements.

2.4 INSULATING GLASS UNITS

- A. Manufacturers:
1. Fabricator certified by glass manufacturer for type of glass, coating, and treatment involved and capable of providing specified warranty.
- B. Insulating Glass Units: Types as indicated.
1. Durability: Certified by an independent testing agency to comply with ASTM E2190.

2. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
 3. Spacer Color: Black.
 4. Edge Seal:
 - a. Color: Black.
 5. Purge interpane space with dry air, hermetically sealed.
- C. Type IG-1 - Insulating Glass Units: Vision glass, double glazed.
1. Applications: Exterior glazing unless otherwise indicated.
 2. Space between lites filled with air.
 3. Outboard Lite: Annealed float glass, 1/4 inch thick, minimum.
 - a. Tint: Clear.
 4. Total Thickness: 1 inch.
 - a. Exterior Glas ply/coating: 1/4" PPG Solarban 90 (3)
 - b. Space: Warm Edge
 - c. Airspace: 1/2-inch
 - d. Silicone: Black
 - e. Interior glass ply: 1/4" inch clear. PPG Solarban 90 (3)
 5. Thermal Transmittance (U-Value), Summer - Center of Glass: [____], nominal.

2.5 GLAZING COMPOUNDS

- A. Type GC-5 - Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; non-bleeding, non-staining; ASTM C920 Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; [____] color.

2.6 ACCESSORIES

- A. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot of glazing or minimum 4 inch by width of glazing rabbet space minus 1/16 inch by height to suit glazing method and pane weight and area.
- B. Glazing Splines: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color black.

PART 3 EXECUTION

3.1 VERIFICATION OF CONDITIONS

- A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.
- B. Verify that the minimum required face and edge clearances are being provided.
- C. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.

3.2 PREPARATION

- A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.
- B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.3 INSTALLATION, GENERAL

- A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.
- B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.

3.4 INSTALLATION - DRY GLAZING METHOD (GASKET GLAZING)

- A. Application - Exterior and/or Interior Glazed: Set glazing infills from either the exterior or the interior of the building.

- B. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.
- C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.
- D. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.5 INSTALLATION - WET GLAZING METHOD (SEALANT AND SEALANT)

- A. Application - Exterior Glazed: Set glazing infills from the exterior of the building.
- B. Place setting blocks at 1/4 points and install glazing pane or unit.
- C. Install removable stops with glazing centered in space by inserting spacer shims both sides at 24 inch intervals, 1/4 inch below sight line.
- D. Fill gaps between glazing and stops with sealant to depth of bite on glazing, but not more than 3/8 inch below sight line to ensure full contact with glazing and continue the air and vapor seal.
- E. Apply sealant to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

3.6 FIELD QUALITY CONTROL

- A. Glass and Glazing product manufacturers to provide field surveillance of the installation of their products.
- B. Monitor and report installation procedures and unacceptable conditions.

3.7 CLEANING

- A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.
- B. Remove non-permanent labels immediately after glazing installation is complete.
- C. Clean glass and adjacent surfaces after sealants are fully cured.
- D. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.8 PROTECTION

- A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.
- B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

END OF SECTION

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SECTION 090561 - COMMON WORK RESULTS FOR FLOORING PREPARATION

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. This section applies to floors identified in Contract Documents that are receiving the following types of floor coverings:
 - 1. Carpet tile.
 - 2. Thin-set ceramic tile and stone tile.
 - 3. Laminated Vinyl Tile.
- B. Removal of existing floor coverings.
- C. Preparation of new and existing concrete floor slabs for installation of floor coverings.
- D. Remediation of concrete floor slabs due to unsatisfactory moisture or alkalinity (pH) conditions.
 - 1. Contractor shall perform all specified remediation of concrete floor slabs. If such remediation is indicated by testing agency's report and is due to a condition not under Contractor's control or could not have been predicted by examination prior to entering into the contract, a contract modification will be issued.
- E. Patching compound.
- F. Remedial floor coatings.

1.2 RELATED REQUIREMENTS

1.3 REFERENCE STANDARDS

- A. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens) 2016a.
- B. ASTM C472 - Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters and Gypsum Concrete 1999 (Reapproved 2014).
- C. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring 2019, with Editorial Revision (2020).

- D. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride 2016a.
- E. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes 2019a.
- F. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings 2011.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate scheduling of cleaning and testing, so that preliminary cleaning has been completed for at least 24 hours prior to testing.

1.5 SUBMITTALS

- A. Visual Observation Report: For existing floor coverings to be removed.
- B. Floor Covering and Adhesive Manufacturers' Product Literature: For each specific combination of substrate, floor covering, and adhesive to be used; showing:
 - 1. Moisture and alkalinity (pH) limits and test methods.
 - 2. Manufacturer's required bond/compatibility test procedure.
- C. Remedial Materials Product Data: Manufacturer's published data on each product to be used for remediation.
 - 1. Manufacturer's qualification statement.
 - 2. Manufacturer's statement of compatibility with types of flooring applied over remedial product.
 - 3. Test reports indicating compliance with specified performance requirements, performed by nationally recognized independent testing agency.
 - 4. Manufacturer's installation instructions.
 - 5. Specimen Warranty: Copy of warranty to be issued by coating manufacturer and certificate of underwriter's coverage of warranty.
- D. Testing Agency's Report:
 - 1. Description of areas tested; include floor plans and photographs if helpful.

2. Summary of conditions encountered.
 3. Copies of specified test methods.
 4. Recommendations for remediation of unsatisfactory surfaces.
 5. Submit report to Architect.
 6. Submit report not more than two business days after conclusion of testing.
- E. Adhesive Bond and Compatibility Test Report.
- F. Copy of RFCI (RWP).

1.6 QUALITY ASSURANCE

- A. Moisture and alkalinity (pH) testing shall be performed by an independent testing agency employed and paid by Contractor.
- B. Testing Agency Qualifications: Independent testing agency experienced in the types of testing specified.
1. Submit evidence of experience consisting of at least 3 test reports of the type required, with project Owner's project contact information.
- C. Contractor's Responsibility Relating to Independent Agency Testing:
1. Provide access for and cooperate with testing agency.
 2. Confirm date of start of testing at least 10 days prior to actual start.
 3. Allow at least 4 business days on site for testing agency activities.
 4. Achieve and maintain specified ambient conditions.
 5. Notify Architect when specified ambient conditions have been achieved and when testing will start.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, handle, and protect products in accordance with manufacturer's instructions and recommendations.
- B. Deliver materials in manufacturer's packaging; include installation instructions.

- C. Keep materials from freezing.

1.8 FIELD CONDITIONS

- A. Maintain ambient temperature in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 65 degrees F or more than 85 degrees F.
- B. Maintain relative humidity in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 40 percent and not more than 60 percent.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Patching Compound: Floor covering manufacturer's recommended product, suitable for conditions, and compatible with adhesive and floor covering. In the absence of any recommendation from flooring manufacturer, provide a product with the following characteristics:
 - 1. Cementitious moisture-, mildew-, and alkali-resistant compound, compatible with floor, floor covering, and floor covering adhesive, and capable of being feathered to nothing at edges.
 - 2. Compressive Strength: 3000 psi, minimum, after 28 days, when tested in accordance with ASTM C109/C109M or ASTM C472, whichever is appropriate.
 - 3. Products:
 - a. TEC, an H.B. Fuller Construction Products Brand; TEC Feather Edge Skim Coat: www.tecspecialty.com/#sle.
 - b. USG Corporation; Durock Brand Advanced Skim Coat Floor Patch: www.usg.com/#sle.
- B. Remedial Floor Coating: Single- or multi-layer coating or coating/overlay combination intended by its manufacturer to resist water vapor transmission to degree sufficient to meet flooring manufacturer's emission limits, resistant to the level of alkalinity (pH) found, and suitable for adhesion of flooring without further treatment.
 - 1. Thickness: 1/8 inch, maximum.

2. Thickness: As required for application and in accordance with manufacturer's installation instructions.
3. Products:
 - a. Custom Building Products; TechMVC Moisture Vapor and Alkalinity Barrier: www.custombuildingproducts.com/#sle.
 - b. Floor Seal Technology, Inc; MES 100 with Floor Seal FloorCem SLU: www.floorseal.com/#sle.
 - c. LATICRETE International, Inc; LATICRETE NXT Vapor Reduction Coating with LATICRETE NXT Level Plus: www.laticrete.com/#sle.
 - d. Sika Corporation; Sikafloor Moisture Tolerance Epoxy Primer and Sikafloor Self-Leveling Moisture Tolerant Resurfacer: www.sikafloorusa.com/#sle.
 - e. USG Corporation; Durock Brand CST Moisture Vapor Reducer: www.usg.com/#sle.

PART 3 EXECUTION

3.1 CONCRETE SLAB PREPARATION

- A. Perform following operations in the order indicated:
 1. Existing concrete slabs (on-grade and elevated) with existing floor coverings:
 - a. Visual observation of existing floor covering, for adhesion, water damage, alkaline deposits, and other defects.
 - b. Removal of existing floor covering.
 2. Existing concrete slabs with coatings or penetrating sealers/hardeners/dustproofers:
 3. Preliminary cleaning.
 4. Specified remediation, if required.
 5. Patching, smoothing, and leveling, as required.
 6. Other preparation specified.

7. Adhesive bond and compatibility test.
8. Protection.

3.2 REMOVAL OF EXISTING FLOOR COVERINGS

- A. Comply with local, State, and federal regulations and recommendations of RFCI Recommended Work Practices for Removal of Resilient Floor Coverings, as applicable to floor covering being removed.
- B. Dispose of removed materials in accordance with local, State, and federal regulations and as specified.

3.3 PRELIMINARY CLEANING

- A. Clean floors of dust, solvents, paint, wax, oil, grease, asphalt, residual adhesive, adhesive removers, film-forming curing compounds, sealing compounds, alkaline salts, excessive laitance, mold, mildew, and other materials that might prevent adhesive bond.
- B. Do not use solvents or other chemicals for cleaning.

3.4 PREPARATION

- A. See individual floor covering section(s) for additional requirements.
- B. Comply with requirements and recommendations of floor covering manufacturer.
- C. Fill and smooth surface cracks, grooves, depressions, control joints and other non-moving joints, and other irregularities with patching compound.
- D. Do not fill expansion joints, isolation joints, or other moving joints.

3.5 ADHESIVE BOND AND COMPATIBILITY TESTING

- A. Comply with requirements and recommendations of floor covering manufacturer.

3.6 APPLICATION OF REMEDIAL FLOOR COATING

- A. Comply with requirements and recommendations of coating manufacturer.

3.7 PROTECTION

- A. Cover prepared floors with building paper or other durable covering.

END OF SECTION

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SECTION 092116 - GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Performance criteria for gypsum board assemblies.
- B. Metal stud wall framing.
- C. Metal channel ceiling framing.
- D. Acoustic insulation.
- E. Gypsum sheathing.
- F. Cementitious backing board.
- G. Gypsum wallboard.
- H. Joint treatment and accessories.

1.2 RELATED REQUIREMENTS

- A. Section 054000 - Cold-Formed Metal Framing: Structural steel stud framing.
- B. Section 061000 - Rough Carpentry: Wood blocking product and execution requirements.
- C. Section 092216 - Non-Structural Metal Framing.
- D. Section 093000 - Tiling: Tile backing board.

1.3 REFERENCE STANDARDS

- A. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units 2018.
- B. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units 1999 (Reaffirmed 2016).
- C. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method 2017.

- D. ASTM C514 - Standard Specification for Nails for the Application of Gypsum Board 2004 (Reapproved 2014).
- E. ASTM C557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing 2003 (Reapproved 2017).
- F. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members 2018.
- G. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing 2017.
- H. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products 2018.
- I. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board 2019b.
- J. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness 2018.
- K. ASTM C1047 - Standard Specification for Accessories For Gypsum Wallboard and Gypsum Veneer Base 2019.
- L. ASTM C1278/C1278M - Standard Specification for Fiber-Reinforced Gypsum Panel 2017.
- M. ASTM C1325 - Standard Specification for Fiber-Mat Reinforced Cementitious Backer Units 2019.
- N. ASTM C1396/C1396M - Standard Specification for Gypsum Board 2017.
- O. ASTM C1629/C1629M - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels 2019.
- P. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber 2016.
- Q. GA-216 - Application and Finishing of Gypsum Panel Products 2016.
- R. GA-600 - Fire Resistance Design Manual 2015.
- S. ICC (IBC) - International Building Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on metal framing, gypsum board, accessories and joint finishing system.

PART 2 PRODUCTS

2.1 GYPSUM BOARD ASSEMBLIES

- A. Provide completed assemblies complying with ASTM C840 and GA-216.

2.2 METAL FRAMING MATERIALS

- A. Manufacturers - Metal Framing, Connectors, and Accessories:
 - 1. ClarkDietrich: www.clarkdietrich.com/#sle.
 - 2. Jaimes Industries: www.jaimesind.com/#sle.
 - 3. R-stud, LLC: www.rstud.com/#sle.
 - 4. SCAFCO Corporation: www.scafco.com/#sle.
 - 5. Steel Construction Systems: www.steelconsystems.com/#sle.
- B. Non-structural Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/120 at 5 psf.
 - 1. Studs: "C" shaped with knurled or embossed faces.
 - 2. Runners: U shaped, sized to match studs.
 - 3. Ceiling Channels: C-shaped.
 - 4. Furring Members: Hat-shaped sections, minimum depth of 7/8 inch.
 - 5. Resilient Furring Channels: Single or double leg configuration; 1/2 inch channel depth.
- C. Non-structural Framing Accessories:
 - 1. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.

- D. Grid Suspension Systems: Steel grid system of main tees and support bars connected to structure using hanging wire.

1. Products:

- a. USG Corporation; Drywall Suspension System: www.usg.com/#sle.
- b. Or similar manufacturer or product.

2.3 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:

- 1. American Gypsum Company: www.americangypsum.com/#sle.
- 2. CertainTeed Corporation: www.certainteed.com/#sle.
- 3. Georgia-Pacific Gypsum: www.gpgypsum.com/#sle.
- 4. National Gypsum Company: www.nationalgypsum.com/#sle.
- 5. USG Corporation: www.usg.com/#sle.

B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.

- 1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
- 2. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
- 3. Thickness:
 - a. Vertical Surfaces: 5/8 inch.
 - b. Ceilings: 5/8 inch.
- 4. Paper-Faced Products:
 - a. American Gypsum Company; FireBloc Type X Gypsum Wallboard.
 - b. CertainTeed Corporation; Type X Drywall.
 - c. Georgia-Pacific Gypsum; ToughRock Fireguard X.

d. National Gypsum Company; Gold Bond BRAND Fire-Shield Gypsum Board.

C. Abuse Resistant Wallboard:

1. Application: High-traffic areas indicated as noted in drawings.
2. Indentation: Level 1, minimum, when tested in accordance with ASTM C1629/C1629M.
3. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
4. Type: Fire-resistance-rated Type X, UL or WH listed.
5. Thickness: 5/8 inch.
6. Edges: Tapered.

D. Backing Board For Wet Areas: One of the following products:

1. Application: Surfaces behind tile in wet areas.
2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
3. ANSI Cement-Based Board: Non-gypsum-based; aggregated Portland cement panels with glass fiber mesh embedded in front and back surfaces complying with ANSI A118.9 or ASTM C1325.
 - a. Thickness: 1/2 inch.
 - b. Products:
 - 1) Custom Building Products: www.custombuildingproducts.com/#sle.
 - 2) National Gypsum Company; PermaBase Cement Board: www.nationalgypsum.com/#sle.
 - 3) USG Corporation: www.usg.com/#sle.

2.4 GYPSUM WALLBOARD ACCESSORIES

- A. Acoustic Insulation: ASTM C665; preformed glass fiber, friction fit type, unfaced. Thickness: 3 1/2" inch.
- B. Finishing Accessories: ASTM C1047, galvanized steel or rolled zinc, unless noted otherwise.

1. Types: As detailed or required for finished appearance.
2. Special Shapes: In addition to conventional corner bead and control joints, provide U-bead at exposed panel edges.
- C. Beads, Joint Accessories and Other Trim: ASTM C1047, rigid plastic, galvanized steel or rolled zinc, unless noted otherwise.
 1. Corner Beads: Low profile, for 90 degree outside corners.
- D. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch in Thickness: ASTM C954; steel drill screws, corrosion-resistant.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that project conditions are appropriate for work of this section to commence.

3.2 FRAMING INSTALLATION

- A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.
- B. Suspended Ceilings and Soffits: Space framing and furring members as indicated.
 1. Laterally brace entire suspension system.
- C. Studs: Space studs at 16 inches on center.
 1. Extend partition framing to structure where indicated and to ceiling in other locations.
 2. Partitions Terminating at Structure: Attach extended leg top runner to structure, maintain clearance between top of studs and structure, and brace both flanges of studs with continuous bridging.
- D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.
- E. Standard Wall Furring: Install at concrete walls scheduled to receive gypsum board, not more than 4 inches from floor and ceiling lines and abutting walls. Secure in place on alternate channel flanges at maximum 24 inches on center.
- F. Blocking: Install wood blocking for support of:

1. Framed openings.
2. Wall-mounted cabinets.
3. Plumbing fixtures.
4. Toilet partitions.
5. Toilet accessories.
6. Wall-mounted door hardware.

3.3 ACOUSTIC ACCESSORIES INSTALLATION

- A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.
- B. Acoustic Sealant: Install in accordance with manufacturer's instructions.

3.4 BOARD INSTALLATION

- A. Comply with ASTM C840, GA-216 and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.
- B. Fire-Resistance-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.
- C. Cementitious Backing Board: Install over steel framing members and plywood substrate where indicated, in accordance with ANSI A108.11 and manufacturer's instructions.
- D. Installation on Metal Framing: Use screws for attachment of gypsum board except face layer of nonrated double-layer assemblies, which may be installed by means of adhesive lamination.

3.5 INSTALLATION OF TRIM AND ACCESSORIES

- A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
- B. Corner Beads: Install at external corners, using longest practical lengths.
- C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.6 JOINT TREATMENT

- A. Glass Mat Faced Gypsum Board and Exterior Glass Mat Faced Sheathing: Use fiberglass joint tape, embed and finish with setting type joint compound.
- B. Paper Faced Gypsum Board: Use paper joint tape, embed with drying type joint compound and finish with drying type joint compound.
- C. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
 - 1. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
 - 2. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
 - 3. Level 1: Fire-resistance-rated wall areas above finished ceilings, whether or not accessible in the completed construction.
- D. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
 - 1. Feather coats of joint compound so that camber is maximum 1/32 inch.

3.7 TOLERANCES

- A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

END OF SECTION

SECTION 093000 - TILING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Tile for floor applications.
- B. Tile for wall applications.
- C. Tile for counters.
- D. Cementitious backer board as tile substrate.
- E. Stone thresholds.
- F. Non-ceramic trim.

1.2 RELATED REQUIREMENTS

- A. Section 092116 - Gypsum Board Assemblies: Tile backer board.
- B. Section 224000 - Plumbing Fixtures: Shower receptor.

1.3 REFERENCE STANDARDS

- A. ANSI A108/A118/A136 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium) 2019.
- B. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar 2017.
- C. ANSI A108.1b - American National Standard Specifications for Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar 2017.
- D. ANSI A108.1c - Specifications for Contractors Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Bed with Dry-Set or Latex-Portland Cement 1999 (Reaffirmed 2016).
- E. ANSI A108.2 - American National Standard General Requirements: Materials, Environmental and Workmanship 2019.

- F. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile-Setting Epoxy Adhesive 2009 (Revised).
- G. ANSI A108.5 - American National Standard Specifications for Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar 1999 (Reaffirmed 2010).
- H. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy 1999 (Reaffirmed 2010).
- I. ANSI A108.8 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout 1999 (Reaffirmed 2010).
- J. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout 1999 (Reaffirmed 2010).
- K. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework 2017.
- L. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units 2018.
- M. ANSI A108.12 - American National Standard for Installation of Ceramic Tile with EGP (Exterior Glue Plywood) Latex-Portland Cement Mortar 1999 (Reaffirmed 2010).
- N. ANSI A108.13 - American National Standard for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone 2005 (Reaffirmed 2016).
- O. ANSI A108.19 - American National Standard Specifications for Interior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs by the Thin-Bed Method Bonded with Modified Dry-Set Cement Mortar or Improved Modified Dry-Set Cement Mortar 2017.
- P. ANSI A118.4 - American National Standard Specifications for Modified Dry-Set Cement Mortar 2012 (Revised).
- Q. ANSI A118.6 - American National Standard Specifications for Standard Cement Grouts for Tile Installation 2010 (Reaffirmed 2016).
- R. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units 1999 (Reaffirmed 2016).

- S. ANSI A137.1 - American National Standard Specifications for Ceramic Tile 2012.
- T. ASTM C373 - Standard Test Methods for Determination of Water Absorption and Associated Properties by Vacuum Method for Pressed Ceramic Tiles and Glass Tiles and Boil Method for Extruded Ceramic Tiles and Non-tile Fired Ceramic Whiteware Products 2018.
- U. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring 2019, with Editorial Revision (2020).
- V. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation 2019.

1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.
- C. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, ceramic accessories and setting details.
- D. Samples: Mount tile and apply grout on two plywood panels, minimum 18 by 18 inches in size illustrating pattern, color variations, and grout joint size variations.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Installer's Qualification Statement:
- G. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Company specializing in performing tile installation, with minimum of five years of documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.7 FIELD CONDITIONS

- A. Do not install solvent-based products in an unventilated environment.
- B. Maintain ambient and substrate temperature above 50 degrees F and below 100 degrees F during installation and curing of setting materials.

PART 2 PRODUCTS

2.1 TILE

- A. Manufacturers: All products of each type by the same manufacturer.
 - 1. American Olean Corporation: www.americanolean.com/#sle.
 - 2. Dal-Tile Corporation: www.daltile.com/#sle.
- B. Glazed Wall Tile, Type Kitchen Wall: ANSI A137.1 standard grade.
 - 1. Size: 6 by 18 inch, nominal.
 - 2. Edges: Cushioned.
 - 3. Surface Finish: Matte glaze.
 - 4. Color(s): Glass Biscuit.
 - 5. Products:
 - a. Dal-Tile Corporation; Color Wheel Linear: www.daltile.com/#sle.
- C. Porcelain Tile, Type Wall: ANSI A137.1 standard grade.
 - 1. Moisture Absorption: 0 to 0.5 percent as tested in accordance with ASTM C373.
 - 2. Size: 24 by 24 inch, nominal.
 - 3. Thickness: 3/8 inch.
 - 4. Edges: Square.
 - 5. Surface Finish: Satin.
 - 6. Color(s): As indicated on drawings.
 - 7. Grout Joint: 1/16 inch.

8. Products:

- a. Dal-Tile Corporation; Chord: www.daltile.com/#sle.

D. Porcelain Tile, Type Floor: ANSI A137.1 standard grade.

1. Moisture Absorption: 0 to 0.5 percent as tested in accordance with ASTM C373.
2. Size: 24 by 24 inch, nominal.
3. Thickness: 3/8 inch.
4. Edges: Square.
5. Surface Finish: Satin.
6. Color(s): As indicated on drawings.
7. Grout Joint: 1/16 inch.

8. Products:

- a. American Olean: Neoconcrete:.

2.2 TRIM AND ACCESSORIES

A. Non-Ceramic Trim: Satin natural anodized extruded aluminum, style and dimensions to suit application, for setting using tile mortar or adhesive.

1. Applications:

- a. Open edges of wall tile.
- b. Transition between floor finishes of different heights.
- c. Floor to wall joints.
- d. Borders and other trim as indicated on drawings.

2. Manufacturers:

B. Thresholds: 2 inches wide by full width of wall or frame opening; beveled edge on both long edges; without holes, cracks, or open seams.

1. Thickness: 1/2 inch.

2. Material: Artificial stone tile; 93 percent quartz aggregate, resin, color pigments.
3. Color and Pattern: As selected from mfg full range of colors.
4. Applications:
 - a. At doorways where tile terminates.
 - b. At open edges of floor tile where adjacent finish is a different height.

2.3 SETTING MATERIALS

- A. Provide setting and grout materials from same manufacturer.
- B. Manufacturers:
 1. Bostik Inc: www.bostik-us.com/#sle.
 2. Custom Building Products: www.custombuildingproducts.com/#sle.
 3. LATICRETE International, Inc: www.laticrete.com/#sle.
- C. Latex-Portland Cement Mortar Bond Coat: ANSI A118.4.
 1. Applications: Use this type of bond coat where indicated and where no other type of bond coat is indicated.
 2. Products:
 - a. ARDEX Engineered Cements; ARDEX N 23 MICROTEC: www.ardexamericas.com/#sle.
 - b. Custom Building Products; ProLite Premium Rapid Setting Large Format Tile Mortar, with Multi-Surface Bonding Primer: www.custombuildingproducts.com/#sle.
 - c. Merkrete, by Parex USA, Inc; Merkrete 735 Premium Flex: www.merkrete.com/#sle.

2.4 GROUTS

- A. Provide setting and grout materials from same manufacturer.
- B. Manufacturers:
 1. ARDEX Engineered Cements: www.ardexamericas.com/#sle.

2. Bostik Inc: www.bostik-us.com/#sle.
3. Custom Building Products: www.custombuildingproducts.com/#sle.
4. LATICRETE International, Inc; LATICRETE PERMACOLOR Grout: www.laticrete.com/#sle.

C. Standard Grout: ANSI A118.6 standard cement grout.

1. Applications: Use this type of grout where indicated and where no other type of grout is indicated.
2. Use sanded grout for joints 1/8 inch wide and larger; use unsanded grout for joints less than 1/8 inch wide.
3. Color(s): As indicated on drawings.
4. Products:
 - a. Custom Building Products; Polyblend Non-Sanded Grout: www.custombuildingproducts.com/#sle.
 - b. Merkrete, by Parex USA, Inc; Merkrete Duracolor Non-Sanded Grout: www.merkrete.com/#sle.

2.5 MAINTENANCE MATERIALS

- A. Tile Sealant: Gunnable, silicone, siliconized acrylic, or urethane sealant; moisture and mildew resistant type.
1. Applications: Between tile and plumbing fixtures.
 2. Color(s): As selected by Architect from manufacturer's full line.
 3. Products:
 - a. ARDEX Engineered Cements; ARDEX SX: www.ardexamericas.com/#sle.
 - b. Custom Building Products; Commercial 100% Silicone Caulk: www.custombuildingproducts.com/#sle.
 - c. LATICRETE International, Inc; LATICRETE LATASIL: www.laticrete.com/#sle.
 - d. Merkrete, by Parex USA, Inc; Merkrete Colored Caulking: www.merkrete.com/#sle.

- B. Grout Sealer: Liquid-applied, moisture and stain protection for existing or new Portland cement grout.
 - 1. Composition: Water-based colorless silicone.
 - 2. Color(s): As selected by Architect from manufacturer's full line.
 - 3. Products:
 - a. Merkrete, by Parex USA, Inc; Merkrete Grout Sealer:
www.merkrete.com/#sle.

2.6 ACCESSORY MATERIALS

- A. Backer Board: Cementitious type complying with ANSI A118.9; high density, glass fiber reinforced, 1/2 inch thick; 2 inch wide coated glass fiber tape for joints and corners.
 - 1. Products:
 - a. Custom Building Products; WonderBoard Lite Backerboard:
www.custombuildingproducts.com/#sle.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.
- C. Verify that subfloor surfaces are dust free and free of substances that could impair bonding of setting materials to subfloor surfaces.
- D. Cementitious Subfloor Surfaces: Verify that substrates are ready for tiling installation by testing for moisture and alkalinity (pH).
 - 1. Obtain instructions if test results are not within limits recommended by tiling material manufacturer and setting material manufacturer.

3.2 PREPARATION

- A. Protect surrounding work from damage.

- B. Vacuum clean surfaces and damp clean.
- C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.
- D. Install backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to a feather edge.

3.3 INSTALLATION - GENERAL

- A. Install tile and thresholds and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.19 , manufacturer's instructions, and TCNA (HB) recommendations.
- B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.
- C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.
- D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.
- E. Form internal angles square and external angles bullnosed.
- F. Install non-ceramic trim in accordance with manufacturer's instructions.
- G. Install thresholds where indicated.
- H. Sound tile after setting. Replace hollow sounding units.
- I. Keep control and expansion joints free of mortar, grout, and adhesive.
- J. Prior to grouting, allow installation to completely cure; minimum of 48 hours.
- K. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.
- L. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

3.4 INSTALLATION - FLOORS - THIN-SET METHODS

- A. Over exterior concrete substrates, install in accordance with TCNA (HB) Method F102, with standard grout.

3.5 INSTALLATION - WALL TILE

- A. On exterior walls install in accordance with TCNA (HB) Method W202, thin-set over concrete and masonry.

3.6 CLEANING

- A. Clean tile and grout surfaces.

3.7 PROTECTION

- A. Do not permit traffic over finished floor surface for 4 days after installation.

END OF SECTION

SECTION 095100 - ACOUSTICAL CEILINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Suspended metal grid ceiling system.

1.2 RELATED REQUIREMENTS

- A. Section 265100 - Interior Lighting: Light fixtures in ceiling system.

1.3 REFERENCE STANDARDS

- A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures Most Recent Edition Cited by Referring Code or Reference Standard.
- B. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.
- C. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) 2014.
- D. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings 2017.
- E. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels 2013.
- F. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials 2019.
- G. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions 2017.
- H. ASTM E1264 - Standard Classification for Acoustical Ceiling Products 2019.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

- B. Do not install acoustical units until after interior wet work is dry.

1.5 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on suspension system components and acoustical units.
- C. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.
 - 2. Extra Acoustical Units: Quantity equal to 5 percent of total installed.

1.6 QUALITY ASSURANCE

- A. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.7 FIELD CONDITIONS

- A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acoustic Tiles/Panels:
 - 1. Armstrong World Industries, Inc: www.armstrongceilings.com/#sle.
- B. Suspension Systems:
 - 1. Same as for acoustical units.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance Rating: Determined in accordance with test procedures in ASTM E119 and complying with the following:

2.3 ACOUSTICAL UNITS

A. Acoustical Panels: Painted mineral fiber, with the following characteristics:

1. Application(s): Ceiling.
2. Classification: ASTM E1264 Type III.
3. Size: 24 by 48 inch.
4. Thickness: 3/4 inch.
5. Light Reflectance: .85 percent, determined in accordance with ASTM E1264.
6. NRC Range: .70 to , determined in accordance with ASTM E1264.
7. Ceiling Attenuation Class (CAC): 40, determined in accordance with ASTM E1264.
8. Panel Edge: Square.
9. Color: White.
10. Suspension System Type Armstrong Prelude: Exposed grid.
11. Products:
 - a. Armstrong World Industries, Inc; Fine Fissured School Zone 1714:
www.armstrongceilings.com/#sle.

2.4 SUSPENSION SYSTEM(S)

A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold down clips, stabilizer bars, clips and splices as required.

1. Materials:
 - a. Aluminum Grid: Aluminum sheet, ASTM B209 (ASTM B209M).

B. Exposed Suspension System: Hot-dipped galvanized steel grid with aluminum cap.

1. Application(s): Acoustical as noted..
 - a. Provide Acoustical wire vibration separation at ceilings below and upper floor.
"Sode Creek"

2. Structural Classification: Intermediate-duty, when tested in accordance with ASTM C635/C635M.
3. Profile: Tee; 15/16 inch face width.
4. Finish: Baked enamel.
5. Color: White.

2.5 ACCESSORIES

- A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.
- B. Hanger Wire: 12-gage 0.08 inch galvanized steel wire.
- C. Perimeter Moldings: Same metal and finish as grid.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that layout of hangers will not interfere with other work.

3.2 PREPARATION

- A. Install after major above-ceiling work is complete.
- B. Coordinate the location of hangers with other work.

3.3 INSTALLATION - SUSPENSION SYSTEM

- A. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M and manufacturer's instructions and as supplemented in this section.
- B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
- C. Lay out system to a balanced grid design with edge units no less than 50 percent of acoustical unit size.
- D. Locate system on room axis according to reflected plan.

- E. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
 - 1. Use longest practical lengths.
 - 2. Overlap and rivet corners.
- F. Suspension System, Non-Seismic: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
- G. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
- H. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
- I. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.
- J. Do not eccentrically load system or induce rotation of runners.

3.4 INSTALLATION - ACOUSTICAL UNITS

- A. Install acoustical units in accordance with manufacturer's instructions.
- B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
- C. Fit border trim neatly against abutting surfaces.
- D. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
- E. Cutting Acoustical Units:
 - 1. Make field cut edges of same profile as factory edges.

3.5 TOLERANCES

- A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.
- B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

END OF SECTION

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SECTION 096500 - RESILIENT FLOORING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Resilient base.
- B. Installation accessories.

1.2 RELATED REQUIREMENTS

1.3 REFERENCE STANDARDS

- A. ASTM F1861 - Standard Specification for Resilient Wall Base 2016.

1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
- C. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing specified flooring with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in installing specified flooring with minimum three years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.
- B. Store all materials off of the floor in an acclimatized, weather-tight space.

PART 2 PRODUCTS

2.1 RESILIENT BASE

- A. Resilient Base: ASTM F1861, Type TS rubber, vulcanized thermoset; top set Style B, Cove.
 - 1. Manufacturers:
 - a. Burke Flooring; Commercial Wall Base - TS: www.burkeflooring.com/#sle.
 - b. Johnsonite, a Tarkett Company: www.johnsonite.com/#sle.
 - c. Roppe Corp: www.roppe.com/#sle.
 - 2. Height: 4 inch.
 - 3. Thickness: 0.125 inch.
 - 4. Finish: Satin.
 - 5. Color: Black.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.

3.2 INSTALLATION - GENERAL

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install in accordance with manufacturer's written instructions.
- C. Adhesive-Applied Installation:
 - 1. Fit joints and butt seams tightly.
 - 2. Set flooring in place, press with heavy roller to attain full adhesion.

3.3 INSTALLATION - RESILIENT BASE

- A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.
- B. Install base on solid backing. Bond tightly to wall and floor surfaces.

3.4 CLEANING

- A. Remove excess adhesive from floor, base, and wall surfaces without damage.
- B. Clean in accordance with manufacturer's written instructions.

3.5 PROTECTION

- A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION

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SECTION 096519 - RESILIENT TILE FLOORING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Resilient tile flooring.
- B. Installation accessories:
 - 1. Adhesives.

1.2 RELATED REQUIREMENTS

- A. Section 079200 - Joint Sealants.
- B. Section 079513 - Expansion Joint Cover Assemblies.

1.3 REFERENCE STANDARDS

- A. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens) 2016a.
- B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring 2019, with Editorial Revision (2020).
- C. ASTM F1700 - Standard Specification for Solid Vinyl Floor Tile 2020.

1.4 SUBMITTALS

1.5 DELIVERY, STORAGE, AND HANDLING

1.6 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. 20-Year Limited Non-Prorated Commercial Material Warranty. Coverage includes:
 - 1. 100 percent cost of material for the entire duration of warranty (20 Years).
 - 2. Pro-rated cost of labor (fair-market value) for the first 10 Years.
 - 3. One-time transferability of warranty.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: Trakett- Contour Series- Wood and Stone

2.2 RESILIENT TILE FLOORING

- A. Luxury Vinyl Plank and Tile:

1. Style: Tile + Plank (Contour Series)
2. Pattern: [_____].
3. Size:
4. Color: [_____].
5. Physical Properties:
 - a. Wear Layer Thickness: 32 mil.
 - b. Total Thickness (Gauge): 0.120".
6. Manufacturing, Performance, and Safety Standards:
 - a. ASTM F1700, Classification: Class III, Type B.

2.3 ACCESSORIES

- A. Adhesives:

1. Products:
 - a. Adhesive as part of material manufacturers specification.

PART 3 EXECUTION

3.1 PREPARATION

- A. Flooring installation should not begin until all site conditions have been assessed, testing has been completed and subfloor conditions have been approved.
- B. Prepare per manufacturer's written instructions, Section 01 7000, and as follows:
 1. Prepare substrates to ensure proper adhesion of Luxury Vinyl Plank & Tile.
 2. Concrete Substrates: Prepare substrate per ASTM F710.

- a. Verify that subfloor is clean, flat, smooth, free of dirt, rust, paint, oil, wax or any contaminant that will interfere with adhesive bonding.
- b. Mechanically remove substrate coatings that are not compatible with adhesives, such as sealers, curing, hardening or parting compounds, soap, wax, oil, etc.
 - 1) Do not use solvents or adhesive removers.
- c. Expansion joints, isolation joints, or other moving joints must be honored and must not be filled with underlayment products or other materials, and floor coverings must not be laid over them. Expansion joint covering systems should be detailed by the architect or engineer, and based upon intended usage and aesthetic considerations.
- d. Surface cracks, grooves, depressions, control joints or other non-moving joints, and other irregularities shall be filled or smoothed with high-quality Portland cement or calcium aluminate based patching or underlayment compound for filling or smoothing, or both.
 - 1) Do not skim-coat large areas with patching compound, especially slick power-troweled surfaces.
 - 2) Sand smooth per manufacturer's instructions.
- e. Slick surfaces such as power-troweled concrete shall be profiled as needed to allow for a mechanical bond between the adhesive and subfloor.
- f. Do not use gypsum-based underlayment products and do not skim coat concrete subfloors.
- g. Self-Leveling Underlayments: Provide a dry and smoothly-sanded underlayment substrate ready for installation of Luxury Vinyl Plank & Tile. Underlayment compound shall be moisture-resistant, mildew-resistant, and alkali-resistant and must have a minimum of 3,000 psi compressive strength per ASTM C109/C109M.
- h. Lightweight concrete shall have a compressive strength greater than 90 pounds per cubic foot with minimum compression strength of 2,500 psi or greater.

3.2 INSTALLATION

A. Installation per manufacturer's written instructions, Section 01 7000, and as follows:

- 1. Layout shall be specified by Architect, Designer or End User.

2. Follow layout and ensure installation reference lines are square.
3. Field tiles shall be installed with directional arrows on back aligned in the same direction, or may be installed in quarter-turned fashion.
4. Check cartons for and do not mix dye lots.
5. Expansion Joints: Locate expansion, isolation, and other moving joints prior to installation.
 - a. Do not fill expansion, isolation, and other moving joints with patching compound nor cover with resilient flooring.
 - b. Install movement joint systems per manufacturer's instructions and per Section 07 9200 and Section 07 9513.
6. Adhesives: Adhere flooring to substrate using the full spread method resulting in a completed installation without gaps, voids, raised edges, bubbles or any other surface imperfections.
 - a. Select appropriate adhesive, trowel and follow manufacturer's instructions.
 - b. Periodically spot-check transfer of adhesive to back of tile during installation.
 - c. Roll floor with a 100 pound roller to ensure proper transfer of adhesive and bonding.
 - d. Protect floor from traffic per manufacturer's instructions.
 - e. Do not wet mop floor until the adhesive has properly set per written instructions.

3.3 FIELD QUALITY CONTROL

- A. Non-conforming work per General Conditions and as follows:

1. Repair or replace damaged material if not acceptable to the Architect.

3.4 CLEANING

- A. Provide progress cleaning per manufacturer's written instructions, Section 01 7000, and as follows:

1. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the work.

- a. Clean and protect completed construction until Date of Substantial Completion.
 - b. During installation, remove wet adhesive from surface of flooring per manufacturer's instructions.
2. Site: Maintain project site free of waste materials and debris.
- B. Provide final cleaning immediately prior to Date of Substantial Completion inspection per manufacturer's written instructions and Section 01 7000.
 1. Protection: Remove manufacturer's and other installed protection immediately prior to Date of Substantial Completion inspection, unless required otherwise.
 2. Clean floor with a neutral 6-8 pH cleaner.

3.5 MAINTENANCE

- A. Initial maintenance per flooring manufacturer's written instructions and as follows:
 1. Allow the adhesive to cure for at least 48 hours prior to wet cleaning the floor.
 2. Sweep, dust mop or vacuum the floor thoroughly to remove all loose dirt, dust, grit and debris. Do not use vacuums with a beater bar assembly.
 3. Remove any dried adhesive residue from the surface with mineral spirits applied to a clean, lint-free cloth.
 4. Damp mop the floor using a cleaner recommended by the flooring manufacturer.
 5. If necessary, scrub the floor using an auto scrubber or rotary machine (300 rpm or less) with a cleaner recommended by the flooring manufacturer. Maintain the proper dilution ratio and use the appropriate scrubbing brush or pad.
 6. Thoroughly rinse the entire floor with fresh, clean water. Remove the dirty residue with a wet-vacuum or clean mop and allow the floor to dry completely.

3.6 PROTECTION

- A. Protect materials from construction operations until Date of Substantial Completion or Owner occupancy, whichever occurs first.
 1. Protect finished floor from abuse and damage by using heavy non-staining kraft paper, drop cloths or equivalent. Use additional, non-damaging protective materials as needed.

2. Light foot traffic on a newly installed floor can be permitted after 24 hours.
3. Keep heavy traffic and rolling loads off the newly installed LVT flooring for 48 hours.
4. Protect the floor from rolling loads by covering with protective boards.

END OF SECTION

SECTION 096700 - FLUID-APPLIED FLOORING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Fluid-applied flooring.

1.2 RELATED REQUIREMENTS

1.3 REFERENCE STANDARDS

1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns and colors available.
- C. Samples: Submit two samples, 4 by 4 inch in size illustrating color and pattern for each floor material for each color specified.
- D. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.
- E. Manufacturer's Installation Instructions: Indicate special procedures.
- F. Manufacturer's Qualification Statement.
- G. Maintenance Data: Include maintenance procedures, recommended maintenance materials, procedures for stain removal, repairing surface, and suggested schedule for cleaning.
- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.
 - 2. Extra Top Coat Materials: 2 gallons.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Applicator Qualifications: Company specializing in performing the work of this section.

1. Minimum 5 years of documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store resin materials in a dry, secure area.
- B. Store materials for three days prior to installation in area of installation to achieve temperature stability.

1.7 FIELD CONDITIONS

- A. Maintain minimum temperature in storage area of 55 degrees F.
- B. Store materials in area of installation for minimum period of 24 hours prior to installation.
- C. Maintain ambient temperature required by manufacturer 72 hours prior to, during, and 24 hours after installation of materials.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Fluid-Applied Flooring:

2.2 FLUID-APPLIED FLOORING SYSTEMS

- A. Fluid-Applied Flooring: Polyurethane cement slurry base coat(s) with broadcast aggregate.
 1. Aggregate: Quartz granules.
 2. System Thickness: 1/4 inch, nominal, when dry.
 3. Texture: Slip resistant.
 4. Sheen: Matte.
 5. Color: As selected by Architect.
 6. Products:
 - a. Sika Corporation; Sikafloor PurCem Self-Leveling Broadcast System:
www.sikafloorusa.com/#sle.

- b. Substitutions: See Section 016000 - Product Requirements.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive flooring.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive flooring.
- C. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of materials to subfloor surfaces.
- D. Verify that wood subfloors have 12 percent maximum moisture content.
- E. Cementitious Subfloor Surfaces: Verify that substrates are ready for fluid-applied flooring installation by testing for moisture and alkalinity (pH).
 - 1. Obtain instructions if test results are not within limits recommended by fluid-applied flooring manufacturer.

3.2 PREPARATION

- A. Remove subfloor ridges and bumps. Fill low spots, cracks, joints, holes, and other defects with subfloor filler.

3.3 INSTALLATION - FLOORING

- A. Apply in accordance with manufacturer's instructions.
- B. Apply each coat to minimum thickness indicated.
- C. Finish to smooth level surface.

3.4 PROTECTION

- A. Prohibit traffic on floor finish for 48 hours after installation.
- B. Barricade area to protect flooring until fully cured.

END OF SECTION

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SECTION 096813 - TILE CARPETING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Carpet tile, fully adhered.

1.2 RELATED REQUIREMENTS

- A. Section 016116 - Volatile Organic Compound (VOC) Content Restrictions.

1.3 REFERENCE STANDARDS

1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.
- C. Samples: Submit two carpet tiles illustrating color and pattern design for each carpet color selected.
- D. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.
- E. Manufacturer's Qualification Statement.
- F. Installer's Qualification Statement.
- G. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.
- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

- 1. See Section 016000 - Product Requirements, for additional provisions.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet tile with minimum three years documented experience.

- B. Installer Qualifications: Company specializing in installing carpet tile with minimum three years documented experience and approved by carpet tile manufacturer.

1.6 FIELD CONDITIONS

- A. Store materials in area of installation for minimum period of 24 hours prior to installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Tile Carpeting:
 - 1. Basis of Design: Tarkett- Powerbond.

2.2 MATERIALS

- A. Tile Carpeting, Type CPT: Tufted, manufactured in one color dye lot.
 - 1. Product: Applause III manufactured by Trakett.
 - 2. Tile Size: 24 by 24 inch, nominal.
 - 3. Pile Height: 0.117" inch.
 - 4. Color: [_____].
 - 5. Pattern: [_____].
- B. Tile Walk Off Carpeting, Type [WOC]:
 - 1. Product: [Abrasive Action II] manufactured by [Tarkett].
 - 2. Tile Size: [24 by 24] inch, nominal
 - 3. Pile Height: [0.187"] inch
 - 4. Color:
 - 5. Pattern:

2.3 ACCESSORIES

- A. Subfloor Filler: White premix latex; type recommended by flooring material manufacturer.

- B. Edge Strips: Embossed aluminum, [] color.
- C. Adhesives:
 - 1. Compatible with materials being adhered; maximum VOC content as specified in Section 016116.
- D. Carpet Tile Adhesive: Recommended by carpet tile manufacturer; releasable type.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that subfloor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.

3.2 PREPARATION

- A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.
- B. Remove subfloor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with subfloor filler.
- C. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.
- D. Vacuum clean substrate.

3.3 INSTALLATION

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install carpet tile in accordance with manufacturer's instructions.
- C. Blend carpet from different cartons to ensure minimal variation in color match.
- D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.
- E. Lay carpet tile in square pattern, with pile direction parallel to next unit, set parallel to building lines.
- F. Fully adhere carpet tile to substrate.
- G. Trim carpet tile neatly at walls and around interruptions.
- H. Complete installation of edge strips, concealing exposed edges.

3.4 CLEANING

- A. Remove excess adhesive without damage, from floor, base, and wall surfaces.
- B. Clean and vacuum carpet surfaces.

END OF SECTION

SECTION 097200 - WALL COVERINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Surface preparation and prime painting.
- B. Wall covering and borders.

1.2 RELATED REQUIREMENTS

1.3 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2019b.
- B. ASTM F793/F793M - Standard Classification of Wall Coverings by Use Characteristics 2015.

1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on wall covering and adhesive.
- C. Samples: Submit two samples of wall covering, 4 by 4 inch in size illustrating color, finish, and texture.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.
 - 2. Extra Wall Covering Materials: 25 linear feet of each color and pattern of wall covering; store where directed.
 - 3. Package and label each roll by manufacturer, color and pattern, and destination room number.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.

- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Inspect roll materials at arrival on site, to verify acceptability.
- B. Protect packaged adhesive from temperature cycling and cold temperatures.
- C. Do not store roll goods on end.

1.7 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the adhesive or wall covering product manufacturer.
- B. Maintain these conditions 24 hours before, during, and after installation of adhesive and wall covering.

PART 2 PRODUCTS

2.1 WALL COVERINGS

- A. General Requirements:
 - 1. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84.
- B. Wall Covering - Type WC: Fabric-backed vinyl roll stock.
 - 1. Comply with ASTM F793, Category V, Type II.
 - 2. Total Weight: 20 oz/sq yd.
 - 3. Roll Width: 54 inches.
 - 4. Backing: Woven, osnaburg fabric.
 - 5. Color: [_____].
 - 6. Pattern: SLAB.
 - 7. Surface Texture: [_____].
 - 8. Overcoating: Manufacturer's standard coating for stain resistance.

9. Manufacturers:

- a. Koroseal/RJF International: www.koroseal.com/#sle.
- C. Adhesive: Type recommended by wall covering manufacturer to suit application to substrate.
- D. Substrate Filler: As recommended by adhesive and wall covering manufacturers; compatible with substrate.
- E. Substrate Primer and Sealer: Alkyd enamel type.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that substrate surfaces are prime painted and ready to receive work, and comply with requirements of wall covering manufacturer.

3.2 PREPARATION

- A. Fill cracks in substrate and smooth irregularities with filler; sand smooth.
- B. Wash impervious surfaces with tetra-sodium phosphate, rinse and neutralize; wipe dry.
- C. Surface Appurtenances: Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.
- D. Surfaces: Correct defects and clean surfaces that affect work of this section. Remove existing coatings that exhibit loose surface defects.
- E. Apply one coat of primer sealer to substrate surfaces. Allow to dry. Lightly sand smooth.
- F. Vacuum clean surfaces free of loose particles.

3.3 INSTALLATION

- A. Apply adhesive and wall covering in accordance with manufacturer's instructions.
- B. Apply adhesive to wall surface immediately prior to application of wall covering.
- C. Apply wall covering smooth, without wrinkles, gaps or overlaps. Eliminate air pockets and ensure full bond to substrate surface.
- D. Butt edges tightly.

- E. Horizontal seams are not acceptable.
- F. Do not seam within 2 inches of internal corners or within 6 inches of external corners.
- G. Install wall covering before installation of bases and items attached to or spaced slightly from wall surface.
- H. Do not install wall covering more than 1/4 inch below top of resilient base.
- I. Remove excess adhesive while wet from seam before proceeding to next wall covering sheet. Wipe clean with dry cloth.

END OF SECTION

SECTION 098430 - SOUND-ABSORBING WALL AND CEILING UNITS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Sound-absorbing panels.
- B. Sound-absorbing ceiling baffles.

1.2 RELATED REQUIREMENTS

- A. Section 095100 - Acoustical Ceilings: Ceiling suspension system.

1.3 REFERENCE STANDARDS

- A. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method 2017.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2019b.
- C. ASTM E795 - Standard Practices for Mounting Test Specimens During Sound Absorption Tests 2016.

1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's printed data sheets for products specified.
- C. Shop Drawings: Fabrication and installation details, panel layout, and fabric orientation.
- D. Selection Samples: Manufacturer's color charts for fabric covering, indicating full range of fabrics, colors, and patterns available.
- E. Test Reports: Certified test data from an independent test agency verifying that panels meet specified requirements for acoustical and fire performance.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company with not less than five years of experience in manufacturing acoustical products similar to those specified.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect acoustical units from moisture during shipment, storage, and handling. Deliver in factory-wrapped bundles; do not open bundles until units are needed for installation.
- B. Store units flat, in dry, well-ventilated space; do not stand on end.
- C. Protect edges from damage.

PART 2 PRODUCTS

2.1 FABRIC-COVERED SOUND-ABSORBING WALL UNITS

- A. Manufacturers:
 - 1. Basis of Design- Hardside Acoustical Wall Panels -Kinetics Noise Control.
 - 2. Substitutions: See Section 016000 - Product Requirements.
- B. General:
 - 1. Surface Burning Characteristics: Flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
- C. Fabric-Covered Acoustical Panels for Walls, Ceilings and Type AWP-2:
 - 1. Panel Core: Manufacturer's standard rigid or semi-rigid fiberglass core.
 - 2. Noise Reduction Coefficient (NRC): Min 1.00 when tested in accordance with ASTM C423 for mounting, per ASTM E795.
 - 3. Panel Size: As noted on Drawings.
 - 4. Panel Thickness: As required to meet required acoustical performance.
 - 5. Edges: Perimeter edges reinforced by a formulated resin hardener.
 - 6. Corners: Mitered.
 - 7. Fabric: Woven polyester.

8. Color: As selected by Architect from manufacturer's full range.
9. Mounting Method: Back-mounted with mechanical fasteners.

2.2 WOOD VENEER ACOUSTICAL CEILING BAFFLES:

- A. Baffle Core: Manufacturer's standard fiberglass core.
- B. Noise Reduction Coefficient (NRC): .90 when tested in accordance with ASTM C423 for Type Suspended mounting, per ASTM E795.
- C. Baffle Size: 12" Tall by length noted in drawings.
- D. Baffle Thickness: 2 inches.
- E. Corners: Square.
- F. Color: Smoke Eucalyptus.
- G. Mounting: Vertically suspended from ceiling or structure by one edge of panel.

2.3 WOOD VENEER SOUND-ABSORBING WALL UNITS

- A. Manufacturers:
 1. Sound Ply, by Navy Island; RF M25.
 2. Substitutions: See Section 016000 - Product Requirements.
- B. Wood Veneer Acoustical Panels for Walls [Type-AEP-1]: Sintered Resin-Reinforced Glass Wool core panels with prime grade finished face veneer and non-woven acoustical fabric adhered to back of panel.
 1. Surface Burning Characteristics: Flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
 2. Noise Reduction Coefficient (NRC): .90 when tested in accordance with ASTM C423 for Type A mounting, per ASTM E795.
 3. Panel Size: As noted in drawings.
 4. Perforated Panel:
 - a. Hole Diameter: .05 mm, nominal.

5. Mounting: Direct Mount per manufacturers recommendations.

2.4 THERMOFORMED PLASTIC SOUND-ABSORBING UNITS

A. Manufacturers:

1. Lamvin; Pyramid Diffuser: www.lamvin.com/#sle.
2. Acoustical Solutions.
3. Substitutions: See Section 016000 - Product Requirements.

B. Thermoformed Copolymer Plastic Acoustical Panels [Type-acc-2] for Ceilings:

1. Surface Burning Characteristics: Flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
2. Noise Reduction Coefficient (NRC): .05 when tested in accordance with ASTM C423 for Type Grid mounting, per ASTM E795.
3. Panel Size: 48 inches by 48 inches.
4. Finish: Gel Coat
5. Color: White
6. Surface Pattern: Pyramid shapes.
7. Mounting: Lay-in panel for suspended ceiling system, exposed grid.
 - a. Suspension System: Specified in Section 095100.

2.5 ACOUSTICAL CUSTOM CEILING PANELS - [TYPE ACC-1]

A. Manufacturers:

1. Armstrong Ceiling and Wall Systems; TECTUM finale.
2. Substitutions: See Section 016000-Product Requirements.

B. Tectum Panel

1. Surface Burning Characteristics: Flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.

2. Noise Reduction Coefficient (NRC): [.75] when tested in accordance with ASTM C423 for Type [Mechanically] mounting, per ASTM E795.
3. Panel Size: 24 inches by 48 inches.
4. Color: Natural

2.6 FABRICATION

- A. Fabric Wrapped, General: Fabricate panels to sizes and configurations as indicated, with fabric facing installed without sagging, wrinkles, blisters, or visible seams.
 1. Where radiused or mitered corners are indicated, install fabric to avoid seams or gathering of material.
 2. For panels suspended from ceiling, provide fabric covering both sides, with seams only at panel edges.
- B. Tolerances: Fabricate to finished tolerance of plus or minus 1/16 inch for thickness, overall length and width, and squareness from corner to corner.

2.7 ACCESSORIES

- A. Back-Mounting Accessories: Manufacturer's standard accessories for concealed support, designed to allow panel removal, and as follows:
 1. Two-part clip and base-support bracket system; brackets designed to support full weight of panels and clips designed for lateral support, with one part mechanically attached to back of panel and the other attached to substrate.
 2. Metal impaling clips designed to support full weight of panels, mechanically attached to substrate and adhesively bonded to back of panels.
- B. Ceiling-Suspended Accessories: Manufacturer's standard accessories at locations as indicated on each acoustical unit, sized appropriately for weight of acoustical unit.
 1. Through-threaded eyelets bolted through concealed perimeter frame.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates for conditions detrimental to installation of acoustical units. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install acoustical units in locations as indicated, following manufacturer's installation instructions.
- B. Suspend ceiling baffles at locations and heights as indicated.
- C. Furring Mounted Wood Veneer Panels:
 - 1. Install furring strip along meeting edges of adjacent panels to ensure they are attached to same furring strip along abutted edge; 24 inch on center, maximum.
 - 2. Install acoustic back-up material between furring as required for application.
 - 3. Adhere first panel from edge to furring strip, and attach subsequent panels using fixing clips.
- D. Install acoustical units to construction tolerances of plus or minus 1/16 inch for the following:
 - 1. Plumb and level.
 - 2. Flatness.

3.3 CLEANING

- A. Clean fabric facing upon completion of installation from dust and other foreign materials, following manufacturer's instructions.

3.4 PROTECTION

- A. Provide protection of installed acoustical panels until Date of Substantial Completion.
- B. Replace panels that cannot be cleaned and repaired to satisfaction of the Architect.

END OF SECTION

SECTION 099113 - EXTERIOR PAINTING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
 - 1. Exposed surfaces of steel lintels and ledge angles.
- D. Do Not Paint or Finish the Following Items:
 - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes.
 - 3. Items indicated to remain unfinished.
 - 4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
 - 5. Floors, unless specifically indicated.
 - 6. Glass.
 - 7. Concealed pipes, ducts, and conduits.

1.2 RELATED REQUIREMENTS

1.3 REFERENCE STANDARDS

- A. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials 2016.
- B. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual Current Edition.

1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
 - 2. MPI product number (e.g. MPI #47).
 - 3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
- C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
 - 1. Where sheen is specified, submit samples in only that sheen.
- D. Certification: By manufacturer that paints and finishes comply with VOC limits specified.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.
 - 2. Extra Paint and Finish Materials: 1 gallon of each color; from the same product run, store where directed.
 - 3. Label each container with color in addition to the manufacturer's label.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's

instructions.

1.7 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.
- B. Paints:
 - 1. Base Manufacturer: Kwal Paints.
- C. Primer Sealers: Same manufacturer as top coats.

2.2 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready mixed, unless required to be a field-catalyzed paint.
 - 1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 - 2. Supply each paint material in quantity required to complete entire project's work from a single production run.
 - 3. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- B. Colors: To be selected from manufacturer's full range of available colors.
 - 1. Selection to be made by Architect after award of contract.

2.3 PAINT SYSTEMS - EXTERIOR

- A. Paint E-OP - Exterior Surfaces to be Painted, Unless Otherwise Indicated: Including concrete, concrete masonry units, brick, fiber cement siding, primed wood and primed metal.
 - 1. Two top coats and one coat primer.
 - 2. Top Coat(s): Exterior Latex; MPI #10, 11, 15, 119, or 214.
 - 3. Top Coat Sheen:
 - a. Satin: MPI gloss level 4; use this sheen at all locations.

2.4 PRIMERS

- A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.
 - 1. Alkali Resistant Water Based Primer; MPI #3.
 - a. Products:
 - 1) [_____].

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.
- C. Test shop-applied primer for compatibility with subsequent cover materials.
- D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
 - 1. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
 - 2. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.

3.2 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.

- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.
- D. Seal surfaces that might cause bleed through or staining of topcoat.
- E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- F. Concrete:
- G. Exterior Wood Surfaces to Receive Opaque Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior calking compound after prime coat has been applied. Back prime concealed surfaces before installation.
- H. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.3 APPLICATION

- A. Exterior Wood to Receive Opaque Finish: If final painting must be delayed more than 2 weeks after installation of woodwork, apply primer within 2 weeks and final coating within 4 weeks.
- B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- D. Apply each coat to uniform appearance.
- E. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- F. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.4 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.5 PROTECTION

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

SECTION 099123 - INTERIOR PAINTING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
- D. Do Not Paint or Finish the Following Items:
 - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes.
 - 3. Items indicated to remain unfinished.
 - 4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
 - 5. Stainless steel, anodized aluminum, bronze, terne coated stainless steel, and lead items.
 - 6. Marble, granite, slate, and other natural stones.
 - 7. Floors, unless specifically indicated.
 - 8. Ceramic and other tiles.
 - 9. Glass.
 - 10. Acoustical materials, unless specifically indicated.
 - 11. Concealed pipes, ducts, and conduits.

1.2 REFERENCE STANDARDS

- A. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual Current Edition.

- B. SSPC-SP 1 - Solvent Cleaning 2015, with Editorial Revision (2016).
- C. SSPC-SP 6 - Commercial Blast Cleaning 2007.

1.3 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
 - 2. MPI product number (e.g. MPI #47).
 - 3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
- C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
 - 1. Where sheen is specified, submit samples in only that sheen.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.6 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.
- B. Paints:
 - 1. Sherwin-Williams Company: www.sherwin-williams.com/#sle.
 - 2. Kwal Paints.
- C. Primer Sealers: Same manufacturer as top coats.

2.2 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready mixed, unless intended to be a field-catalyzed paint.
 - 1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 - 2. Supply each paint material in quantity required to complete entire project's work from a single production run.
 - 3. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

2.3 PAINT SYSTEMS - INTERIOR

- A. Paint I-OP-MD-WC - Medium Duty Vertical and Overhead: Including gypsum board, plaster, concrete, concrete masonry units, uncoated steel, shop primed steel, galvanized steel and aluminum.
 - 1. Two top coats and one coat primer.
 - 2. Top Coat(s): Interior Epoxy-Modified Latex; MPI #115 or 215.
 - a. Products:

1) Kwal Paints.

PART 3 EXECUTION

3.1 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- D. Seal surfaces that might cause bleed through or staining of topcoat.
- E. Concrete:
- F. Masonry:
- G. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.
- H. Plaster: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.
- I. Aluminum: Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
- J. Galvanized Surfaces:
- K. Ferrous Metal:
 - 1. Solvent clean according to SSPC-SP 1.
 - 2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
 - 3. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.

3.2 APPLICATION

- A. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- C. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
- D. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- E. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

END OF SECTION

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SECTION 101100 - VISUAL DISPLAY UNITS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Markerboards
- B. Tackboards

1.2 RELATED REQUIREMENTS

1.3 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2019b.

1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's data on chalkboard, markerboard, tackboard, tackboard surface covering, trim and accessories.

1.5 QUALITY ASSURANCE

1.6 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year warranty for markerboard to include warranty against discoloration due to cleaning, crazing or cracking and staining.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. MooreCo, Inc: www.moorecoinc.com/#sle.

2.2 VISUAL DISPLAY UNITS

- A. Markerboards: Porcelain enamel on steel, laminated to core.
 - 1. Color: White.

2. Steel Face Sheet Thickness: 24 gage, 0.0239 inch .
3. Core: Particleboard, manufacturer's standard thickness, laminated to face sheet.
4. Backing: Aluminum foil, laminated to core.
5. Size: As indicated on drawings.
6. Frame: Extruded aluminum , with concealed fasteners.
7. Frame Finish: Anodized, natural.
8. Accessories: Provide marker tray and map rail.
9. Provide Staffed marked board in Music Rooms.
10. Manufacturers:
 - a. Mooreco: Evolution Projection Board.

B. Tackboards: Composition cork.

1. Cork Thickness: 1/8 inch.
2. Color: As selected from manufacturer's full range.
3. Backing: Hardboard, 1/4 inch thick, laminated to tack surface.
4. Surface Burning Characteristics: Flame spread index of 25, maximum, and smoke developed index of 450, maximum, when tested in accordance with ASTM E84.
5. Size: As indicated on drawings.
6. Frame: Same type and finish as for chalkboard.

2.3 ACCESSORIES

- A. Map Rail: Extruded aluminum, manufacturer's standard profile, with cork insert and runners for accessories; 1 inch wide overall , full width of frame.
- B. Marker Tray: Aluminum, manufacturer's standard profile, one piece full length of markerboard, molded ends, concealed fasteners, same finish as frame.
- C. Mounting Brackets: Concealed.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install boards in accordance with manufacturer's instructions.
- B. Secure units level and plumb.

END OF SECTION

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SECTION 101400 - SIGNAGE

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

1.2 REFERENCE STANDARDS

- A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines current edition.
- B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.
- C. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.

1.3 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.
- C. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
 - 1. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.
 - 2. When content of signs is indicated to be determined later, request such information from Owner through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
 - 3. Submit for approval by Owner through Architect prior to fabrication.
- D. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips.
- E. Verification Samples: Submit samples showing colors specified.
- F. Manufacturer's Installation Instructions: Include installation templates and attachment devices.

- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Package signs as required to prevent damage before installation.
- B. Package room and door signs in sequential order of installation, labeled by floor or building.
- C. Store tape adhesive at normal room temperature.

1.6 FIELD CONDITIONS

- A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.
- B. Maintain this minimum temperature during and after installation of signs.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Flat Signs:
 - 1. Best Sign Systems, Inc; [____]: www.bestsigns.com/#sle.
 - 2. FASTSIGNS; [____]: www.fastsigns.com/#sle.
 - 3. Inpro; [____]: www.inprocorp.com/#sle.
 - 4. Mohawk Sign Systems, Inc; [____]: www.mohawksign.com/#sle.
 - 5. Substitutions: See Section 016000 - Product Requirements.

2.2 SIGNAGE APPLICATIONS

- A. Accessibility Compliance: Signs are required to comply with ADA Standards and ICC A117.1, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.

- B. Room and Door Signs: Provide a sign for every doorway, whether it has a door or not, not including corridors, lobbies, and similar open areas.

1. Sign Type: Flat signs with engraved panel media as specified.
2. Provide "tactile" signage, with letters raised minimum 1/32 inch and Grade II braille.
3. Character Height: 1 inch.
4. Sign Height: 2 inches, unless otherwise indicated.

2.3 SIGN TYPES

- A. Flat Signs: Signage media without frame.

1. Edges: Square.
2. Corners: Square.
3. Wall Mounting of One-Sided Signs: Tape adhesive.

- B. Color and Font: Unless otherwise indicated:

1. Character Font: Helvetica, Arial, or other sans serif font.
2. Character Case: Upper case only.
3. Background Color: Clear.
4. Character Color: Contrasting color.

2.4 TACTILE SIGNAGE MEDIA

- A. Engraved Panels: Laminated colored plastic; engraved through face to expose core as background color:

1. Total Thickness: 1/16 inch.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that substrate surfaces are ready to receive work.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install neatly, with horizontal edges level.
- C. Locate signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.
- D. Protect from damage until Substantial Completion; repair or replace damaged items.

END OF SECTION

SECTION 102113.17 - PHENOLIC TOILET COMPARTMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Phenolic toilet compartments.
- B. Urinal screens.

1.2 RELATED REQUIREMENTS

- A. Section 051200 - Structural Steel Framing: Concealed steel support members.
- B. Section 055000 - Metal Fabrications: Concealed steel support members.
- C. Section 061000 - Rough Carpentry: Blocking and supports.
- D. Section 102800 - Toilet, Bath, and Laundry Accessories.

1.3 REFERENCE STANDARDS

- A. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate the work with placement of support framing and anchors in walls and ceilings.

1.5 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on panel construction, hardware, and accessories.
- C. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall supports, door swings.
- D. Samples: Submit two samples of partition panels, 4 by 4 inch in size illustrating panel finish, color, and sheen.
- E. Manufacturer's Installation Instructions: Indicate special procedures.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Phenolic Toilet Compartments:

1. Bobrick Dura Line Series - Compact Laminate (SL) 1182.67.
2. Substitutions: Not permitted.

2.2 PHENOLIC TOILET COMPARTMENTS

A. Toilet Compartments: Factory fabricated doors, pilasters, and divider panels made of solid phenolic core panels with integral melamine finish, floor-mounted headrail-braced.

1. Color: Desert Zephyr 4841-60.

B. Doors:

1. Thickness: 3/4 inch.
2. Width: As noted on drawings.
3. Width for Handicapped Use: 36 inch, out-swinging.
4. Height: 58 inch.

C. Panels:

1. Thickness: 1/2 inch.
2. Height: 58 inch.
3. Depth: As indicated on drawings.

D. Pilasters:

1. Thickness: 3/4 inch.
2. Width: As required to fit space; minimum 3 inch.

E. Screens: Without doors; to match compartments; mounted to wall with full height panel brackets floor to ceiling end panel post.

2.3 ACCESSORIES

- A. Pilaster Shoes: Formed ASTM A666 Type 304 stainless steel with No. 4 finish, 3 inch high, concealing floor fastenings.
 - 1. Provide adjustment for floor variations with screw jack through steel saddles integral with pilaster.
 - 2. Provide ceiling attachment using two adjustable hanging studs, attached to above-ceiling framing.
- B. Head Rails: Hollow anodized aluminum, 1 inch by 1-1/2 inch size, with anti-grip profile and cast socket wall brackets.
- C. Wall and Pilaster Brackets: Polished stainless steel; manufacturer's standard type for conditions indicated on drawings.
- D. Attachments, Screws, and Bolts: Stainless steel , tamper proof type.
 - 1. For attaching panels and pilasters to brackets: Through-bolts and nuts ; tamper proof.
- E. Hardware: Polished stainless steel:
 - 1. Pivot hinges, gravity type, adjustable for door close positioning; two per door.
 - 2. Door Latch: Slide type with exterior emergency access feature.
 - 3. Door strike and keeper with rubber bumper; mounted on pilaster in alignment with door latch.
 - 4. Coat hook with rubber bumper; one per compartment, mounted on door.
 - 5. Provide door pull for outswinging doors.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify correct spacing of and between plumbing fixtures.
- C. Verify correct location of built-in framing, anchorage, and bracing.

3.2 INSTALLATION

- A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.
- B. Maintain 3/8 inch to 1/2 inch space between wall and panels and between wall and end pilasters.
- C. Attach panel brackets securely to walls using anchor devices.
- D. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.
- E. Field touch-up of scratches or damaged finish will not be permitted. Replace damaged or scratched materials with new materials.

3.3 TOLERANCES

- A. Maximum Variation From True Position: 1/4 inch.
- B. Maximum Variation From Plumb: 1/8 inch.

3.4 ADJUSTING

- A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch.
- B. Adjust hinges to position doors in partial opening position when unlatched. Return out-swinging doors to closed position.
- C. Adjust adjacent components for consistency of line or plane.

END OF SECTION

SECTION 102600 - WALL AND DOOR PROTECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Corner guards.

1.2 RELATED REQUIREMENTS

1.3 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2019b.

1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Indicate physical dimensions, features, wall mounting brackets with mounted measurements, anchorage details and rough-in measurements.
- C. Shop Drawings: Include plans, elevation, sections, and attachment details. Show design and spacing of supports for protective corridor handrails, required to withstand structural loads.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Corner Guards:
 - 1. Babcock-Davis: www.babcockdavis.com/#sle.
 - 2. Inpro: www.inprocorp.com/#sle.
 - 3. Koroseal Interior Products: www.koroseal.com/#sle.
 - 4. Nystrom, Inc: www.nystrom.com/#sle.
 - 5. Substitutions: See Section 016000 - Product Requirements.

2.2 PRODUCT TYPES

A. Corner Guards - Flush Mounted:

1. Material: High impact vinyl with full height extruded aluminum retainer.
2. Material: Polyethylene terephthalate (PET or PETG); PVC-free with full height extruded aluminum retainer.
3. Performance: Resist lateral impact force of 100 lbs at any point without damage or permanent set.
4. Surface Burning Characteristics: Provide assemblies with flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
5. Width of Wings: 2 inches.
6. Corner: Square.
7. Color: As selected from manufacturer's standard colors.
8. Length: One piece.

2.3 FABRICATION

- A. Fabricate components with tight joints, corners and seams.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that rough openings, concealed blocking, and anchors are correctly sized and located.
- B. Verify that substrate surfaces for adhered items are clean and smooth.

3.2 INSTALLATION

- A. Position corner guard 4 inches above finished floor to 48 inches high.

END OF SECTION

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Commercial toilet accessories.
- B. Under-lavatory pipe supply covers.
- C. Electric hand/hair dryers.
- D. Utility room accessories.

1.2 RELATED REQUIREMENTS

- A. Section 093000 - Tiling: Ceramic washroom accessories.
- B. Section 224000 - Plumbing Fixtures: Under-lavatory pipe and supply covers.

1.3 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.
- B. ASME A112.18.9 - Protectors/Insulators for Exposed Waste and Supplies on Accessible Fixtures 2011 (Reaffirmed 2017).
- C. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service 2015a (Reapproved 2019).
- D. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.
- E. ASTM C1036 - Standard Specification for Flat Glass 2016.
- F. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass 2018.
- G. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror 2018.
- H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2019b.

- I. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports and reinforcement of toilet partitions to receive anchor attachments.

1.5 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.
- C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Commercial Toilet, Shower, and Bath Accessories:
 - 1. AJW Architectural Products: www.ajw.com/#sle.
 - 2. American Specialties, Inc: www.americanspecialties.com/#sle.
 - 3. Bradley Corporation: www.bradleycorp.com/#sle.
- B. Under-Lavatory Pipe Supply Covers:
 - 1. Plumberex Specialty Products, Inc: www.plumberex.com/#sle.
- C. Electric Hand/Hair Dryers:
 - 1. Excel Dryer; Xlerator: www.exceldryer.com/#sle.

2.2 MATERIALS

- A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
- B. Stainless Steel Sheet: ASTM A666, Type 304.

- C. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.
- D. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.
- E. Mirror Glass: Tempered safety glass, ASTM C1048; and ASTM C1036 Type I, Class 1, Quality Q2, with silvering as required.
- F. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.

2.3 FINISHES

- A. Stainless Steel: Satin finish, unless otherwise noted.

2.4 COMMERCIAL TOILET ACCESSORIES

- A. Mirrors: Stainless steel framed, 1/4 inch thick annealed float glass; ASTM C1036.
 - 1. Annealed Float Glass: Silvering, protective and physical characteristics in compliance with ASTM C1503.
 - 2. Size: 24x36.
 - 3. Frame: 0.05 inch angle shapes, with mitered and welded and ground corners, and tamperproof hanging system; satin finish.
 - 4. Backing: Full-mirror sized, minimum 0.03 inch galvanized steel sheet and nonabsorptive filler material.
- B. Grab Bars: Stainless steel, smooth surface.
 - 1. Standard Duty Grab Bars:
 - a. Push/Pull Point Load: 250 pound-force, minimum.
 - b. Dimensions: 1-1/4 inch outside diameter, minimum 0.05 inch wall thickness, exposed flange mounting, 1-1/2 inch clearance between wall and inside of grab bar.
 - c. Length and Configuration: As indicated on drawings.

2.5 UNDER-LAVATORY PIPE AND SUPPLY COVERS

- A. Under-Lavatory Pipe and Supply Covers:

1. Insulate exposed drainage piping including hot, cold, and tempered water supplies under lavatories or sinks to comply with ADA Standards.
2. Exterior Surfaces: Smooth non-absorbent, non-abrasive surfaces.
3. Construction: 1/8 inch flexible PVC.
 - a. Surface Burning Characteristics: Flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
 - b. Comply with ICC A117.1.
4. Color: White.
5. Fasteners: Reusable, snap-locking fasteners with no sharp or abrasive external surfaces.
6. Products:
 - a. Plumberex Specialty Products, Inc; Plumberex Handy-Shield Maxx: www.plumberex.com/#sle.

2.6 ELECTRIC HAND/HAIR DRYERS

- A. Electric Hand Dryers: Traditional fan-in-case type, with downward fixed nozzle.
 1. Operation: Automatic, sensor-operated on and off.
 2. Mounting: Surface mounted with wall guard plate below.
 3. Cover: Epoxy painted steel or die-cast zinc alloy.
 - a. Tamper-resistant screw attachment of cover to mounting plate.
 4. Air Velocity: 18,000 linear feet per minute, minimum, at full power.
 5. Heater: 500 W, minimum, at full power.
 6. Total Wattage: 1500 W, maximum.
 7. Runtime: Field adjustable or automatic, up to 35 seconds.
 8. Wall Guards for Electric Hand Dryers: Match finish of dryer.
 - a. Products:

- 1) Excel- Antimicrobial Wall Guard.

2.7 UTILITY ROOM ACCESSORIES

- A. Combination Utility Shelf/Mop and Broom Holder: 0.05 inch thick stainless steel, Type 304, with 1/2 inch returned edges, 0.06 inch steel wall brackets.
 1. Drying rod: Stainless steel, 1/4 inch diameter.
 2. Hooks: Two, 0.06 inch stainless steel rag hooks at shelf front.
 3. Mop/broom holders: Three spring-loaded rubber cam holders at shelf front.
 4. Length: 36 inches.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify exact location of accessories for installation.
- C. For electrically-operated accessories, verify that electrical power connections are ready and in the correct locations.

3.2 PREPARATION

- A. Deliver inserts and rough-in frames to site for timely installation.
- B. Provide templates and rough-in measurements as required.

3.3 INSTALLATION

- A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.
- B. Install plumb and level, securely and rigidly anchored to substrate.
- C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.

3.4 PROTECTION

- A. Protect installed accessories from damage due to subsequent construction operations.

END OF SECTION

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SECTION 104400 - FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Fire extinguishers.
- B. Fire extinguisher cabinets.
- C. Accessories.

1.2 RELATED REQUIREMENTS

- A. Section 061000 - Rough Carpentry: Wood blocking product and execution requirements.

1.3 REFERENCE STANDARDS

- A. NFPA 10 - Standard for Portable Fire Extinguishers 2017, with Errata (2018).

1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide extinguisher operational features.
- C. Shop Drawings: Indicate locations of cabinets and cabinet physical dimensions.
- D. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.

1.5 FIELD CONDITIONS

- A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Fire Extinguishers:
 - 1. Ansul, a Tyco Business: www.ansul.com/#sle.

2. Kidde, a unit of United Technologies Corp: www.kidde.com/#sle.

3. Nystrom, Inc: www.nystrom.com/#sle.

B. Fire Extinguisher Cabinets and Accessories:

1. Ansul, a Tyco Business: www.ansul.com/#sle.

2. Kidde, a unit of United Technologies Corp: www.kidde.com/#sle.

3. Larsen's Manufacturing Co: www.larsensmfg.com/#sle.

4. Nystrom, Inc: www.nystrom.com/#sle.

2.2 FIRE EXTINGUISHERS

A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.

B. Water Type Fire Extinguishers: Stainless steel tank, pressurized, with premixed antifreeze solution, including hose and nozzle.

1. Class: 2-A type.

2. Size: 2.5 gallon.

3. Finish: Red.

2.3 FIRE EXTINGUISHER CABINETS

A. Cabinet Construction: Non-fire rated.

1. Formed primed steel sheet; 0.036 inch thick base metal.

B. Cabinet Configuration: Recessed type.

1. Size to accommodate accessories.

2. Trim: Flat square edge, with 2 inch wide face.

C. Door: 0.036 inch metal thickness, reinforced for flatness and rigidity with nylon catch. Hinge doors for 180 degree opening with two butt hinge.

D. Door Glazing: Acrylic plastic, clear, 1/8 inch thick, flat shape and set in resilient channel glazing gasket.

- E. Finish of Cabinet Exterior Trim and Door: No. 4 - Brushed stainless steel.

2.4 ACCESSORIES

- A. Lettering:{ }“FIRE EXTINGUISHER” decal, or vinyl self-adhering, pre-spaced black lettering in accordance with authorities having jurisdiction (AHJ).

PART 3 EXECUTION

3.1 EXAMINATION

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Secure rigidly in place.

END OF SECTION

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SECTION 113013 - RESIDENTIAL APPLIANCES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Kitchen appliances.

1.2 RELATED REQUIREMENTS

- A. Section 260583 - Wiring Connections: Electrical connections for appliances.

1.3 REFERENCE STANDARDS

- A. UL (DIR) - Online Certifications Directory Current Edition.

1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's data indicating dimensions, capacity, and operating features of each piece of residential equipment specified.
- C. Copies of Warranties: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.
- B. Electric Appliances: Listed and labeled by UL (DIR) and complying with NEMA Standards (National Electrical Manufacturers Association).

1.6 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Provide five (5) year manufacturer warranty on refrigeration system of refrigerators.
- C. Provide ten (10) year manufacturer warranty on tub and door liner of dishwashers.

PART 2 PRODUCTS

2.1 KITCHEN APPLIANCES

- A. Provide Equipment Eligible for Energy Star Rating: Energy Star Rated.
- B. Refrigerator: Free-standing, side-by-side, and frost-free.
 - 1. Capacity: Total minimum storage of 25.3 cubic ft.
 - 2. Energy Usage: Minimum 20 percent more energy efficient than energy efficiency standards set by U.S. Department of Energy (DOE).
 - 3. Exterior Finish: Porcelain enameled steel, color white.
 - 4. Manufacturers:
 - a. GE Appliances; GSE25GGHSS: www.geappliances.com/#sle.
- C. Waste Disposer: Standard type, overload protection, direct wired, dishwasher connection.
 - 1. Power: 1/2 HP.
 - 2. Capacity: Large.
 - 3. Height: 14-1/2 inch.
 - 4. Depth: 8-1/2 inch.
 - 5. Controls: Wall switch.
 - 6. Voltage: 115 volts, 60 Hz, 4 amps.
 - 7. Sink Flange Kit: Stainless steel.
 - 8. Manufacturers:
 - a. GE Appliances: www.geappliances.com/#sle.
 - b. Substitutions: See Section 016000 - Product Requirements.
- D. Dishwasher: Undercounter.
 - 1. Finish: Stainless Steel .
 - 2. Manufacturers:
 - a. Hobart LXeR advansys- High Temperature.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify utility rough-ins are provided and correctly located.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

3.3 ADJUSTING

- A. Adjust equipment to provide efficient operation.

3.4 CLEANING

- A. Remove packing materials from equipment and properly discard.
- B. Wash and clean equipment.

END OF SECTION

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SECTION 114000 - FOOD SERVICE EQUIPMENT**PART 1 – GENERAL****1.1 RELATED DOCUMENTS**

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 food service equipment indicated on Drawings and Schedules.
- B. Owner Furnished Equipment: Where indicated, Owner shall furnish equipment items. Purveyor Furnished Equipment: Where indicated, Purveyor shall furnish equipment items. General Contractor Furnished Equipment: Where indicated, General Contractor will furnish equipment items.
- C. Related Sections includes the following:
 - 1. Division 5 Section "Metal Fabrications" for equipment supports.
 - 2. Division 6 Section "Interior Architectural Woodwork" for wood casework and plastic laminate substrates.
 - 3. Refer to Division 15 Sections for supply and exhaust fans; exhaust ductwork; service rough-ins; drain traps; atmospheric vents; valves, pipes and fittings; fire extinguishing systems; and other materials required to complete food service equipment installation.
 - 4. Refer to Division 16 Sections for connection to fire alarm systems, wiring, disconnects and other electrical materials required to complete the food service installation.
- D. Allowances: Furnish food service equipment under the allowances indicated as specified in Division 1 Section "Allowances."

1.3 DEFINITIONS

- A. Terminology Standard: Refer to NSF 7, "Food Equipment" or other applicable NSF standards for definitions of food service equipment and installation terms not otherwise defined in this Section or in other referenced standards.

1.4 SUBMITTALS

- A. Product Data Brochure: Before proceeding with the purchase of manufactured equipment, submit brochures in a PDF format. Brochures shall consist of :
 - 1. Title page
 - 2. Index of all items with columns for: Item Numbers, Quantity, Description and Status
 - 3. Provide for each manufacturer item a typed lead sheet showing: Optional Finishes, Equipment and Accessories, Plumbing, Electrical, Refrigeration and / or Ventilation Requirements, Special Notes and any Verification required.
- B. Shop Drawings: For food service equipment not manufactured as standard production and catalog items by manufacturers. Include plans, elevations, sections, rough-in dimensions, fabrication details, service requirements and attachments to other work or items.

1. Plumbing and electrical rough-ins shall be on separate drawing.
 2. Rough-ins shall be stubbed out of walls wherever possible.
 3. Use of existing electrical / plumbing services only with consent of KEC.
 4. Scale shall be $\frac{1}{4}" = 1'-0"$
 5. Shop drawings shall include dimensioned plans, elevations and vertical sections for all fabricated-equipment. The drawings shall show all details of construction, installation and relationship to adjoining equipment and related areas where cutting and/or close fitting may be required. The drawings shall show all reinforcements, anchorage and other work required for the complete installation of all equipment
 6. Scale shall be $\frac{3}{4}" = 1'-0"$ for plans and elevations and $1 \frac{1}{2}" = 1'-0"$ for vertical sections.
 7. Wiring Diagrams: Details of wiring for power, signal and control systems and differentiating between manufacture-installed and field-installed wiring.
 8. Piping Diagrams: Details of piping systems and differentiating between manufacturer-installed and field-installed piping.
- C. Coordination Drawings: For locations of food service equipment and service utilities, Key equipment with item numbers and descriptions indicated in Contract Documents. Include plans and elevations of equipment, access- and maintenance-clearance requirements, details of concrete or masonry bases and floor depressions and service-utility characteristics. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for exposed products with color finishes.
- D. Samples for Verification: Of each type of exposed finish required, minimum 4-inch (100-mm) square or 6-inch (150-mm) long sections of linear shapes and of same thickness and material indicated for work. Where finishes involve normal color and texture variations, include sample sets showing the full range of variations expected. Add requirements for fabrication samples for custom equipment, if any.
- E. Product Certificates: As required, signed by manufacturers of refrigeration systems or their authorized agents certifying that systems furnished comply with requirements and will maintain operating temperatures indicated in the areas or equipment that they will serve.
- F. Maintenance Data: Operation, maintenance, and parts data for food service equipment to include in the maintenance manuals specified in Division 1. Include a product schedule as follows:
1. Product Schedule: For each food service equipment item, include item number and description indicated in Contract Documents, manufacturer's name and model number, and authorized service agencies' addresses and telephone numbers.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer to perform work of this Section who has specialized in installing food service equipment, who has completed installations similar in design and extent to that indicated for this Project, and who has a record of successful in-service performance.

Fabricator Qualifications: Engage a firm experienced in manufacturing food service equipment similar to that indicated for this Project and with a record of successful in-service performance.

Source Limitations: Obtain each type of food service equipment through one source from a single manufacturer.

Regulatory Requirements: Comply with the following National Fire Protection Association (NFPA) codes:

1. NFPA 17, "Dry Chemical Extinguishing Systems."
 2. NFPA 17A, "Wet Chemical Extinguishing Systems."
 3. NFPA 54, "National Fuel Gas Code."
 4. NFPA 70, "National Electrical Code."
 5. NFPA 96, "Ventilation Control and Fire Protection of Commercial Cooking Operations."
- E. Listing and Labeling: Provide electrically operated equipment or components specified in this Section that are listed and labeled.
- F. AGA Certification: Provide gas-burning appliances certified by the American Gas Association (AGA).
- G. ASME Compliance: Fabricate and label steam-generating and closed steam-heating equipment to comply with ASME Boiler and Pressure Vessel Code.
- H. ASHRAE Compliance: Provide mechanical refrigeration systems complying with the American Society of Heating, Refrigerating and Air-Conditioning Engineers' ASHRAE 15, "Safety Code for Mechanical Refrigeration."
- I. NSF Standards: Comply with applicable NSF International (NSF) standards and criteria and provide NSF Certification Mark on each equipment item, unless otherwise indicated.
- J. ANSI Standards: Comply with applicable ANSI standards for electric-powered and gas-burning appliances; for piping to compressed-gas cylinders; and for plumbing fittings, including vacuum breakers and air gaps, to prevent siphonage in water piping.
- K. Seismic Restraints: Provide seismic restraints for food service equipment according to the Sheet Metal and Air Conditioning Contractors National Association's (SMACNA) "Kitchen Equipment Fabrication Guidelines," appendix 1, "Guidelines for Seismic Restraints of Kitchen Equipment," unless otherwise indicated
- L. All gas fired equipment to be factory calibrated for high altitude operation. No retrofit or dealer added altitude adjustment will be accepted.
- M. Pre-installation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings." Review methods and procedures related to food service equipment including, but not limited to, the following:
1. Review access requirements for equipment delivery.
 2. Review equipment storage and security requirements.
 3. Inspect and discuss condition of substrate and other preparatory work performed by other trades.
 4. Review structural loading limitations.
 5. Review and finalize construction schedule and verify availability of materials, installer's personnel, equipment, and facilities needed to make progress and avoid delays.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver food service equipment as factory-assembled units with protective crating and covering.
- B. Store food service equipment in original protective crating and covering and in a dry location.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions of food service equipment installation areas by field measurements before equipment fabrication and indicate measurements on Shop Drawings and Coordination Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish required dimensions and proceed with fabricating equipment without field measurements. Coordinate construction to ensure actual dimensions correspond to established dimensions.

1.8 COORDINATION

- A. Coordinate equipment layout and installation with other work, including light fixtures, HVAC equipment, and fire-suppression system components.
- B. Coordinate location and requirements of service-utility connections.
- C. Coordinate size, location, and requirements of concrete bases, positive slopes to drains, floor depressions, and insulated floors. Concrete, reinforcement, and formwork requirements are specified in Division 3 Section "Cast-in-Place Concrete."
- D. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 7 Section "Roof Accessories."

1.9 WARRANTY

- A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
- B. Refrigeration Compressor Warranty: Submit a written warranty signed by manufacturer agreeing to repair or replace compressors that fail in materials or workmanship within the specified warranty period. Failures include, but are not limited to, the following:
 - 1. Breakage.
 - 2. Faulty operation.
- C. Warranty Period:
 - 1. Compressors: 5 years from date of Substantial Completion.
 - 2. Other: 1 year parts and labor from date of Substantial Completion, unless otherwise specified.

PART 2 - PRODUCTS**2.1 MATERIALS**

- A. Stainless-Steel Sheet, Strip, Plate, and Flat Bar: ASTM A 666, Type 304, stretcher leveled, and in finish specified in "Stainless-Steel Finishes" Article. In accordance with good stewardship, stainless steel with a high recycled content is preferred.
- B. Stainless-Steel Tube: ASTM A 554, Grade MT-304, and in finish specified in "Stainless-Steel Finishes" Article.
- C. Zinc-Coated Steel Sheet: ASTM A 653, G115 (ASTM A 653M, Z350) coating designation; commercial quality; cold rolled; stretcher leveled; and chemically treated.
- D. Zinc-Coated Steel Shapes: ASTM A 36 (ASTM A 36M), zinc-coated according to ASTM A 123 requirements.
- E. Plastic Laminate: Complying with NEMA LD 3 and NSF 35 requirements; NSF certified for end-use application indicated; 0.050 inch (1.27 mm) thick for horizontal and vertical surfaces and 0.042 inch (1.07 mm) thick for post-formed surfaces; smooth texture; and easily cleanable.
 - 1. Color: As selected by Architect from manufacturer's full range of colors.
- F. Plywood and Lumber: Provide plywood and lumber as specified in Division 6 Section "Interior Architectural Woodwork."
- G. Sealant: ASTM C 920; Type S, Grade NS, Class 25, Use NT. Provide elastomeric sealant NSF certified for end-use application indicated. Provide sealant that, when cured and washed, meets requirements of Food and Drug Administration's 21 CFR, Section 177.2600 for use in areas that come in contact with food.
 - 1. Color: As selected by Architect from manufacturer's full range of colors.
 - 2. Backer Rod: Closed-cell polyethylene, in diameter larger than joint width.
- H. Tempered Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated surfaces), Type I (transparent), Class 1 (clear), Quality q3 (glazing select). Provide products complying with ANSI Z97.1, manufactured by horizontal (roller-hearth) process, and 6 mm thick, unless otherwise indicated. Provide exposed safety edges, if any, seamed before tempering.
- I. Plastic: Except for plastic laminate, provide plastic materials and components complying with NSF 51.
- J. Sound Dampening: Underside of tabletops, shelves, sinks, and drain boards shall be sound deadened in accordance with N.S.F. with "Tacky Tape", manufactured by Schnee-Morehead.
- K. Gaskets: NSF certified for end-use application indicated; of resilient rubber, neoprene, or PVC that is nontoxic, stable, odorless, nonabsorbent, and unaffected by exposure to foods and cleaning compounds.

2.2 ACCESSORIES

- A. Cabinet Hardware: Provide NSF-certified, stainless steel hardware for equipment items as indicated. Provide lock where indicated.
- B. Casters: NSF-certified, standard-duty, stainless-steel, swivel stem casters with 5-inch (125-mm) diameter wheels, polyurethane tires with 1-inch (25-mm) tread width, and 200-lb (90-kg) load capacity per caster. Provide brakes on 2 casters per unit.

2.3 FABRICATION, GENERAL

- A. Fabricate food service equipment according to NSF 2 requirements. Factory assembled equipment to greatest extent possible.
- B. Plastic-Laminate and Wood Casework: Fabricate according to requirements specified in Division 6 Section "Interior Architectural Woodwork."
- C. Welding: Use welding rod of same composition as metal being welded. Use methods that minimize distortion and develop strength and corrosion resistance of base metal. Provide ductile welds free of mechanical imperfections such as gas holes, pits, or cracks.
 - 1. Welded Butt Joints: Provide full-penetration welds for full-joint length. Make joints flat, continuous, and homogenous with sheet metal without relying on straps under seams, filling in with solder, or spot welding.
 - 2. Grind exposed welded joints flush with adjoining material and polish to match adjoining surfaces.
 - 3. Where fasteners are welded to underside of equipment, finish reverse side of weld smooth and undepressed.
 - 4. Coat unexposed stainless-steel welded joints with suitable metallic-based paint to prevent corrosion.
 - 5. After zinc-coated steel is welded, clean welds and abraded areas and apply SSPC-Paint 20, high-zinc-dust-content, galvanizing repair paint to comply with ASTM A 780.
- D. Fabricate field-assembled equipment prepared for field-joining methods indicated. For metal butt joints, comply with referenced SMACNA standard, unless otherwise indicated.
- E. Where stainless steel is joined to a dissimilar metal, use stainless-steel welding material or fastening devices
- F. Form metal with break bends that are not flaky, scaly, or cracked in appearance; where breaks mar uniform surface appearance of material, remove marks by grinding, polishing, and finishing.
- G. Sheared Metal Edges: Finish free of burrs, fins, and irregular projections.
- H. Provide surfaces in food zone, as defined in NSF 2, free from exposed fasteners.
- I. Cap exposed fastener threads, including those inside cabinets, with stainless-steel lock washers and stainless-steel cap (acorn) nuts.
- J. Provide pipe slots on equipment with turned-up edges and sized to accommodate service and utility lines and mechanical connections.

- K. Provide enclosures, including panels, housings, and skirts, to conceal service lines, operating components, and mechanical and electrical devices including those inside cabinets, unless otherwise indicated.
- L. Seismic Restraints: Fabricate to comply with referenced SMACNA standard, unless otherwise indicated.

2.4 STAINLESS STEEL EQUIPMENT

- A. Edges and Backsplashes: Provide equipment edges and backsplashes indicated complying with referenced SMACNA standard, unless otherwise indicated.
- B. Apply sound dampening to underside of metal work surfaces, including sinks and similar units. Provide coating with smooth surface and hold coating 1 inch (25 mm) back from open edges for cleaning.
- C. Tables: Fabricate with reinforced tops, legs, and reinforced under shelves or cross bracing to comply with referenced SMACNA standard, unless otherwise indicated, and as follows:
 - 1. Tops: Minimum 14-Ga 0.0781-inch (1.984-mm) thick stainless steel, unless otherwise indicated.
 - 2. Legs: 1-5/8 inch (41.3 mm) OD, minimum 16-Ga 0.0625-inch (1.588-mm-) thick stainless steel with stainless-steel gusset and adjustable insert bullet-type feet with minimum adjustment of 1 inch (25 mm) up or down without exposing threads, unless otherwise indicated.
 - 3. Under Shelves: Minimum 16-Ga 0.625-inch (1.588-mm) thick stainless steel, unless otherwise indicated.
 - 4. Top and Under Shelf Reinforcement: Provide minimum 14-Ga 0.0781-inch (1.984-mm) thick, stainless-steel reinforcing, unless otherwise indicated.
 - 5. Cross Bracing: 1-1/4 inch (31.75 mm) OD, minimum 14-Ga 0.0781-inch (1.588-mm) thick stainless steel, unless otherwise indicated.
- D. Sinks: Fabricate of minimum 14 Ga 0.0781-inch (1.984-mm) thick stainless steel with fully welded, 1-piece construction. Construct 2 sides and bottom of sink compartment from 1 stainless-steel sheet with ends welded integral and without overlapping joints or open spaces between compartments. Provide double-wall partitions between compartments with 1/2-inch (13-mm) radius rounded tops that are welded integral with sink body. Cove horizontal, vertical, and interior corners with 3/4-inch (19-mm) radius. Pitch and crease sinks to waste for drainage without pooling. Seat wastes in die-stamped depressions without solder, rivets, or welding. Unless otherwise indicated.
 - 1. Wastes:
 - a. 2-inch (50-mm) nickel-plated bronze, rotary-handle waste assembly with stainless-steel strainer plate and nickel-plated brass, connected overflow.
 - b. 1- 1/2 inch nickel plated basket strainer drain with connected overflow.
 - c. 1- inch nickel plated open drain.
 - d. 1-inch copper indirect drain – extended to nearest floor sink or drain. Drain shall be wrapped with insulating tape to prevent sweating, concealed wherever possible and pitched to ensure adequate drainage.

2. Drain Boards: Minimum 14 Ga 0.0781-inch- (1.984-mm-) thick stainless steel, pitched to sink at 1/8inch/12 inches (3 mm/300 mm) of length. Reinforce drain boards with minimum 0.0781-inch- (1.984-mm-) thick stainless steel, unless otherwise indicated.
3. Legs: 1-5/8 inch (41.3 mm) OD, minimum 16-Ga 0.0625-inch (1.588-mm) thick stainless steel with stainless-steel gusset welded to 0.1094-inch (2.779-mm) thick, stainless-steel support plate. Provide adjustable insert bullet-type feet with minimum adjustment of 1 inch (25 mm) up or down without exposing threads, unless otherwise indicated.
4. Drainboard Braces: 1 inch (25 mm) OD, minimum 16 Ga 0.0625-inch (1.588-mm) thick stainless steel, unless otherwise indicated.
5. Cross Bracing: 1-1/4 inch (31.75 mm) OD, minimum 14 Ga 0.0625-inch (1.588-mm) thick stainless steel, unless otherwise indicated.

- E. Wall Shelves and Over Shelves: Fabricate to comply with referenced SMACNA standard, unless otherwise indicated, and with minimum 16-Ga 0.0625-inch (1.588-mm) thick, stainless-steel shelf tops.
- F. Drawers: Provide lift-out type, 1-piece, die-stamped drawer pan fabricated from 18-Ga 0.050-inch (1.27-mm) thick stainless steel with inside corners radiused. Support drawer pan with 0.0625-inch (1.588-mm) thick, stainless steel channel frame welded to drawer front. Provide 1-inch- (25-mm) thick, double-wall front fabricated from 16-Ga 0.0625-inch (1.588-mm) thick stainless steel and with integral recessed pull. Fill void in drawer front with semi-rigid fiberglass sound dampening. Mount drawers on NSF-certified, full-extension, stainless-steel drawer slides that have minimum 100-lb (45-kg) load capacity per pair, ball-bearing rollers, and positive stop. Mount drawer slides for self-closing on drawer housing as indicated.
- G. Wall Brackets: 14 Ga 0.0781-inch- (1.984-mm-) thick stainless steel.
- H. Wall Flashing: 20 Ga 0.0375-inch (.953-mm-) thick stainless steel

2.5 EXHAUST HOOD FABRICATION

- A. General Hood Fabrication: See itemized specifications.

2.6 STAINLESS STEEL FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.
1. Remove or blend tool and die marks and stretch lines into finish
 2. Grind and polish surfaces to produce uniform, directional textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
- B. Concealed Surfaces: No. 2B finish (bright, cold-rolled, unpolished finish).
- C. Exposed Surfaces: No. 4 finish (bright, directional polish).
- D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
- E. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipment.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances, service-utility connections, and other conditions affecting installation and performance of food service equipment. Do not proceed with installation until unsatisfactory conditions have been corrected.
- B. Examine roughing-in for piping, mechanical, and electrical systems to verify actual locations of connections before installation.

3.2 INSTALLATION, GENERAL

- A. Install food service equipment level and plumb, according to manufacturer's written instructions, original design, and referenced standards.
- B. Complete equipment field assembly, where required, using methods indicated.
 - 1. Provide closed butt and contact joints that do not require a filler.
 - 2. Grind field welds on stainless-steel equipment smooth, and polish to match adjacent finish. Comply with welding requirements in "Fabrication, General" Article
- C. Install equipment with access and maintenance clearances according to manufacturer's written instructions and requirements of authorities having jurisdiction.
- D. Provide cutouts in equipment, neatly formed, where required to run service lines through equipment to make final connections.
- E. Except for mobile and adjustable-leg equipment, securely anchor and attach items and accessories to walls, floors, or bases with stainless-steel fasteners, unless otherwise indicated.
- F. Install cabinets and similar equipment on concrete or masonry bases in a bed of sealant
- G. Install hoods to comply with NFPA 96 requirements and to remain free from vibration when operating.
- H. Install seismic restraints according to referenced SMACNA standard.
- I. Install trim strips and similar items requiring fasteners in a bed of sealant. Fasten with stainless-steel fasteners at 48 inches (1200 mm) o.c. maximum.
- J. Install sealant in joints between equipment and abutting surfaces with continuous joint backing, unless otherwise indicated. Provide airtight, watertight, vermin-proof, sanitary joints.

3.3 PROTECTING

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, that ensure food service equipment is without damage or deterioration at the time of Substantial Completion.

3.4 COMMISSIONING

- A. Startup Services: Engage factory-authorized service representatives to perform startup services and to demonstrate and train Owner's maintenance personnel as specified below.
 - 1. Coordinate food service equipment startup with service-utility testing, balancing, and adjustments. Do not operate steam lines before they have been cleaned and sanitized.
 - 2. Remove protective coverings and clean and sanitize equipment, both inside and out, and relamp equipment with integral lighting. Where applicable, comply with manufacturer's written cleaning instructions.
 - 3. Test each equipment item for proper operation. Repair or replace equipment that is defective in operation, including units that operate below required capacity or that operate with excessive noise or vibration.
 - 4. Test refrigeration equipment's ability to maintain specified operating temperature under heavy-use conditions. Repair or replace equipment that does not maintain specified operating temperature
 - 5. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 6. Test motors and rotating equipment for proper rotation and lubricate moving parts according to manufacturer's written instructions.
 - 7. Test water, drain, gas, steam, oil, refrigerant, and liquid-carrying components for leaks. Repair or replace leaking components.
 - 8. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance for each food service equipment item.
 - 9. Review data in the operation and maintenance manuals. Refer to Division 1 Section "Contract Closeout."
 - 10. Review data in the operation and maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data."
 - 11. Schedule training with Owner, through Architect, with at least 7 days' advance notice.

3.5 FOOD SERVICE EQUIPMENT SCHEDULE

- A. All equipment and items shall be furnished complete as per manufacturer's standard specifications, except where noted otherwise. Provide long life warm white incandescent, fluorescent or LED (as per specification) lamps, with safety covers where required for all standard manufactured items.
- B. All custom equipment shall be fabricated as per contract documents. Each item shall include all integral components shown or specified and shall provide for all related items.
- C. All items included in these specifications shall be installed, started up, checked and demonstrated by Contractor unless noted otherwise. Equipment demonstration shall be scheduled by the Contractor at a time convenient to the operations stall and conducted by a factory representative. Architect shall be notified in writing that such demonstration has taken place by each manufacturer.
- D. All items with doors shall be hinged per plans and details
- E. Remote refrigeration systems shall be furnished by one contractor.

- F. Equipment shall be complete with connection terminals as standardized by equipment manufacturers, unless otherwise specified, ready for connection by other contractors.
- G. Wall mounted hand sink heights shall be 34”.
- H. All refrigeration equipment shall not contain HCFC’s.

END OF SECTION

SSSD Strawberry Park: ITEMIZED EQUIPMENT SPECIFICATION

Legend:	NIC	Not In <u>Kitchen</u> Contract
	GC:	General Contractor
	KEC:	Kitchen Equipment Contractor
	OWNER:	Supplied by the operator and or their supplier or vendor
	S/S:	Stainless Steel

ITEM #1 SINK, 3 COMPARTMENT, CORNER

Quantity: 1ea
Mfg: Nationwide Fabrication
Model #: 3N1818-2D24
Options: 14 gauge, 300 series fully fabricated S/S construction, lever drains, overflows
2 ea FAUCET: T&S Brass B-0231

ITEM #2 WALL SHELVES

Quantity: 2ea
Mfg: Nationwide Fabrication
Model #: WSD-119x12 ("L" to match sink length below)
Options: 16 gauge SS construction, mounting brackets shipped loose

ITEM #3 HAND SINK

Quantity: 2ea
Mfg: Universal Stainless
Model #: EHS-1RL
Options: S/S construction, w/ splash guards left and right sides,

ITEM #4 DISH TABLE, CLEAN

Quantity: 1ea
Mfg: Nationwide Fabrication
Model #: CDT-60, operation as per plan, 14 gauge SS,
Options: 9" tall backsplash, stainless steel legs and under shelf
Verify all dimensions at job site.

ITEM #5 WALL SHELVES

Quantity: 2ea
Mfg: Nationwide Fabrication
Model #: WSD-72x12
Options: S/S construction, wall mounting brackets shipped loose

ITEM #6 BOOSTER HEATER

Quantity: 1ea
Mfg: Hubbell
Model #: J-67 (verify w/ existing dish machine)
Options: Filtration, incoming temp gauge, outgoing temp gauge, pressure reducing valve.
Dielectric union, shock absorber

ITEM #7**DISH MACHINE**

Quantity: EXISTING, KEC TO RELOCATE TO NEW LOCATION
Mfg: EXISTING, KEC TO RELOCATE TO NEW LOCATION
Model #: EXISTING, KEC TO RELOCATE TO NEW LOCATION
Options: EXISTING, KEC TO RELOCATE TO NEW LOCATION

ITEM #8**CONDENSATE HOOD**

Quantity: 1ea
Mfg: Nationwide Fabrication
Model #: C-4242
Options: S/S construction w/ 2" perimeter gutter and integral drain
For complete air flow specifications, please refer to sheet FS-2
HOOD ONLY. No hanging, ductwork, fans, MUA, etc.
SS enclosure from top of hood to kitchen ceiling by KEC.
Coordinate height with tall dish machine below.

ITEM #9**SPARE NUMBER**

Quantity: N/A
Mfg: N/A
Model #: N/A
Options: N/A

ITEM #10**SPARE NUMBER**

Quantity: N/A
Mfg: N/A
Model #: N/A
Options: N/A

ITEM #11**DISPOSAL**

Quantity: 1ea
Mfg: In Sink Erator
Model #: SS-200
Options: 15" cone w/ strainer, baffle, reversing switch, swirl sprays, syphon breaker, solenoid valve and flow control to make a complete unit.

ITEM #12**SPRAY RINSE**

Quantity: 1ea
Mfg: T&S Brass
Model #: B-0133-B
Options: Splash mounted w/ wall bracket

ITEM #13	DISH TABLE, SOILED
Quantity:	1ea
Mfg:	Nationwide Fabrication
Model #:	Custom as per plan
Options:	14 gauge stainless steel top with tray drop area, rolled edges as per plan, stainless steel legs and under shelf. Top constructed w/ integral slope to dish machine. Disposal switch bracket. Scrap trough, knock outs for siphon breaker 4" OC and spray rinse 8" OC. 9" tall backsplash. Cone welded and polished integral to top. Verify all dimensions at job site.
ITEM #14	CLEAN UTENSIL STORAGE
Quantity:	1 sections
Mfg:	Metro Shelving
Model #:	5ea MX1872G (shelves) 4ea MX74UP (posts)
Options:	5 tier, casters 2 locking, 2 non locking per section
ITEM #15	SINK, VEGETABLE PREP
Quantity:	1ea
Mfg:	Nationwide Fabrication
Model #:	1N1818-DB24
Options:	14 gauge, 300 series fully fabricated S/S construction, lever drains, overflows 1 ea FAUCET: T&S Brass B-0231
ITEM #16	WALL SHELVES
Quantity:	2ea
Mfg:	Nationwide Fabrication
Model #:	WSD-46x12 (match sink length)
Options:	16 gauge S/S construction, wall mounting brackets shipped loose
ITEM #17	WORK TABLE
Quantity:	1ea
Mfg:	Nationwide Fabrication
Model #:	6SLSB-24
Options:	14 gauge SS top, 16 gauge SS under shelf, SS legs
ITEM #18	SPARE NUMBER
Quantity:	N/A
Mfg:	N/A
Model #:	N/A
Options:	N/A
ITEM #19	SPARE NUMBER
Quantity:	N/A
Mfg:	N/A
Model #:	N/A
Options:	N/A

ITEM #20 SPARE NUMBER

Quantity: N/A
Mfg: N/A
Model #: N/A
Options: N/A

ITEM #21 WALL SHELVES

Quantity: 2ea
Mfg: Nationwide Fabrication
Model #: WSD-72x12
Options: 16 gauge S/S construction, wall mounting brackets shipped loose

ITEM #22 REFRIGERATOR, 2 DOOR

Quantity: 1ea
Mfg: Continental
Model #: 2-RN
Options: Casters

ITEM #23 MERCHANDISER, OPEN AIR

Quantity: 1ea
Mfg: Federal
Model #: RSSM-560SC
Options: Casters 2.5", roll up cover, sliding rear doors

ITEM #24 ICE MACHINE and BIN

Quantity: 1ea
Mfg: Manitowoc
Model #: IY-324A
Options: Filter and bin B-420

ITEM #25 HEATED CABINET

Quantity: EXISTING
Mfg: EXISTING
Model #: EXISTING
Options: EXISTING

ITEM #26 CONVECTION OVENS, DOUBLE STACKED

Quantity: 1ea double stacked unit
Mfg: Blodgett Range
Model #: DFG-100
Options: Casters, gas manifold, manual controls
Flex gas line: 1ea T&S BRASS HG-4D-48K-PS

ITEM #27	STEAMER, 10 PAN
Quantity:	1ea
Mfg:	Cleveland Range
Model #:	24CGA-10.2
Options:	9797-21 Water filters, 106174 descale solution Flex gas line: 1ea T&S HG-4D-48K-PS
ITEM #28	SPARE NUMBER
Quantity:	N/A
Mfg:	N/A
Model #:	N/A
Options:	N/A
ITEM #29	SPARE NUMBER
Quantity:	N/A
Mfg:	N/A
Model #:	N/A
Options:	N/A
ITEM #30	SPARE NUMBER
Quantity:	N/A
Mfg:	N/A
Model #:	N/A
Options:	N/A
ITEM #31	EXHAUST HOOD, TYPE 2
Quantity:	1ea
Mfg:	Captive Aire
Model #:	5424 VHB-G-ND
Options:	4ea lights, fan / light Stainless steel enclosure extending from top of hood to ceiling by KEC. For air flow specifications, please refer to Exhaust Hood drawings Remote fan and light switch to be included.
ITEM #32	STAINLESS STEEL WALL PANELING, BELOW HOODS
Quantity:	1 lot
Mfg:	Custom
Model #:	20 gage S/S 18/8 mill finish, w/ no exposed screws.
Options:	Chrome joiner strips between vertical panels joints w/ wall end caps.
ITEM #33	SERVING LINE
Quantity:	1ea
Mfg:	Nationwide Fabrication
Model #:	Custom
Options:	Stainless base w/ stainless top

ITEM #34**HEAT LAMPS**

Quantity: 5ea
Mfg: Hatco
Model #: DL-775-RL (brushed metal)
Options: Adjustable length w/ retractable cords
Remote switch by Electrical Engineer

ITEM #35**EMPLOYEE LOCKERS**

Quantity: NIC
Mfg: NIC
Model #: NIC
Options: NIC

ITEM #36**CLEANING SUPPLIES STORAGE**

Quantity: 1 sections
Mfg: Metro Shelving
Model #: 5ea MX1824G (shelves), 4ea MX74P (posts)
Options: 5 tier, standard feet

ITEM #37**MOP SINK**

Quantity: NIC
Mfg: NIC
Model #: NIC
Options: NIC

ITEM #38**SPARE NUMBER**

Quantity: N/A
Mfg: N/A
Model #: N/A
Options: N/A

ITEM #39**SPARE NUMBER**

Quantity: N/A
Mfg: N/A
Model #: N/A
Options: N/A

ITEM #40**SPARE NUMBER**

Quantity: N/A
Mfg: N/A
Model #: N/A
Options: N/A

ITEM #41 HOSE BIB FOR CHEM DISPENSER

Quantity: NIC
Mfg: NIC
Model #: NIC
Options: NIC

ITEM #42 TRAY RETURN TABLE

Quantity: 1ea
Mfg: Nationwide Fabrication
Model #: 7SLSB-30
Options: 14 gauge SS top, 16 gauge SS under shelf, SS legs, left side splash

END OF ITEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

Drawings and general provisions of the Construction Contract, Division - 1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK

Furnish and Install:

1. Play Structures

Related Work Specified Elsewhere

Playground Surfacing – Section 32 18 16 Playground Protective Surfacing

1.3 QUALITY ASSURANCE

Acceptable Manufacturers – Manufactured Items

1. Landscape Structures, Inc, as indicated on plans

1.4 SUBMITTALS

Equals must be submitted for approval not less than seven (7) calendar days prior to bid opening. No substitution will be approved after that time.

The Contractor shall submit a copy of the manufacturer's shop drawings and installation instructions on all prefabricated catalog items to the Project Manager prior to installation.

1.5 PRODUCT HANDLING AND STORAGE

Materials shall be carefully handled and stored under cover in a manner to ensure proper ventilation and drainage, prevent deformation and damage to the materials and to shop finishes, to prevent rusting and the accumulation of foreign matter on the metal work, and to protect against damage from vandalism and theft. All such work shall be repaired and cleaned before erection.

Upon receipt at the job site, all materials shall be checked to ensure that no damage occurred during shipping or handling.

PART 2 - PRODUCTS

2.1 PLAY STRUCTURE: See Plans and Details

2.2 PLAY AREA SURFACING

See Section 32 18 16 Playground Protective Surfacing

PART 3 - EXECUTION

3.1 MANUFACTURED ITEMS

Assemble and install manufactured item per manufacturer's recommendations and/or as indicated in the details. Item shall be installed properly and completely in order to function as intended.

END OF SECTION 11 68 16

SECTION 122400 - WINDOW SHADES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Interior manual roller shades.

1.2 RELATED REQUIREMENTS

1.3 REFERENCE STANDARDS

- A. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi 2015.
- B. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films 2019.

1.4 SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets including materials, finishes, fabrication details, dimensions, profiles, mounting requirements, and accessories.
- B. Shop Drawings: Include shade schedule indicating size, location and keys to details, head, jamb and sill details, mounting dimension requirements for each product and condition and operation direction.
- C. Certificates: Manufacturer's documentation that line voltage components are UL listed or UL recognized.
- D. Selection Samples: Include fabric samples in full range of available colors and patterns.
- E. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver shades in manufacturer's unopened packaging, labeled to identify each shade for each opening.
- B. Handle and store shades in accordance with manufacturer's recommendations.

1.7 FIELD CONDITIONS

1.8 WARRANTY

- A. Provide manufacturer's warranty from Date of Substantial Completion, covering the following:
 - 1. Shade Hardware: One year.
 - 2. Fabric: One year.

PART 2 PRODUCTS

2.1 MANUFACTURERS

2.2 ROLLER SHADES

- A. General:
 - 1. Provide shade system components that are easy to remove or adjust without removal of mounted shade brackets.
 - 2. Provide shade system that operates smoothly when shades are raised or lowered.
- B. Roller Shades:
 - 1. Description - Interior Roller Shades: Single roller, manually operated fabric window shade system complete with mounting brackets, roller tubes, hembars, hardware, and accessories.
 - a. Drop Position: Regular roll.
 - b. Roll Direction: Roll down, closed position is at window sill.
 - c. Mounting: Window jamb mounted- inside, between jambs.
 - d. Size: As indicated on drawings.
 - e. Fabric: As indicated under Shade Fabric article.

2. Brackets and Mounting Hardware: As recommended by manufacturer for mounting indicated and to accommodate shade fabric roll-up size and weight.
 - a. Material: Stamped steel.
3. Roller Tubes: As required for type of shade operation.
 - a. Material: Extruded aluminum, clear anodized finish.
4. Hembars: Designed to maintain bottom of shade straight and flat.
5. Manual Operation for Interior Shades:
 - a. Clutch Operator: Manufacturer's standard material and design, permanently lubricated.
 - b. Drive Chain: Continuous loop beaded ball chain, 95 pounds minimum breaking strength. Provide upper and lower limit stops.
6. Accessories:
 - a. Fascia: Extruded aluminum, size as required to conceal shade mounting, attachable to brackets without exposed fasteners; clear anodized finish.
 - b. End Caps: Provide manufacturer's standard end caps to cover exposed ends of brackets.

2.3 SHADE FABRIC

- A. Fabric: Non-flammable, color-fast, impervious to heat and moisture, and able to retain its shape under normal operation.
 1. Manufacturers:
 - a. Hunter Douglas: ShearWeave Performance +.
 - b. Substitutions: See Section 016000 - Product Requirements.
 2. Material: Vinyl coated polyester.
 3. Performance Requirements:
 - a. Flammability: Pass NFPA 701 large and small tests.
 - b. Fungal Resistance: No growth when tested according to ASTM G21.

- c. Solar Transmittance (Ts): 3.
- 4. Openness Factor: 1%.
- 5. Color: As selected by Architect from manufacturer's full range of colors.
- 6. Fabrication:
 - a. Fabric Orientation: Railroaded, fabric is turned 90 degrees off the roll.
 - b. Battens: Full width of shade, enclose in welded shade fabric pocket.

2.4 ROLLER SHADE FABRICATION

- A. Field measure finished openings prior to ordering or fabrication.
- B. Dimensional Tolerances: Fabricate shades to fit openings within specified tolerances.
 - 1. Vertical Dimensions: Fill openings from head to sill with 1/2 inch space between bottom bar and window stool.
 - 2. Horizontal Dimensions - Inside Mounting: Fill openings from jamb to jamb.
- C. Dimensional Tolerances: As recommended in writing by manufacturer.
- D. At openings requiring continuous multiple shade units with separate rollers, locate roller joints at window mullion centers; butt rollers end-to-end.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine finished openings for deficiencies that may preclude satisfactory installation.
- B. Start of installation shall be considered acceptance of substrates.

3.2 PREPARATION

- A. Prepare surfaces using methods recommended by manufacturer for achieving best result for substrate under the project conditions.
- B. Coordinate with window installation and placement of concealed blocking to support shades.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions and approved shop drawings, using mounting devices as indicated.
- B. Adjust level, projection, and shade centering from mounting bracket. Verify there is no telescoping of shade fabric. Ensure smooth shade operation.

3.4 CLEANING

- A. Clean soiled shades and exposed components as recommended by manufacturer.
- B. Replace shades that cannot be cleaned to "like new" condition.

3.5 PROTECTION

- A. Protect installed products from subsequent construction operations.

END OF SECTION

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SECTION 123600 - COUNTERTOPS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Wall-hung counters and vanity tops.
- B. Sinks molded into countertops.

1.2 RELATED REQUIREMENTS

- A. Section 093000 - Tiling: Tile for countertops.

1.3 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2019b.
- B. AWI (QCP) - Quality Certification Program Current Edition.
- C. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards 2014, with Errata (2018).
- D. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.1 2017, with Errata (2019).
- E. IAPMO Z124 - Plastic Plumbing Fixtures 2017.
- F. ISFA 2-01 - Classification and Standards for Solid Surfacing Material 2013.
- G. PS 1 - Structural Plywood 2009.
- H. SEFA 2 - Installations 2010.

1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Specimen warranty.

- C. Shop Drawings: Complete details of materials and installation ; combine with shop drawings of cabinets and casework specified in other sections.
- D. Verification Samples: For each finish product specified, minimum size 6 inches square, representing actual product, color, and patterns.
- E. Test Reports: Chemical resistance testing, showing compliance with specified requirements.
- F. Certificate: Submit labels and certificates required by quality assurance and quality control programs.
- G. Installation Instructions: Manufacturer's installation instructions and recommendations.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.
- B. Quality Certification:
 - 1. Comply with AWI (QCP) woodwork association quality certification service/program in accordance with requirements for work specified in this section: www.awiqcp.org/#sle.
 - 2. Provide labels or certificates indicating that the installed work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.
 - 3. Provide designated labels on shop drawings as required by certification program.
 - 4. Provide designated labels on installed products as required by certification program.
 - 5. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.7 FIELD 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.

PART 2 PRODUCTS

2.1 COUNTERTOPS

- A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
- B. Solid Surfacing Countertops: Solid surfacing sheet or plastic resin casting over continuous substrate.
 - 1. Flat Sheet Thickness: 1/2 inch, minimum.
 - 2. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
 - a. Manufacturers:
 - 1) Dupont: www.corian.com/#sle.
 - b. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
 - c. Sinks and Bowls: Integral castings; minimum 3/4 inch wall thickness; comply with IAPMO Z124.
 - d. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.
 - e. Color and Pattern: As indicated on drawings.
 - 3. Other Components Thickness: 1/2 inch, minimum.
 - 4. Exposed Edge Treatment: Built up to minimum 1-1/4 inch thick; square edge; use marine edge at sinks.
 - 5. Back and End Splashes: Same sheet material, square top; minimum 4 inches high.
 - 6. Skirts: As indicated on drawings.

2.2 MATERIALS

- A. Plywood for Supporting Substrate: PS 1 Exterior Grade, A-C veneer grade, minimum 5-ply; minimum 3/4 inch thick; join lengths using metal splines.
- B. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.

2.3 FABRICATION

- A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
 - 1. Join lengths of tops using best method recommended by manufacturer.
 - 2. Fabricate to overhang fronts and ends of cabinets 1 inch except where top butts against cabinet or wall.
 - 3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.
- B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
 - 1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
 - 2. Height: 4 inches, unless otherwise indicated.
- C. Solid Surfacing: Fabricate tops and wall panels up to 144 inches long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.
 - 1. Integral sinks: Shop-mount securely to countertop with adhesives, using flush configuration, as per manufacturer's instructions, and as detailed on drawings.
- D. Wall-Mounted Counters: Provide skirts, aprons, brackets and braces as indicated on drawings, finished to match.

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 Architect of unsatisfactory preparation before proceeding.
- C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

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. Install laboratory worksurface countertops in compliance with requirements of SEFA 2.
- B. Install vanities in accordance with manufacturer's instructions and approved shop drawings
- C. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.
- D. Seal joint between back/end splashes and vertical surfaces.

3.4 TOLERANCES

- A. Variation From Horizontal: 1/8 inch in 10 feet, maximum.
- B. Offset From Wall, Countertops: 1/8 inch maximum; 1/16 inch minimum.
- C. Field Joints: 1/8 inch wide, maximum.

3.5 CLEANING

- A. Clean countertops surfaces thoroughly.

3.6 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

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SECTION 129300 - SITE FURNISHINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes benches, picnic tables, and bicycle racks.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified.

1.3 CLOSEOUT SUBMITTALS

- A. Maintenance data.

PART 2 - PRODUCTS

2.1 BENCHES

- A. Products: Subject to compliance with requirements, provide the following:
 - 1. Kaleidoscope bench seating as supplied by Landscape Structures. Re: Plans & Details

2.2 SHADE STRUCTURE

- A. Products: Subject to compliance with requirements, provide the following:
 - 1. Skyways Cantilever Single Post Pyramid 10'x10' Shade Structure, 8' entry height by Landscape Structures, Inc. Re: Plans and Details

2.3 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

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 AWWA 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.

2.4 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.

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - 1. Run directional finishes with long dimension of each piece.
 - 2. Directional Satin Finish: No 4.
 - 3. Dull Satin Finish: No. 6.

PART 3 - EXECUTION

3.1 INSTALLATION

- 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 at locations indicated on Drawings.

END OF SECTION 129300

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SECTION 310000 - EARTHWORK

PART 1 GENERAL

1.1 DESCRIPTION

- A. Work Included: Excavation and borrow pits, removing and satisfactorily disposing of all materials taken from within work limits, dust control, including excavation for ditches and channels, inlet and outlet ditches for culverts and structures, all necessary shaping and sloping for the construction, preparation, processing soil to proper moisture content, and completion of all backfill, embankments, subgrade, shoulders, slopes and intersections, to required alignment, grade, and typical cross section shown on drawings.
- B. Related Work:
1. Site Clearing: Section 311000
 2. Site Demolition: Section 024113
 3. Erosion and Sedimentation Control: Section 312500
- C. Definitions:
1. Suitable Material: Earth fill material consisting of on-site or similar non-organic sands, gravels, clays, silts and mixtures thereof with maximum size of 6". Bedrock that breaks down to specified soil types and sizes during excavation, hauling, and placement may be considered as suitable material. Rock fill material which consists predominantly of cobbles or boulder-sized pieces of blasted or broken rock with maximum size of 12".
 2. Unsuitable Material: Any material containing vegetable or organic matter, muck, peat, excessive expansive materials, organic silt, topsoil, frozen materials, trees, stumps, certain manmade deposits, or industrial waste, sludge or landfill, or other undesirable materials.
 3. Unclassified Excavation: Any and all materials, including surface boulders, encountered during construction. Rock formations that can be removed by ripping with D-9 tractor in good repair with single tooth hydraulic ripper are considered as unclassified excavation.
 4. Rock Excavation: Rock formations which cannot be excavated without blasting. Includes removal and disposal of all rock.
 5. Backfill and Embankment: Embankments, including preparation of area upon which they are to be placed, dikes within or outside right-of-way. Placing and compacting approved material within areas where unsuitable materials have been removed. Placing and compacting of material in holes, pits and other depressions to lines and grades shown on drawings. Use only suitable materials in construction of embankments and backfills.

6. Borrow: Backfill or embankment material which must be acquired from designated borrow areas to make up deficiencies which cannot be completed from excavation within work limits. Borrow material must be agreed to by Engineer.
7. Proof Rolling: Applying test loads over subgrade surface by means of heavy pneumatic-tired roller of specified design, to locate weak areas in subgrade.

1.2 PERMITS

- A. Fugitive Dust
- B. Road Cut
- C. Stormwater Discharge Permit (CDPHE)
- D. Construction Dewatering (CDPHE)
- E. 404 Permit
- F. Access Permit (CDOT)

PART 2 PRODUCTS

2.1 FILL AND EMBANKMENT MATERIAL

Any suitable material or borrow as defined above. Free-running water shall be drained from materials before placement.

2.2 CONSTRUCTION WATER

Acceptable water shall be provided at Contractor's expense.

PART 3 EXECUTION

3.1 EXCAVATION

Unclassified Excavation: All excess or unsuitable excavated materials, including rock and boulders, that cannot be used in backfill and embankments, shall be placed in designated disposal areas or disposed of off site. Where shown on drawings or considered necessary, construct intercepting ditches above top of cut slopes and carry to outlets near ends of cuts. To blend intersection of cut slopes with slope of adjacent natural ground surfaces in uniform manner, shape tops of all cut slopes, except those in solid rock, for flattening and rounding in accordance with details shown on drawings. Treat earth overburden above solid rock cuts in same manner as earth cut. Engineer reserves the right to change cut slopes during progress of excavation. Scale all exposed rippable rock cuts of loose, potentially falling rock at Contractor's expense.

3.2 PROOF ROLLING

Proof rolling will be required to determine whether subgrade meets compaction and/or stable requirements. Proof roll designated areas with heavy rubber-tired roller approved by Engineer. Areas found to be weak or fail the test shall be repaired in accordance with recommendations by the Engineer.

3.3 SUBGRADE PREPARATION

Adjust completed subgrade from slope or grade stakes to assure surface width conforms to typical section, dimensions, lines, and grades on drawings. Compact subgrade in accordance with compaction requirements.

3.4 EMBANKMENT AND FILL CONSTRUCTION

- A. Place earth fill materials for backfill or embankment in thin horizontal layers near optimum moisture content and compact as specified before next layer is placed. Use effective spreading equipment on each lift to obtain uniform thickness prior to compacting. As compaction of each layer progresses, continuously level and manipulate to assure uniform density. Add or remove water as necessary to obtain maximum density. Place embankment in layers not greater than 12" which have been demonstrated to meet compaction standards. Occasional cobble and boulder-sized pieces of excavated rocks with sizes from 6" to 12", may be placed in earth fill if agreed to by Engineer. Space large rocks so compaction of earth fill will meet compaction requirements.
- B. When embankment is to be placed and compacted on hillsides, or when new embankment is to be compacted against existing embankments, or when embankment is built one-half width at a time, slopes which are steeper than 4:1 measured longitudinally or at right angles to roadway shall be continuously benched over as work is brought up in layers. Benching shall be well keyed into existing slopes a minimum of 8' wide. Begin each horizontal bench at intersection of original ground and sides of previous benches. Material benched shall be excavated and recompacted along with new embankment material at Contractor's expense.
- C. Rock fill embankment material consists predominantly of rock 6" to 12" in diameter placed in loose lifts up to average rock dimension. Placing of occasional boulders of sizes larger than maximum layer thickness may be agreed to by Engineer provided material is carefully placed, large stones well distributed, and voids completely filled with smaller stones, earth, sand, or gravel. Level and smooth each layer with suitable equipment, distributing soils and finer fragments of earth. Wet each loose layer as necessary to facilitate compaction prior to placing additional lifts. Embankments consisting predominantly of rock larger than 6" in greatest dimension, shall not be constructed above an elevation 2' below finished subgrade. Balance of embankment shall be composed of suitable material smoothed and placed in layers not exceeding 8" in loose thickness and compacted as specified.
- D. Remove all sod and vegetable matter from surface upon which embankment is to be placed. Completely break up cleared surface by plowing, scarifying, or stepping a minimum of 8" to insure a bond between embankment and original ground. Recompect to specifications.
- E. Frozen materials shall not be used in construction of embankments.

- F. During construction maintain area in such condition that it will be well-drained at all times.
- G. At the end of every construction day all fill areas must be flat rolled to provide proper drainage.

3.5 BORROW

Provide test pit if required by Engineer to evaluate acceptability and limits of source at Contractor's expense.

If more borrow is placed than required, amount of overrun will be deducted from borrow volume. Contractor shall notify Engineer at least 10 working days in advance of need before opening borrow area.

Strip all borrow pits of sod, topsoil, and unsuitable materials. Restore borrow area, grade and shape to provide proper drainage before placement of topsoil, to the satisfaction of the Engineer.

3.6 DISPOSAL OF MATERIALS

Remove and dispose of all waste material off site.

3.7 COMPACTION REQUIREMENTS

- A. Thoroughly scarify surface upon which embankment is to be placed to depth of 8".
- B. Compact scarified materials and embankments to following % AASHTO T99. Moisture content shall be within 2% of optimum.
 - 1. Landscaped area 90%
 - 2. Roadway 95%
 - 3. Driveways, sidewalks, hardscape 95%
 - 4. Parking lots 95%
 - 5. Public roadways 95%
 - 6. Beneath structures 100%
 - 7. Fills over 8' shall be 100%
- C. Where Engineer agrees to rock fill material embankments constructed without moisture and density control, place in loose lifts up to maximum rock dimension not exceeding 12". Apply water as necessary to facilitate compaction. Route construction equipment, compactors, or both, uniformly over each lift prior to placing additional lifts. Apply sufficient compactive effort to each lift to achieve uniform, well-compacted rock fill. Distribute rocks throughout layer, spaced far enough apart to allow compaction equipment to pass between and permit cross rolling. Place, move and compact embankment materials, and apply water to facilitate compaction and prevent voids in embankment. Number of passes required will depend on available compaction equipment to achieve compactive effort agreed to by Engineer.

3.8 DUST CONTROL

Contractor shall take appropriate measures to minimize adverse impacts caused by dust by watering exposed surfaces and haul roads and by implementing other measures.

END OF SECTION 310000

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SECTION 311000 - SITE CLEARING

PART 1 GENERAL

1.1 DESCRIPTION

- A. Work included: Clearing, grubbing, removing and disposing of all vegetation and debris within work limits and from borrow pits, and such other areas as required, except objects designated to remain or to be removed. Also includes preservation from injury or defacement of all vegetation and objects designated to remain.
- B. Related Work:
 - 1. Site Demolition: Section 024113
 - 2. Earthwork: Section 310000
 - 3. Erosion and Sedimentation Control: Section 312500

1.2 PERMITS

- A. Fugitive Dust
- B. Stormwater Discharge Permit (CDPHE)
- C. Construction Dewatering (CDPHE)
- D. 404 Permit

1.3 JOB CONDITIONS

Protection: Protect trees, shrubs and planted areas to remain from damage or from unnecessary vehicular traffic, in manner acceptable to Owner and Engineer. Protect bench marks, staking, existing structures, roads, sidewalks, paving, and curbs from damage. Maintain designated temporary roadways, walkways, and detours. Burning is not permitted.

PART 2 NONE

PART 3 EXECUTION

3.1 CLEARING

- A. Clear and/or grub all surface objects and all trees, stumps, roots, bushes and other protruding obstructions, not designated to remain.

3.2 DISPOSAL

Deposit all waste material in designated waste areas. Grade and shape disposal site to satisfaction of Engineer. Where disposal sites are not designated, remove and dispose of all waste materials off site.

END OF SECTION 311000

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SECTION 31 22 19 - TOPSOIL

PART 1 - GENERAL

- 1.1 RELATED DOCUMENTS: The General Contract Conditions, Drawings and Division - 1 Specification sections apply to Work of this section.
- 1.2 SUMMARY:
 - A. Work Includes: Furnishing, stockpiling and placing topsoil on a previously prepared subgrade.
 - B. Related Sections:
 - 1. Division 31 Section 21 20 00 "Earth Moving"
 - 2. Division 32 Section 32 91 13 "Soil Preparation"
 - 3. Division 32 Section 32 92 20 "Native Seeding"
 - 4. Division 32 Section 32 93 00 "Plants"
 - 5. Division 32 Section 32 92 23 "Sodding"
- 1.3 QUALITY CONTROL: Submit soil analysis report for on-site and imported topsoil from the State University Agricultural Extension Service or other approved soil testing laboratory according to specifications outlined in Section 32 91 13 – Soil Preparation. Testing will be at the expense of the Contractor.
- 1.4 DELIVERY, STORAGE AND HANDLING: Do not deliver or place topsoil in a frozen, wet, or muddy condition.

PART 2 - MATERIALS

- 2.1 ON-SITE TOPSOIL: Topsoil previously stripped and stockpiled prior to earthwork operations.
- 2.2 IMPORTED TOPSOIL: All topsoil shall be a loam or sandy clay loam. At least ten (10) days prior to topsoil delivery, notify Project Manager of the source(s) from which topsoil is to be furnished, accompanied by a soil testing analysis/report. Topsoil shall be furnished by the Contractor and shall be a natural, friable soil representative of productive soils and shall meet the following conditions;
 - A. Imported topsoil shall be certified weed free and pest free.
 - B. It shall be obtained from the top twelve inches (12") of well drained areas.
 - C. Fertile, friable, loamy soil, reasonably free from subsoil, refuse, roots, heavy or stiff clay, stones larger than one inch (1"), coarse sand, noxious weed seed, sod, sticks, brush, litter, and other deleterious substances; suitable for the germination of seeds and the support of vegetative growth. The PH value shall be between 6.0 and 8.0.

- D. Soil Texture: Sand, thirty to fifty percent (30% - 50%); silt, thirty to fifty percent (30% - 50%) percent; clay, fifteen to thirty-five percent (15% - 35%).
- E. Additives: As determined by soil fertility tests.
- F. Percent Organic Content: two point nine percent (2.9%) minimum five percent (5%) maximum.
- G. Soluble Salts: Electric conductivity shall be less than three point three (3.3) mmhos/cm for dryland areas and less than five (5.0) mmhos/cm for irrigated lands.

PART 3 - EXECUTION

3.1 PLACING TOPSOIL:

- A. Rip or scarify compacted subgrade to a 12" inch depth to bond topsoil to subsoil. Place topsoil to a minimum depth of 6" inches after settlement.
- B. Topsoil shall be spread evenly and graded to elevations and slopes shown on drawings. Hand rake areas inaccessible to machine grading.
- C. Utilize topsoil salvaged from on site as the top layer to the extent available. If sufficient on-site material is not available, the Contractor shall furnish and install imported topsoil in the manner described above. Topsoil shall mixed thoroughly with the salvaged topsoil prior to placement and amended after placement.

END OF SECTION 31 22 19

SECTION 312319 - DEWATERING

PART 1 GENERAL

1.1 SUMMARY

- A. Provide dewatering including, but not limited to:
 - 1. Lowering and controlling groundwater levels during excavation and construction.
 - 2. Control of hydrostatic pressures during excavation and construction.
 - 3. Control of surface and subsurface water, ice, and snow related to dewatering.
 - 4. Standby equipment for system back-up.
 - 5. Establishment and monitoring of observation wells.
 - 6. Legal disposal of water removed from excavations.
 - 7. Removal of observation wells when no longer required.

1.2 SUBMITTALS

- A. Submit the dewatering plan, layout, observation well reports.

1.3 QUALITY ASSURANCE

- A. Comply with governing codes and regulations. Use experienced workers.

PART 2 PRODUCTS – Not Applicable To This Section

PART 3 EXECUTION

3.1 OBSERVATION WELLS

- A. Provide, take measurements and maintain observation wells indicated and additional observation wells as may be required by governing authorities.
- B. Remove observation wells when dewatering is completed.

3.2 DEWATERING

- A. Provide a system to lower and control groundwater in order to permit construction activities. Install sufficient dewatering equipment to drain water-bearing strata above and below bottom of foundations, drains, and other excavations.
- B. Operate dewatering system continuously until dewatering is no longer required. Dispose of water removed from excavation in a manner to avoid endangering public health, property, and portions of work under construction or completed. Provide flow control devices as required by governing authorities.

END OF SECTION 312319

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SECTION 312500 - EROSION AND SEDIMENTATION CONTROL

PART 1 GENERAL

1.1 DESCRIPTION

- A. Work Included: Excavation, grading, and installation and maintenance of riprap, stabilized construction entrances, sediment ponds, filter material, erosion control blanket, straw bale sediment barriers, silt fences, wattles, and all necessary appurtenances. Includes removal of temporary erosion and sediment control devices after site is stabilized.
- B. Related Work:
1. Site clearing: Section 311000
 2. Earthwork: Section 310000
 3. Storm Drainage: Section 334000

1.2 SUBMITTALS

- A. Test Reports: If requested, furnish copies of tests from certified and acceptable testing laboratory
1. Gradation and Soundness of Riprap.
 2. Gradation of Filter Material.

1.3 PERMITS

- A. Construction Dewatering (CDPHE)
- B. Stormwater Discharge Permit (CDPHE)

PART 2 PRODUCTS

2.1 RIPRAP

Hard, dense, sound, angular rough fractured stone meeting AASHTO T 85. Excavated shot rock may be used if agreed to by the Owner's representative and the Engineer. Neither breadth nor thickness of single stone to be less than one-third its length.

Nominal Size	Min. Volume	Min. Weight
9"	0.25 CF	30 lbs.
12"	0.5 CF	75 lbs.
18"	1.8 CF	250 lbs.
24"	4 CF	600 lbs.

Size of stone and total thickness of riprap as shown on drawings. Stone well graded so voids can be filled, and at least 50% of mass equal to or larger than size called for on drawings.

2.2 FILTER MATERIAL

Aggregate Filter: Conform to following gradation:

Sieve Size	Percentage by Weight Passing Square Mesh Sieves
3"	100
3/4"	20-90
No. 4	0-20
No. 200	0-3

2.3 FILTER FABRIC

Manufactured especially for stability of erosion control construction. Made from polyethylene and polypropylene yarns, in accordance with following:

Weight	4.0 oz/yd	ASTM D1910
Thickness	15 mils	ASTM D1777
Grab Strength	130 lbs.	ASTM D1682
Elongation Break	62%	ASTM D1682
Burst Strength	125 psi	ASTM D7742
Trapezoid Tear Strength	70 lb.	ASTM 2263
Water Permeability	0.02 cm/se	CFMC
Water Flow Rate	4.80 gal/min/ft	CFMC
Equivalent Opening Size	70-100 U.S. Sieve	ASTM D422

2.4 EROSION CONTROL BLANKETS AND TURF REINFORCEMENT MATS

A. Install Landlok 450 TRM, C2 Fabric or as shown on plans

2.5 EROSION LOGS

Erosion logs shall be curled aspen wood excelsior with a consistent width of fibers evenly distributed throughout the log. The casing shall be seamless, photodegradable tube netting and shall have minimum dimensions as shown below, based on the diameter of the log called for in the plans. The curled aspen wood excelsior shall be fungus free, resin free and shall be free of growth or germination inhibiting substances.

Nominal Dimensions of Erosion Logs

Diameter	Length	Weight (min.)	Stake Dimensions
9 inch	10 feet	1.4 lbs/ft	1.5 by 1.5 by 20 inches
12 inch	10 feet	2.5 lbs/ft	1.5 by 1.5 by 24 inches
18 inch	10 feet	3.5 lbs/ft	1.5 by 1.5 by 30 inches

2.6 DANDY SACK

A. The Dandy Sack™ inlet protection unit shall be a sewn in the U.S.A. geotextile fabric unit.

- B. The Dandy Sack™ shall have lifting straps to allow removal of the unit and manual inspection of the storm water system.
- C. The Dandy Sack™ unit shall utilize an orange monofilament fabric that is manufactured in the U.S.A. with the following characteristics:

PROPERTY	TEST METHOD	UNITS	MARV
Grab Tensile Strength	ASTM D 4632	kN (lbs)	1.62 (365) x 0.89 (200)
Grab Tensile Elongation	ASTM D 4632	%	24 x 10
Puncture Strength	ASTM D 4833	kN (lbs)	0.44 (100)
Mullen Burst Strength	ASTM D 3786	kPa (psi)	3097 (450)
Trapezoid Tear Strength	ASTM D 4533	kN (lbs)	0.51 (115) x 0.33 (75)
% Open Area	COE - 22125-86	%	10
Apparent Opening Size	ASTM D 4751	mm (US Std Sieve)	0.425 (40)
Permittivity	ASTM D 4491	sec ¹	2.14
Permeability	ASTM 4491	cm/sec	0.142
Water Flow Rate	ASTM 4491	l/min/m ² (gal/min/ft ²)	5607 (145)
Ultraviolet Resistance	ASTM D 4355	%	70
Color			Orange ¹

¹The color orange is a trademark of Dandy Products, Inc.

2.7 DANDY CURB SACK

- A. The Dandy Curb Sack™ curb and gutter inlet protection unit shall be a sewn geotextile fabric unit made in the U.S.A. enclosing a porous structure in the form of a cylindrical tub placed in front and extending beyond the inlet opening on both sides and have a geotextile fabric sack attached designed to fit the opening of the catch basin or drop inlet and to hang underneath the grate and into the catch basin.
- B. The Dandy Curb Sack™ shall have lifting straps to allow removal of the unit and manual inspection of the storm water system.
- C. The Dandy Curb Sack™ unit shall utilize an orange monofilament fabric that is manufactured in the U.S.A with the following characteristics:

PROPERTY	TEST METHOD	UNITS	MARV
Grab Tensile Strength	ASTM D 4632	kN (lbs)	1.62 (365) x 0.89 (200)
Grab Tensile Elongation	ASTM D 4632	%	24 x 10
Puncture Strength	ASTM D 4833	kN (lbs)	0.44 (100)
Mullen Burst Strength	ASTM D 3786	kPa (psi)	3097 (450)
Trapezoid Tear Strength	ASTM D 4533	kN (lbs)	0.51 (115) x 0.33 (75)
% Open Area	COE - 22125-86	%	10
Apparent Opening Size	ASTM D 4751	mm (US Std Sieve)	0.425 (40)
Permittivity	ASTM D 4491	sec ¹	2.14
Permeability	ASTM 4491	cm/sec	0.142
Water Flow Rate	ASTM 4491	l/min/m ² (gal/min/ft ²)	5607 (145)
Ultraviolet Resistance	ASTM D 4355	%	70
Color			Orange ¹

¹The color orange is a trademark of Dandy Products, Inc.

2.8 SILT FENCE

- A. Silt Fence Fabric: The fabric shall meet the following specifications:

<u>Fabric Properties</u>	<u>Minimum Acceptable Value</u>	<u>Test Method</u>
Grab Tensile Strength (lbs)	90	ASTM D1682
Elongation at Failure (%)	50	ASTM D1682
Mullen Burst Strength (PSI)	190	ASTM D3786
Puncture Strength (lbs)	40	ASTMD751(modified)
Slurry Flow Rate (gal/min/sf)	0.3	
Equivalent Opening Size	40-80	USStdSieveCW-2215
Ultraviolet Radiation Stability %	90	ASTM-G-26

- B. Fence Posts (for fabricated units): The length shall be a minimum of 36 inches long. Wood posts will be of sound quality hardwood with a minimum cross sectional area of 3.0 square inches. Steel posts will be standard T and U section weighing not less than 1.00 pound per linear foot.
- C. Wire Fence (for fabricated units): Wire fencing shall be a minimum 14-1/4 gage with a maximum 6" mesh opening, or as approved.
- D. Prefabricated Units: Envirofence or approved equal may be used in lieu of the above wire fence providing the unit is installed per manufacturer's instructions.

PART 3 EXECUTION

3.1 FILTER FABRIC

Place fabric over shaped surface loosely where, when large stones are placed, they will not cause stretching of fabric beyond elastic limits. Overlap joining sections 2' at edges. Secure overlapped edges to subgrade with cinch pins. If riprap is dropped, place aggregate bedding 2" thick over fabric. Place riprap in a manner that fabric will not be damaged by stretching, punching, or ripping.

3.2 RIPRAP

- A. Angular reasonably well-graded from smallest to maximum size specified. Stones smaller than 10% of smallest size not permitted. Control gradation of riprap by visual inspection to assure thickness of riprap conforms with drawings.
- B. Hand Placed: Rectangular to facilitate butt placement. Fill openings with loose, well-graded road aggregate base material.

3.3 FILTER MATERIAL

Wet subgrade, reasonably shape, and compact prior to placing filter material. Filter material may be backdragged with loader bucket to a reasonably smooth surface for placement to lines and grades of drawings.

3.4 WATER BARS/INTERCEPTOR TRENCHES

Construct ditch in accordance with drawings. Flow line of water bar not steeper than 1%. Discharge on existing vegetated slopes alternately to avoid erosion.

3.5 STRAW BALE SEDIMENT BARRIER

Use straw bale barriers at storm drain inlets, across minor swales and ditches, and other applications where barrier is of temporary nature. Bind straw bales with nylon or baling wire, not twine. Anchor bales to ground with two posts per bale.

3.6 EROSION CONTROL BLANKETS AND TURF REINFORCEMENT MATS

A. Site Preparation

1. Grade and compact area of installation and remove all rocks, clods, vegetation or other obstructions so that the installed blanket/mat will have direct contact with soil surface.
2. Prepare seedbed by loosening 2-3 in (50-75mm) of topsoil above final grade.
3. Incorporate fertilizer into soil.
4. Do not mulch areas where mat is to be placed

B. Seeding

1. Apply seed to the soil surface before installing blanket/mat, or after installation (TRM only) for enhanced performance (preferable)
2. When seeding prior to installation, all check slots and other areas disturbed must also be reseeded.
3. When using a TRM and soil filling, seed TRM and entire disturbed area after installation, prior to filling mat with soil.

C. Installation on Banks and Slopes

1. Extended blanket/mat 2-3 ft (600-900mm) over crest of slope and excavate a 12x6 in (300x150mm) terminal anchor trench.
2. Anchor blanket/mat in trench on 1 ft (300mm) spacings, backfill and compact soil.
3. Unroll blanket/mat down slope with small netting on bottom, large netting on top.
4. Overlap adjacent rolls at least 3 in (75mm), and anchor every 18 in (450mm) minimum across the overlap. The higher elevation blanket/mat should be placed over the lower blanket/mat.
5. Overlap blanket/mat edges approximately 2 in (50mm) and staple according to anchor pattern guide. Make sure that edge overlaps are shingled away from prevailing winds.
6. Lay blanket/mat loose to maintain direct contact with soil. (Do not pull blanket/mat taut. This may allow bridging of soil surface.)
7. Secure blanket/mat to ground surface using U-shaped wire staples (preferred) or geotextile pins.

8. Refer to manufacturer's recommendation for appropriate number and pattern of anchors.
9. Place outer edge of blanket/mat in previously excavated longitudinal slots, anchor using prescribed staple pattern, backfill and compact soil.
10. Anchor, backfill and compact upstream end of blanket/mat in a 12x6 in (300x150mm) terminal trench.
11. Secure blanket/mat to ground surface using U-shaped wire staples(preferred) or geotextile pins.
12. When using a TRM, seed and fill with soil for enhanced performance.
13. When using a TRM with a geotextile attached. Always seed after installing mat, then fill with soil.

D. Installation in Storm Water Channels

1. Excavate an initial anchor trench 12 in (300mm) deep and 6 in (150mm) wide across the channel at the lower end of the project area.
2. Construct check slots along the channel in the following manner: Excavate intermittent check slots 6 in (150mm) deep and 6 in (150mm) wide across the channel at 30 ft (9.1m) intervals.
3. Cut longitudinal channel anchor slots 4 in (100mm) deep and 4 in (100mm) wide along both sides of the installation to bury edges of blanket/mat. Whenever possible extend mat 2-3 ft (600-900 mm) above crest of channel side slopes.
4. Beginning at the center if downstream end of the channel, place the end of the first roll in the anchor trench and secure with fastening devices at 1 ft (300mm) intervals. Note: blanket/mat will initially be upside down in anchor trench; smaller netting on top.
5. In same manner, position adjacent rolls in anchor trench. Overlapping the preceding roll minimum of 3 in (75mm).
6. Again, staple at 1 ft (300mm) intervals, backfill and compact soil.
7. Unroll blanket/mat over the compacted trench with smaller netting on bottom, large netting on top. Stop at next check slot or terminal anchor trench.
8. Unroll adjacent rolls upstream in order to maintain a minimum 3 in (75mm) overlap. Anchor every 18 in (450mm) minimum across the overlap.
9. Fold and secure blanket/mat rolls snugly into intermittent check slots. Lay blanket/mat in the bottom and fold back against itself. Anchor through both layers of blanket or mat at 1 ft(300mm) intervals then backfill and compact soil. Continue rolling upstream over the compacted slot to the next check slot of terminal anchor trench.
10. Overlap roll ends a minimum of 1ft (300mm) with upstream blanket/mat on top. Begin all new rolls in a check slot. Anchor overlapped area by placing two rows of anchors, 1 ft (300mm) apart on 1ft (300mm) intervals.

E. Soil Filling

1. If specified, soil filling is recommended for optimum performance.
2. After seeding, spread and lightly rake $\frac{1}{2}$ - $\frac{3}{4}$ in (12-19mm) of fine topsoil into the TRM and completely fill the voids. Use backside of rake or other flat tool.
3. If equipment must operate on the TRM, make sure it is of the rubber-tired type. No tracked equipment or sharp turns are allowed on the mat.

4. Avoid any traffic over TRM if loose or wet soil conditions exist.
5. Use shovels, rakes or brooms for fine grading and finishing.
6. Smooth soils fill in order to just expose the top netting of matrix. Do not place excessive soil above the mat.
7. Broadcast additional seed and mulch above the soil-filled TRM.
8. Water as necessary to enhance growth.
9. Consult manufacturer's technical representative or local distributor for installation assistance. Particularly if unique conditions apply (i.e. fine sandy soils, infertile environment)

3.7 EROSION LOGS

The Contractor shall maintain the erosion logs during construction to prevent sediment from passing over or under the logs or from sediment accumulation greater than two thirds of the original exposed height of each erosion log.

Erosion logs shall be embedded 2-inches into the soil.

Stakes shall be embedded to a minimum depth of 12 inches. At the discretion of the Engineer, a shallower depth may be permitted if rock is encountered.

3.8 DANDY SACK

- A. Remove the grate from the catch basin.
- B. *For Oil and Sediment Model; to install or replace absorbent, place absorbent pillow in unit, on the bottom (below-grade side) of the unit.*
- C. Stand the grate on end. Move the top lifting straps out of the way and place the grate into the Dandy Sack™ unit so that the grate is below the top straps and above the lower straps. The grate should be cradled between the upper and lower straps.
- D. Holding the lifting devices, insert the grate into the inlet, being careful that the grate remains in place and being careful not to damage the Dandy Sack™ unit.
- E. Remove all accumulated sediment and debris from vicinity of unit after each storm event.
- F. After each storm event and at regular intervals, look into the Dandy Sack™ unit. If the unit is more than 1/3 full of accumulated sediment, the unit must be emptied.
- G. To empty the unit, using the lifting straps lift the unit out of the inlet and remove the grate. Transport the unit to an appropriate location for removal of the contents. Holding the dumping straps on the outside at the bottom of the unit, turn the unit upside down, emptying the contents. Reinstall unit as above.
- H. *For Oil and Sediment Model; remove and replace absorbent when near saturation.*

- I. Dispose of unit and/or absorbent in accord with applicable Federal, state and local environmental laws and regulations.

3.9 DANDY CURB SACK

- A. Remove the grate from the catch basin.
- B. *For Oil and Sediment Model; to install or replace absorbent, place absorbent pillow in unit, on the bottom (below-grade side) of the unit.*
- C. Stand the grate on end. Move the top lifting straps out of the way and place the grate into the Dandy Curb Sack™ unit so that the grate is below the top straps and above the lower straps. The grate should be cradled between the upper and lower straps.
- D. Holding the lifting devices, insert the grate into the inlet, then lower back edge with cylindrical tube into place, being careful that the grate remains in place and being careful not to damage the Dandy Curb Sack™ unit. The cylindrical tube should partially block the curb hood opening when installed properly.
- E. Remove all accumulated sediment and debris from vicinity of unit after each storm event.
- F. After each storm event and at regular intervals, look into the Dandy Curb Sack™ unit. If the unit is more than 1/3 full of accumulated sediment, the unit must be emptied.
- G. To empty the unit, using the lifting straps lift the unit out of the inlet and remove the grate. Transport the unit to an appropriate location for removal of the contents. Holding the dumping straps on the outside at the bottom of the unit, turn the unit upside down, emptying the contents. Reinstall unit as above.
- H. *For Oil and Sediment Model; remove and replace absorbent when near saturation.*
- I. Dispose of unit and/or absorbent in accord with applicable Federal, state and local environmental laws and regulations.

3.10 CHECK DAMS

Install bottom of check dam at least 6" below maximum depth of newly graded channel. Extend to 6" above maximum design water depth. Install materials in accordance with drawings.

3.11 SEDIMENT POND/TRAP

- A. Construct pond per plans and as directed by Engineer.
- B. The area under embankment shall be cleared, grubbed and stripped of any vegetation and root mat. The pool area shall be cleared.

- C. The fill material for the embankment shall be free of roots or other woody vegetation as well as over-sized stones, rocks, organic material or other objectionable material. The embankment shall be compacted by traversing with equipment while it is being constructed. Maximum height of embankment shall be 4' measured at centerline of embankment.
- D. All cut and fill slopes shall be 2:1 or flatter.
- E. Geotextile Class C shall be placed over riser. Fabric shall be embedded at least 6" into existing ground at bottom of pond.
- F. Outlet – An outlet shall include a means of conveying the discharge in a erosion free manner to an existing stable channel. Protection against scour at the discharge point shall be provided as necessary.
- G. Outlet channel must have positive drainage from the trap.
- H. Sediment shall be removed and trap restored to its original dimensions when the sediment has accumulated to $\frac{1}{2}$ of the wet storage depth of the trap (900 cf/ac). Removed sediment shall be deposited in a suitable area and in such a manner that it will not erode.
- I. The structure shall be inspected periodically after each rain and repaired as needed.
- J. Construction of traps shall be carried out in such a manner that sediment pollution is abated. Points of concentrated inflow shall be protected.
- K. The structure shall be dewatered by approved methods, removed and the area stabilized when the drainage area has been properly stabilized.

3.12 SILT FENCE

Install silt fence in accordance with drawings.

END OF SECTION 312500

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PART 1 GENERAL

1.1 DESCRIPTION

- A. Work included: Preparing surface of subgrade immediately prior to paving including proofrolling, repair of areas showing excess deflection during proofrolling and furnishing and placing one or more courses of aggregate in conformance with lines, grades, and typical sections shown on drawings.
- B. Related Work:
1. Earthwork: Section 310000

1.2 SUBMITTALS

- A. Test Reports: If requested, furnish proposed source of materials and copies of tests from certified and acceptable testing laboratory:
1. Sieve analysis - ASTM C136
 2. Wear Abrasion - ASTM C131
 3. Liquid Limit - AASHTO T89, T90
 4. Moisture Density Curves - AASHTO T99

PART 2 PRODUCTS

2.1 AGGREGATE

- A. Aggregate shall conform to following gradation:

Sieve Size	Percentage by Weight Passing square Mesh Sieves			
	Class 2	Class 4	Class 5	Class 6
4"	100	-	-	-
3"	95-100	-	-	-
2"	-	100	-	-
1-1/2"	-	90-100	-	-
1"	-	-	100	-
3/4"	-	50-90	-	100
No. 4	-	30-50	30-70	30-65
No. 8	-	-	-	25-55
No. 200	3-15	3-12	3-15	3-12

Liquid limit not greater than 35 for Class 2; 30 for Class 4, 5, or 6.
Plasticity Index not exceeding 6.

- B. Requirements for this Project:
Furnish Class 6 aggregate for this Project.

PART 3 EXECUTION

3.1 PREPARATION

- A. Staking: Contractor shall provide slope stakes every 50 foot station. Contractor will provide at his expense all additional staking necessary to ensure work conforms with drawings.
- B. Subgrade Preparation: Shape and compact to crown, line, grades, and typical cross section shown on drawings before placing base material. Compact to 95% AASHTO T99.
- C. Shortly before placement of surfacing, the exposed subgrade soils should be scarified and compacted to a minimum depth of at least 8 to 12 inches, mixed to achieve a uniform moisture content at moisture contents within 2 percent of optimum, and then recompact to 95 percent of the standard Proctor density (ASTM D698). Subgrade preparation should extend the full width of the surfaced areas and at least 3 feet beyond the edges.

3.2 MIXING

The Contractor shall mix the aggregate by methods that insure a thorough and homogeneous mixture.

3.3 PLACEMENT

If required compacted depth of aggregate base course exceeds 6", construct in two or more layers of approximately equal thickness. Maximum compacted thickness of any one layer shall not exceed 6". When vibratory or other approved types of special compacting equipment are used, compacted depth of single layer may be increased to 8" upon approval of Engineer.

3.4 SHAPING AND COMPACTION

Compact each layer to 95% AASHTO T99. Maintain surface of each layer during compaction so that uniform texture is produced and aggregates are firmly keyed. Apply water uniformly during compaction so moisture content is within 2% of optimum.

END OF SECTION 321100

SECTION 321200 - FLEXIBLE PAVEMENT

PART 1 GENERAL

1.1 DESCRIPTION

- A. Work Included: Furnishing, laying, and compacting hot-mixed asphaltic concrete pavement in conformance with lines, grades, and typical cross-sections shown on the drawings.
- B. Related Work:
 - 1. Unbound Base Course: Section 321100

1.2 QUALITY ASSURANCE

- A. Source: Engineer shall have access to batching plant at all times work is in progress.
- B. Record of Work: Contractor shall keep record of time and date of placement, temperature, and weather conditions. Retain until completion and furnish copy to Engineer.
- C. Owner will arrange and pay for all field tests to determine compliance of base course and pavement materials and compaction with the specification and the approved design mix formula.

1.3 SUBMITTALS

- A. Samples: If requested, provide samples of proposed materials.
- B. Test Reports: If requested, furnish copies of tests from certified and acceptable testing laboratory:
 - 1. Aggregate - AASHTO T96, CP-45, AASHTO T304, AASHTO T176, AASHTO T89, AASHTO T90
 - 2. PG Graded Binders, use PG 58-34 - AASHTO T48, TP48, TP5 AND ASTM D113
 - 3. Liquid Asphalt - AASHTO M81, M82; ASTM D2026
 - 4. Emulsified Asphalt - AASHTO M140 or M208
 - 5. Compaction – Colorado Procedure 51, CP44 or CP81
- C. Job Mix Formula: The Contractor shall submit the following to the Engineer.
 - 1. A proposed job – mix gradation as required by the contract, which shall be wholly within the Master Range Table of Table 703–4 of the CDOT Standard Specifications for Road and Bridge Construction (CDOT Specifications) before the tolerances shown in Table 401–1, of the CDOT Specifications, are applied.

The job–mix formula shall establish a single percentage of aggregate passing each required sieve size. A single percentage of bituminous material to be added to the aggregate and a single temperature for the mixture at the discharge point of the plant.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Trucks used for hauling bituminous mixtures shall have tight, clean, smooth metal beds thinly coated with a minimum amount of paraffin oil, lime solution, or other approved release agent. Petroleum distillates such as kerosene or fuel oil will not be permitted. Each truck shall have a cover of canvas or other suitable material to protect the mixture from the weather.

1.5 JOB CONDITIONS

- A. Weather Limitations: Bituminous plant mix shall be placed only on properly constructed surfaces that are free from water, snow, or ice. The bituminous mixtures shall be placed in accordance with the temperature limitations of Table 401-3 "of the CDOT Standard Specifications for Road and Bridge Construction" and only when weather conditions permit the pavement to be properly placed and finished, as determined by the Engineer.
- B. Protection: After final rolling, do not permit vehicular traffic on asphaltic concrete pavement until cooled and hardened. Provide barricades, flagmen, and warning devices as required to protect pavement. Maintain pedestrian and vehicular traffic as required. Cover openings of structures in paving until permanent coverings are placed.
- C. Confirm in writing, aggregate base course constructed by others has been compacted to requirements of these specifications. Use any means necessary to proof roll or test to confirm aggregate base is satisfactory to receive asphaltic concrete. Notify in writing to Owner any deficient areas so they may be brought into conformance with specifications prior to placement of asphaltic concrete.

PART 2 - PRODUCTS

2.1 AGGREGATE

Clean, hard, durable particles of crushed stone, crushed gravel, natural gravel, or crushed slag with not more than 45% of wear, AASHTO T96.

<u>Sieve</u>	Percentage by Weight Passing Square Mesh Sieves
	<u>Grading</u>
	SX
1-1/2"	-
1"	-
3/4"	100
1/2"	90-100
3/8"	-
#4	-

#8	28-58
#30	-
#200	2-10

Use Grading SX for this project.

2.2 ASPHALTIC CEMENT

- A. Viscosity Graded Asphalt Cement conforming to the requirements of AASHTO M226, Table 2.
- B. Superpave Performance Graded Binders shall conform to AASHTO Provisional Standard MP1 for PG 58-34 Performance Graded Binders

2.3 TACK COAT

One of the following, grade and type as recommended by supplier:

- A. Emulsified asphalt, AASHTO M140
- B. Cationic emulsified asphalt, AASHTO M208

2.5 MIX DESIGN

- A. Use Grading SX, 75 Design Gyration, PG 58-34 Binder.
 - 1. Job – Mix Formula as defined in the Submittal Section (321200–1, Part 1.03 C).
- B. Furnish aggregate gradation.
- C. Accepted design mix shall meet compaction requirements of these specifications.

2.6 MIXING

- A. General: Comply with ASTM D995 for material storage, control, mixing, and plant equipment and operation.
- B. Aggregates: Keep each component of various-sized combined aggregates in separate stockpiles. Maintain so separate aggregate sizes will not be intermixed and to prevent segregation. Heat-dry aggregates to reduce moisture content to not more than 2%. Deliver dry aggregate to mixer at recommended temperature to suit penetration, grade, and viscosity characteristics of asphaltic cement, ambient temperature, and workability of mixture.
- C. Asphaltic Cement: Heat bitumen to viscosity at which it can be uniformly distributed throughout mixture. Select temperature range of 275 degrees F to 350 degrees F to suit temperature - viscosity characteristics of asphalt. Do not exceed 350 degrees F.

- D. Mixing: Accurately weigh or measure dry aggregates and weigh or meter asphaltic cement to comply with job-mix formula requirements. Mix aggregate and asphaltic cement to achieve 95% minimum coated particles for base mixtures in accordance with AASHTO T195 and 85-90% coated particles for surface mixtures when tested in accordance with ASTM D2489.
- E. The minimum temperature of the mixture when discharged from the mixer and when delivered for use shall be as shown:

Asphalt Grade	Minimum Mix Discharge Temperature, °F ¹	Minimum Delivered Mix Temperature, °F ²
PG 58-28	275	235
PG 64-28	320	280
PG 70-28	320	280
PG 58-34	300	280

¹ The maximum mix discharge temperature shall not exceed the minimum discharge temperature by more than 30° F.

² Delivered mix temperature shall be measured behind the paver screed.

Hot mix asphalt mixture shall be produced at the lowest temperature within the specified temperature range that produces a workable mix and provides for uniform coating of aggregates (95 percent minimum in accordance with AASHTO T195), and that allows the required compaction to be achieved.

Storing or holding of asphalt mixture will be permitted provided the characteristics of the mixture are not altered. If storing or holding of the mixture causes segregation, excessive heat loss, or adversely affects the quality of the finished product, corrective action shall be taken. Unsuitable mixture shall be disposed of at the Contractor's expense.

PART 3 EXECUTION

3.1 PREPARATION OF SURFACES

- A. Base Course: Blade, shape, and smooth aggregate base course to uniform section in accordance with the technical specification for Unbound Base Course Section 321100. Remove loose materials. Clean the surface to be paved by mechanical sweepers, blowers, or hand brooms, until surface is free from dust. Hot mixed asphalt shall be placed only on properly prepared unfrozen surfaces which are free of water, snow, and ice.
- B. Existing Surfaces: Clean of all foreign materials. Fill holes and low places with levelling courses and compact prior to surface placement. Tack coat existing surfacing at 0.1 gallon per square yard (undiluted). Apply only to areas on which surfacing is to be placed immediately. Do not extend more than 2000' ahead of paving equipment. Prevent traffic from traveling on tack coat.

3.2 FRAME ADJUSTMENTS

Set frames of structures to final grade. Place compacted asphaltic concrete to top of frame. If permanent covers are not in place, provide temporary covers over openings until compaction is complete. Where frames and covers are paved over, mark so crews can find on emergency basis until cut out and adjusted to final surfacing.

3.3 SPREADING AND FINISHING

- A. Place at temperatures of not less than 275 degrees F, or more than 305 degrees F. If temperature is below 50 degrees F and falling, asphaltic concrete mix shall not be less than 300 degrees F, while on trucks just prior to laydown. Mechanical, self-powered pavers shall be capable of spreading mix within specified tolerances, true to line, grade, and crown as indicated on drawings. Road grader equipped with automatic blade control may be used for levelling courses. Pavers shall be equipped with hoppers and distribution screws which place mix evenly in front of adjustable screeds. Screed shall be adjustable for height and crown, equipped with controlled heating device for use as required. Screed shall strike off mix without tearing, shaving or gouging surface, to depth and cross-section specified, without aid of manual adjustment during operation. Paver shall be capable of placing courses in thicknesses from 1/2" to 4" and from widths of 8' to 15'. Extensions and cut-off shall permit changes in widths by increments of 6".
- B. Strike finish surface smooth; true to cross section; uniform in density and texture; free from hollows, transverse corrugations, and other irregularities. Paint contact surfaces between gutters, manhole rings, catch basins, and other similar structures with thin, uniform coating of tack coat. Final surface shall be 1/4" above all structures and gutters sloping away from paving, flush with gutters sloping towards paving.
- C. Hand Placement: Where certain areas because of irregularity, inaccessibility, or unavoidable obstacles, do not lend themselves to machine placement, Engineer may agree to hand placement. Spread and compact to same finish and compaction tolerances of these specifications.
- D. Joints: Make joints between old and new pavement, or between successive day's work, to insure thorough bond between old and new surfaces. Clean surfaces free of sand, dirt, dust, or other materials, and apply tack coat. Construction joints must have same texture, density, and smoothness tolerances as other surfacing.
 - 1. Construct transverse joints to existing material by cutting material back to expose full depth edge. Paint thin uniform tack coat on joint and place new asphaltic concrete.
 - 2. In every pavement layer the longitudinal joints shall not be constructed in the wheel paths. Prepare longitudinal joints by overlapping screed 1" on existing surface. Deposit sufficient material to complete joint. Push excess by hand rake 1/2" on new mat leaving vertical uncompacted face approximately 1" high. Compact against joint by rolling equipment. No depression allowed exceeding 1/8" for width of 6", after final compaction.

- E. Finish Tolerance: Place levelling courses within 1/2" of design grade. Finished surfaces will be tested with 10' straight edge, parallel to center line at location of wheel paths for each lane. Straight edge will be advanced 5' and space under straight edge shall not exceed 1/4". Correct areas deficient in smoothness by completely removing surface material and replacing. Overlay corrections may be made only if approved by Owner.
- F. Thickness Tolerance: Compacted thickness shall be no less than that shown on drawings. Any surfacing which does not meet minimum thickness shall be removed and replaced.
- G. Segregated areas in the top lift shall be removed and replaced, full lane width, at the Contractor's expense.

3.4 COMPACTION

- A. General: Provide rollers to obtain required density, surface texture, and rideability. Begin rolling operations immediately following placement of asphaltic concrete. Do not permit heavy equipment, rollers, etc. to stand on finished surface where deformation may occur. End each pass of roller in different place.
- B. Rollers
 - 1. Steel-wheel rollers self-propelled, developing contact pressure under compression wheels of 250 to 350 psi per inch of width of roller wheel. Rollers equipped with adjustable scrapers and means for keeping wheel wet to prevent mix from sticking.
 - 2. Pneumatic-tired rollers self-propelled, developing contact pressure under each tire of 85 to 110 psi. Wheels so spaced that one pass will accomplish one complete coverage equal to rolling width of machine. Wheels oscillate but not wobble. Remove and replace immediately any tires picking up fines.
- C. Compaction Procedures
 - 1. Compact longitudinal joints and edges first, starting at outside edge and gradually progress towards center of pavement. Begin superelevated curves rolling on low side on previously transversely compacted material. Successive passes should overlap by one half width of roller. Mat temperature must not be below 185 degrees F.
 - 2. Immediately follow rolling of longitudinal joint and edges with breakdown rolling. Place drive wheel nearest paver and pull roller towards paver. Return roller to existing surface and make gradual shift to overlap previous pass by half roller width. Operate pneumatic-tired rollers as close to paver as necessary to obtain density required. Make enough passes for reasonably smooth surface.
 - 3. Final rolling by a combination of steel and pneumatic rollers to obtain density, surface texture, and surface tolerances required.

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- D. Pavement shall be compacted to a density of 92% to 96% of the maximum theoretical density, determined according to Colorado Procedure 51. Field density determinations will be made in accordance with Colorado Procedure 44 or 81.

3.5 PATCHING

Cut out and fill with fresh, hot asphaltic concrete. Remove deficient areas for full depth of surface and base course. Cut sides perpendicular and parallel, and perpendicular to direction of traffic to extent of failure. Apply tack coat to exposed surfaces before placing new pavement. Compact and finish to specification.

3.6 CLEAN UP

After completing operations, clean surfaces, pick up excess paving materials, and clean work area.

END OF SECTION 321200

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SECTION 321300 - RIGID PAVEMENT

PART 1 GENERAL

1.1 DESCRIPTION

- A. Work Included: Furnishing, forming, jointing, placing and curing of concrete pavement, curbs and gutters, sidewalks, pans, in conformance with lines, grades, and typical cross sections shown on the drawings.

1.2 RELATED ITEMS SPECIFIED ELSEWHERE

- A. Earthwork: Section 310000
- B. Unbound Base Course: Section 321100
- C. Cold Weather Concreting: Section 321301
- D. Hot Weather Concreting: Section 321302
- E. Concrete Paving Joints: Section 321306
- F. Concrete Paving Curing: Section 321307

1.2 QUALITY ASSURANCE

- A. Source: Engineer shall have access to batching plant at all times work is in progress.
- B. Record of Work: Contractor shall keep record of time and date of placement, temperature, and weather conditions. Retain until completion and furnish copy to Engineer.
- C. Installers:
 - 1. All work in this section to be accomplished under direct on-site supervision of thoroughly trained and experienced journeymen who are completely familiar with the requirements of this work and the recommendations contained in the reference standards. Unless otherwise specified, hand finishing methods will be permitted only when performed under the direct supervision of a Craftsman holding the following certificate: ACI Concrete Flatwork Finisher and Technician (ACICFFT) or other Flatwork Finisher certification program approved by CDOT. A minimum of one certified Craftsman is required at each finishing operation. A minimum of one certified Craftsman is required for each three or fewer finishers (non-certified ACICFFTs) at each operation
 - 2. In acceptance of the finished work, allowance will not be made for lack of skill on the part of the workers.
- D. Manufacturer's Recommendations: Manufacturer's recommendations shall be strictly adhered to concerning both methods and materials. Where surrounding conditions or base materials are not compatible with manufacturer's recommendations, notify Engineer in writing prior to bidding.

- E. Design Criteria: See Part 2 Products
- F. Testing Agency: All testing shall be performed by an approved testing laboratory and paid by the Owner with the exception of Contractor submittal requirements, qualifications of proposed materials and establishment of mixture proportions and other tests required by the Contractor to assure Contractor is furnishing materials and construction in compliance with the contract documents.
- G. Source Quality Control: The Engineer or his representative shall be offered uninterrupted access to the ready-mix batching plant at all times that the work is in progress.
- H. Record of Work: Keep record listing time, location and date of placement of concrete for structure. Keep such record until completion of project and make available to Engineer for examination at any time.

1.3 SUBMITTALS

- A. Shop Drawings: Reinforcement, precast sections.
- B. Manufacturers Data: Additives, joint materials, curing compounds, concrete sealant with 1-year manufacturer warranty, fly ash, reinforcement, concrete bonding agent, precast concrete reinforcing supports.
- C. Mix Design: Proportions of fine and coarse aggregate, water, cement, air content, admixtures, fly ash. A laboratory trial mix shall be prepared and test results submitted. The Concrete Mix Design will not be approved when the laboratory trial mix data are the results from tests performed more than two years in the past or aggregate data are the results from tests performed more than two years in the past. Provide all of the information outlined below for the concrete mix proposed for the project:

Identification:

- 1. Project.
- 2. Name and address of Contractor and concrete producer.
- 3. Mixture designation.
- 4. Class of concrete and intended use.

Materials and Proportions:

- 1. Name and location of material sources for aggregate, cement, admixtures and water.
- 2. Type of cement and additives (if used).
- 3. Cement content in kilograms per cubic meter (pounds per cubic yard) of concrete.
- 4. The water/cement ratio of modified concrete is the ratio of the mass of water to the combined masses of Portland cement and supplementary cementitious material.
- 5. The saturated surface dry batch mass for the coarse and fine aggregate in kilograms per cubic meter (pounds per cubic yard) of concrete.

6. Water content (including free moisture in the aggregate plus water in the drum, exclusive of absorbed moisture in the aggregate) in kilograms per cubic meter (pounds per cubic yard) of concrete.
7. Target water/cementitious ratio.
8. Dosage of admixture(s). Entrained air may be obtained either by the use of an air-entraining Portland cement or by the use of an air-entraining admixture.
9. Sieve analysis of aggregates.
10. Absorption of fine and coarse aggregate.
11. Bulk specific gravity (dry and saturated surface dry) of fine and coarse aggregate.
12. Dry rodded unit mass of coarse aggregate in kilograms per cubic meter (pounds per cubic yard).
13. Fineness modulus (FM) of fine aggregate.
14. Concrete unit mass.
15. Material certifications for Portland cement, admixtures, and aggregate.

The laboratory trial mix shall include results of the following:

1. AASHTO T119 slump of hydraulic cement concrete.
2. AASHTO T121 weight per cubic foot, yield, and air content (gravimetric) of concrete. Air content from AASHTO T152 air content of freshly mixed concrete by the pressure method may be used in lieu of the air content by the gravimetric method in AASHTO T121.
3. AASHTO T22 compressive strength of cylindrical concrete specimens shall be performed with at least two specimens at 7 days, two at 14 days and three specimens at 28 days. (4500 psi minimum)
4. Report compressive strength at other times as necessary for expected opening to traffic requirements.

D. Placement: Method proposed.

1.4 DELIVERY, STORAGE AND HANDLING

A. Hauling Time:

1. Mix concrete in accordance with ASTM C94. When air temperature is above 85°F, reduce mixing and delivery time to 75 minutes. When air temperature is above 90°F, reduce mixing and delivery time to 60 minutes.
2. Excessive slump or delivery time will be considered as a basis for rejection of the concrete placement.

B. Extra Water:

1. Deliver concrete to site in exact quantities required by design mix.
2. Should extra water be required before depositing concrete, the General Contractors Superintendent shall have sole authority to authorize addition of water. Any additional water added to mix after leaving batch plant shall be indicated on truck ticket and signed by person responsible.

3. Where extra water is added to concrete it shall be mixed thoroughly for 40 revolutions of drum or 3-1/2 minutes at mixing speed, whichever is greater.

1.5 PROJECT CONDITIONS

A. Environmental Requirements:

1. Cold Weather Placement:

- a. When placing concrete in cold weather, as defined in Section 321301, follow specifications for Cold Weather Concreting, Section 321301.
- b. When placing concrete in cold weather that does not meet the definition of “cold weather” in Section 321301, the following requirements shall be observed:
 1. Maintain concrete temperature at minimum of 50°F for not less than 72 hours after depositing.
 2. Maintain forms in place for minimum of 72 hours after depositing concrete..
 3. Do not place concrete without acceptance of Engineer on days when temperature 9:00 A.M. is below 40°F until, the General Contractor has taken all necessary precautions and supplied all necessary equipment to prevent concrete from freezing.

2. Hot Weather Placement:

- a. When depositing concrete in hot weather, follow specifications for Hot Weather Concreting, Section 321302.

- ### B. Protection: Protect newly finished slabs from rain damage. Cover masonry walls, glazing and other finish materials with polyethylene or otherwise protect from damage due to pouring slabs, sidewalks, or other concrete.

PART 2 PRODUCTS

2.1 READY-MIXED CONCRETE

AASHTO M157

2.2 CEMENT

Portland Cement ASTM C 150, TYPE I/II.

2.3 CONCRETE

Use CDOT Concrete Class P or indicated on plans.

2.4 AGGREGATES

- #### A. Fine Aggregate - AASHTO M 6.

1. Fineness Modulus (FM) – AASHTO T 176, $2.50 < FM < 3.50$

- B. Coarse Aggregate - AASHTO M80. Coarse Aggregate shall conform to the requirements of CDOT Class P concrete. For curb and gutter, curbs, sidewalks, pads and pans use AASHTO M43 coarse aggregate gradation #67.

2.5 WATER - AASHTO T26

- A. The maximum slump of the delivered concrete shall be the slump of the approved concrete mix design plus 1-1/2".
- B. Water cement ratio - 0.44 maximum

2.6 ADMIXTURES

- A. Air Entraining Agent - AASHTO M154. See table for percent air requirements.

<u>Nominal Maximum Size aggregate, in.</u>	<u>Target Entrained Air Content at the point of delivery, percent*</u>
3/8	7-1/2
1/2	7
3/4	6
1	6
1-1/2	5-1/2
2	5

* tolerance, -1% to +2%

- B. Chemical-Admixtures AASHTO M194

2.7 QUALITY

- A. Provide approved mix design
- B. Conform to applicable requirements of ACI 301
- C. For CDOT Class P concrete, field cylinders shall produce 28-day minimum compressive strength of 4500 psi. Cementitious content 520 lb/cy minimum.

2.8 REINFORCEMENT

- A. Deformed and plain billet-steel bars AASHTO M31
- B. Fabricated steel bar rod mats, steel wire fabric AASHTO M54

2.9 JOINT MATERIAL

AASHTO M173

2.10 CURING MATERIALS

- A. Burlap cloth from jute or kenaf - AASHTO M182
- B. Liquid membrane - AASHTO M148, 1 gal/150 SF
- C. Sheet Materials - AASHTO M171, 4 mil

2.11 SEALANTS

- A. Euclid Baracade Silane 100 High Performance Water Repellent or Symons Silane 40%

2.12 WATER: CLEAN AND POTABLE

2.13 FLY ASH:

- A. ASTM C 618. Use Class F fly ash only. The amount of fly ash shall conform to the percentages allowed in CDOT Class P concrete. Fly ash shall be from a source listed on CDOT's Approved Products List (APL). Verification from the supplier shall be submitted, confirming the fly ash is currently on CDOT's APL.

2.14 DOWEL BARS AND TIE BARS:

- A. Dowel bars for transverse joints shall conform to AASHTO M 254 for the coating and to ASTM A615, Grade 60 for the core material and shall be epoxy coated, smooth and lightly greased for their full length. Dowel bar sizes and placement shall be as designated in the current CDOT M&S Standards unless indicated on the plans and details.
- B. Tie bars for longitudinal and transverse joints shall conform to AASHTO M 284 and shall be grade 40, epoxy coated, deformed steel bars. Tie bar sizes and placement shall be as designated in the current CDOT M&S Standards unless indicated on the plans and details. When tie bars are required between concrete pavement and adjacent curb and gutter, the gutter thickness shall be increased to match the pavement thickness.

PART 3 EXECUTION

3.1 SUBGRADE/BASE COURSE

- A. Check for soft spots by proof-rolling or other means prior to setting forms. Remove soft yielding material and replace. Compact to specification. Wet to optimum moisture to 6" deep, not more than 12 hours prior to placement so subgrade will not absorb moisture from concrete.
- B. Test for crown and/or elevation to assure specified thickness. If additional material used to bring subgrade to correct elevation, compact to specification. Before placing concrete, clean subgrade of all loose materials. No disturbance inside forms after fine grading subgrade.

3.2 INLETS, MANHOLES AND SIMILAR STRUCTURES CAST IN PAVEMENT:

Thicken pavement and install joints and bond breaker at inlets, manholes and similar structures according to the current CDOT M Standards unless indicated on the plans and details. Smaller structures such as valve and monument boxes do not require a bond breaker.

3.3 FORMS

- A. Capable of supporting loads imposed by construction equipment, with maximum deflection of 1/4". Straight and free from warp, with maximum surface deviation of 1/8". In good condition, clean, and strong enough to resist pressure of concrete when placed. Joined neatly and accurately to line and grade, and mechanically tamped to assure firm placement. Oil prior to concrete placement.
- B. Set dowels if required and expansion joints, preformed construction joints, and header boards in accordance with current CDOT M Standards unless indicated on the plans and details. Securely stake preformed baskets to prevent movement. Lightly grease dowels full length.
- C. Backfill behind forms as required to prevent water from entering subgrade.

3.4 REINFORCEMENT

When indicated, place wire mesh as shown on drawings. If required for this project, place dowels and tie bars in accordance with current CDOT M Standards unless indicated on the plans and details. Hold all tie and marginal bars in proper position by sufficient supports or pins. If center longitudinal joint sawed in lieu of placing metal or plastic strip, bars may be mechanically installed or placed on supports. Where rebar, rod mats or steel wire mesh is required, support with bar chairs. Where two layers of mesh are required, support bottom layer by bar chairs with separators for top mesh.

3.5 READY-MIXED CONCRETE

The use of ready-mixed concrete shall in no way relieve the Contractor of the responsibility for proportion, mix, delivery, or placement of concrete. All ready-mixed concrete shall comply with ASTM C94.

Concrete shall be continuously mixed or agitated from the time the water is added until the time of use. The concrete shall be deposited in place within 90 minutes after batching when concrete is delivered in truck mixers or agitating trucks. The 90 minute time limit for mixer or agitating truck may be extended to 120 minutes if: (1) no water is added after 90 minutes (2) the concrete temperature prior to placements is less than 90° F. The 90 minute time limit for mixer or agitating trucks may be extended to 180 minutes if (1) no water is added after 90 minutes (2) the concrete temperature prior to placement is less than 90°F (3) the approved concrete mix contains a water reducing and retarding admixture which conforms to AASHTO M194, Type D. In accordance with ASTM C94, water may be added to ready-mix concrete one time in order to get slump within range, as long as the specified water-cement ratio is not exceeded.

Engineer shall have free access to the ready mix plant at all times. The organization supplying the concrete shall have sufficient plant and transportation facilities to assure continuous delivery of the concrete at the required rate.

The contractor shall collect delivery or batch tickets from the driver for all concrete used on the project and shall deliver them to the Engineer. Batch tickets shall provide the following information in accordance with ASTM C94:

- A. Name of ready-mix batch plant
- B. Serial number of ticket
- C. Date
- D. Truck number
- E. Name of purchaser
- F. Specific designation of job (name and location)
- G. Mix # or specific class or designation of the concrete
- H. Amount of concrete in cubic yards
- I. Time loaded or of first mixing of cement and aggregates
- J. Water added by receiver of concrete and his initials
- K. Weights of fine and coarse aggregates
- L. Type, brand and amount of cement
- M. Type, brand and amount of admixtures
- N. Weight (in gallons) of water, including surface water on aggregates

3.6 PLACEMENT

Deposit near final position on grade with minimum segregation and without damage to subgrade. Operate transit mixer outside forms at all times, except in locations agreed to by Engineer. Place concrete on subgrade in successive batches for full width between forms in manner requiring as little rehandling as possible. Spread mechanically to prevent segregation and separation of materials. Additional spreading may be by hand shovels. Deposit excess concrete to provide roll ahead of strike off screed for full length of screed. Consolidate concrete with vibrators and spade next to forms, so final surfaces will not have holes or honeycombs.

3.7 FINISHING

- A. Use equipment designed to spread, consolidate, screed and float freshly placed concrete in one pass, providing well consolidated, homogenous mixture, requiring minimum of hand finishing to meet surface tolerances. Strike hand finished surfaces to tolerances by methods agreed to by Engineer.
- B. Finished surfaces will be tested with 10' straight edge parallel to centerline immediately following first floating of surface. Straight edge will be advanced 5' and space under straight edge shall not exceed 3/16".
- C. Final finish pavements after floating and straight edging. Curbs, gutters, pans, and sidewalks shall be a medium broom finished unless otherwise indicated.

- D. Finish: Broom finish unless otherwise indicated. Finish edges with a slightly rounded edging tool.
- E. ACI certificated finisher(s) must be on-site during finishing.
- F. The contractor shall not add water to the surface of the concrete to assist in finishing operations.

3.8 CURING (see Section 321307 Site Concrete Paving Curing for detailed specifications)

Apply curing compounds or sheets immediately after finishing. Do not mark or mar finished surface. Coat sides within one hour after form removal.

3.9 PROTECTION

- A. Have plastic sheeting or other suitable materials available at all times to protect fresh uncured surfaces from rain.
- B. Provide full protection from freezing. Admixtures (calcium chloride) are not acceptable for freeze protection.
- C. For hot weather, use fog spray or water retarding additives. Do not throw water directly on surface.
- D. When indicated, apply two (2) coats deep penetrating sealant.
- E. Conform to ACI 102.2R-09 “Guide to Durable Concrete”

3.10 JOINTS (see Section 321306 Site Concrete Paving Joints for detailed specifications)

- A. Contraction joints. For concrete pavement and concrete pans, depth $\frac{1}{3}$ the thickness of concrete. For sidewalks, depth $\frac{1}{4}$ the thickness of concrete. For curb and gutter, depth $\frac{1}{4}$ the thickness of the gutter concrete. If curb and gutter is poured monolithically with concrete pavement, transverse joints shall be to the same depth as the pavement.
 - 1. Hand formed with tool, header board, or trowel pushed into surface to move all aggregate from joint.
 - 2. Saw joints as soon as concrete can support equipment without marring and cutting can proceed without chipping, spalling or tearing, no later than 12 hours after placement. Saw as soon as possible to prevent erratic or uncontrolled cracking and prior to the development of shrinkage cracking. Transverse joints to be perpendicular to centerline. First joints sawed approximately 60 feet apart, intermediate joints sawed after initial joints. Suitable guidelines shall be provided to ensure joint is straight and true to line.
 - 3. Curb and gutter, sidewalk and pan joints shall have tooled radii per current CDOT M Standards unless indicated on the plans and details.

4. Longitudinal joints, including tie bars if required, shall conform with current CDOT M Standards unless indicated on the plans and details.
 5. Fabricated steel or plastic strip held rigidly in place.
- B. Construction joints shall conform to the current CDOT M Standards unless indicated on the plans and details and, if required, tie bars shall be installed. Transverse construction joints shall be planned to coincide with a contraction joint location.
1. Joints constructed by forms with tie bars.
- C. Expansion joints with preformed joint filler in a vertical position, deviating not more than 1/4" from a straight line. Install at all existing and proposed structures projecting through, into, or against pavement, in accordance with current CDOT M Standards unless indicated on the plans and details.
- D. Install joint sealant in all joints, at temperatures above 50 degrees F., in accordance with manufacturer's recommendations. Clean all dust, debris and water from joint. Concrete to cure a minimum of 21 days prior to joint sealant. Seal joints per CDOT construction specifications standards

3.11 THICKNESS

Remove and replace work less than 95% of thickness according to drawings at Contractor's expense.

3.12 CLEANUP

After completing concrete operations, clean surfaces, pick up excess materials, and clean work area.

3.13 OPENING TO TRAFFIC

The Engineer will determine when the pavement shall be opened to traffic; otherwise the pavement shall not be opened to traffic until 14 days after the concrete was placed or the concrete has achieved a compressive strength of 3000 psi.

3.14 FIELD QUALITY CONTROL

- A. General: All testing, with the exception of slump tests, shall be performed by an approved testing laboratory. The following tests and procedures are subject to change during construction at the discretion of the Engineers.
- B. Testing Laboratory: The selection of a testing laboratory for any of the following tests shall be subject to the approval of the Engineer.

- C. Testing Priority: Control tests shall be used to determine the concrete quality throughout the project, however, special tests shall have precedence over control tests, and core tests shall have precedence over all previous tests.
- D. Slump Tests: Provide all necessary equipment and make tests in conformity with ASTM C143 at a minimum frequency as indicated by CDOT specifications, with additional testing as needed or as directed by the Engineer. Provide for tests to be made by a person thoroughly familiar with the requirements specified. Reject batch if slump excess the limits specified. Keep accurate record of time, location in the work, and the results of all slump tests. Make available for inspection by the Engineer.
- E. Control Tests: Control tests of concrete work, as a minimum, shall be made at such times and in such manner as indicated by CDOT specifications, with additional testing as needed or as directed by the Engineer at the expense of the Owner. For this project, each test shall consist of 5 standard 6" test cylinders cast and cured in accordance with ASTM C31 and ASTM C172. Compressive strength samples shall be obtained at a minimum frequency of one sampling per day and more if deemed necessary by materials testing organization. Two cylinders shall be broken at the end of 7 days after placing and three cylinders shall be broken 28 days after placing. The Engineer reserves the right to stop all future concrete work when the 7 or 28-day tests indicate unsatisfactory results; until, in his opinion, proper corrective measures have been taken to assure quality concrete in future work. Tests shall be made at the time test cylinders are taken, and recorded on the reports to determine the slump, air content, unit weight, and temperature of the concrete. All tests shall be made in accordance with ASTM C39, ASTM C138 or ASTM C231.
- F. Maturity metering: When maturity metering is required, each pour shall include the necessary wires and connectors for maturity meter monitoring.

3.15 PROTECTION

General: Protect all exposed surfaces of concrete from premature drying and frost. Protect freshly placed concrete against rain damage. Protect all concrete surfaces from staining, cracking, chipping and other damage during progress of work, and leave in good condition upon completion.

END OF SECTION 321300

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SECTION 321301 - ACI 306.1-90 - COLD WEATHER CONCRETING

1 - GENERAL

1.1 - Scope

1.1.1 This Standard Specification covers requirements for cold weather concreting and protection of concrete from freezing during the specified protection period.

1.1.2 The provision of this Standard Specification shall govern unless otherwise specified in the Contract Documents.

1.2. - Definitions

These definitions are to assist in interpreting the provisions of this specification.

Accepted - Accepted by or acceptable to the Engineer.

Engineer - The engineer or engineering firm issuing Project Drawings and Specifications, or administering the Work under the Contract Documents.

Cold weather - A period when for more than three successive days the average daily outdoor temperature drops below 40 F. The average daily temperature is the average of the highest and lowest temperature during the period from midnight to midnight. When temperatures above 50 F occur during more than half of any 24 hr duration, the period shall no longer be regarded as cold weather.

Cold weather concreting - Operations concerning the placing, finishing, curing, and protection of concrete during cold weather.

Contractor - The person, firm, or corporation with whom the Owner enters into an agreement for construction of the Work.

Contract documents - Documents including the Project Drawings and Project Specifications covering the required Work.

Day - A time period of 24 consecutive hours.

Owner - The corporation, association, partnership, individual, or public body or authority with whom the Contractor enters into an agreement and for whom the Work is provided.

Project drawings - The drawings, which along with the Project Specifications, complete the descriptive information for constructing the Work required or referred to in the Contract Documents.

Project specifications - The written documents which specify requirements for a project in accordance with the service parameters and other specific criteria established by the Owner.

Protection period - The required time during which the concrete is maintained at or above a specific temperature in order to prevent freezing of the concrete or to ensure the necessary strength development for structural safety.

Reference standards - Standards of a technical society, organization, or association, including the codes of local or state authorities, which are referenced in the Contract Documents.

Required - Required by this Specification or the Contract Documents.

Submitted - Submitted to the Engineer for review.

Work - The entire construction or separately identifiable parts thereof which are required to be furnished under the Contract Documents. Work is the result of performing services, furnishing labor, and furnishing and incorporating materials and equipment into the construction, all as required by the Contract Documents.

1.3 - Reference organizations

ACI: American Concrete Institute
P.O. Box 19150
Detroit, MI 48219

ASTM: American Society for Testing and Materials
1916 Race Street
Philadelphia, PA 19103

1.4 - Reference standards

1.4.1 *ACI Standards*

301-89 Specifications for Structural Concrete for Buildings

1.4.2 *ASTM Standards*

C 31-88 Standard Method of Making and Curing Concrete Test Specimens in the Field

C 150-86 Standard Specification for Portland Cement

C 494-86 Standard Specification for Chemical Admixtures for Concrete

C 803-82 Standard Test Method for Penetration Resistance of Hardened Concrete

C 873-85 Standard Test Method for Compressive Strength of Concrete Cylinders Cast in Place in Cylindrical Molds

C 900-87 Standard Test Method for Pullout Strength of Hardened Concrete

1.5 - Submittal of procedures

1.5.1 *Detailed procedures* - If required, submit detailed procedures for the production, transportation, placement, protection, curing, and temperature monitoring of concrete during cold weather. In the submittal, include procedures to be implemented upon abrupt changes in weather conditions or equipment failures. Do not begin cold weather concreting until these procedures have been reviewed and accepted. Minimum procedures for placement, curing and protection of the concrete shall follow the recommendations in ACI 306R, "Cold Weather Concreting." The details should include, but not be limited to, the following:

- a. Procedures for protecting the subgrade from frost and the accumulation of ice or snow on reinforcement or forms prior to placement.
- b. Methods for temperature protection during placement.
- c. Types of covering, insulation, housing, or heating to be provided.
- d. Curing methods to be used during and following the protection period.
- e. Use of strength accelerating admixtures.
- f. Methods for verification of in-place strength.
- g. Procedures for measuring and recording concrete temperatures.
- h. Procedures for preventing drying during dry, windy conditions.

2 - - MATERIALS

2.1 Scheduling protection materials

All materials and equipment required for protection shall be available at the project site before cold weather concreting.

2.2 - Concrete

Concrete for slabs and other flatwork exposed to cycles of freezing and thawing in a wet condition during the construction period shall be air entrained.

3-- EXECUTION**3.1 - Preparation before concreting**

Remove all snow, ice, and frost from the surfaces, including reinforcement, against which the concrete is to be placed. Before beginning concrete placement, completely thaw the subgrade. Do not place concrete around massive embedments identified in the Contract Documents unless such embedments are at a temperature above freezing.

3.2 - Concrete temperature

3.2.1 *Placement temperature* - The minimum temperature of concrete immediately after placement shall be as specified in Column 2 of Table 3.2.1. The temperature of concrete as placed shall not exceed the values shown in Column 2 of Table 3.2.1 by more than 20F.

Table 3.2.1 - Concrete temperature

(1)	(2)	(3)
Least dimension of section, in.	Minimum temperature of concrete as placed and maintained during protection period, °F	Maximum gradual decrease in surface temperature during any 24 h after end of protection, °F
Less than 12	55	50
12 to less than 36	50	40
36 to 72	45	30
Greater than 72	40	20

3.2.2 *Protection temperature* - Unless otherwise specified, the minimum temperature of concrete during the protection period shall be as shown in Column 2 of Table 3.2.1. Temperatures specified to be maintained during the protection period shall be those measured at the concrete surface, whether the surface is in contact with formwork, insulation, or air. Measure the temperature with a surface temperature measuring device having an accuracy of +/-2 F. Measure and record the temperature of concrete in each placement at regular time intervals at a frequency not less than twice per 24-hr period.

3.2.3 *Termination of protection* - The maximum decrease in temperature measured at the surface of the concrete in a 24-hour period shall not exceed the values shown in Column 3 of Table 3.2.1. Do not exceed these limits until the surface temperature of the concrete is within 20 F of the ambient or surrounding temperatures. When the surface temperature of the concrete is within 20 F of the ambient or surrounding temperature, all protection may be removed.

3.3 - Curing of concrete

Prevent concrete from drying during the required curing period. If water curing is used, terminate use at least 24 hr before any anticipated exposure of the concrete to freezing temperatures.

3.4 - Protection of concrete

3.4.1 *Combustion heaters* - Vent flue gases from combustion heating units to the outside of the enclosure.

3.4.2 *Overheating and drying* - Place and direct heaters and ducts to avoid areas of overheating or drying of the concrete surface.

3.4.3 *Maximum air temperature* - During the protection period, do not expose the concrete surface to air having a temperature more than 20 F above the values shown in Column 2 of Table 3.2.1, unless higher values are required by an accepted curing method.

3.4.4 *Protection against freezing* - Cure and protect concrete against damage from freezing for a minimum period of 3 days, unless otherwise specified. Maintain the surface temperature of the concrete during that period in accordance with Column 2 of Table 3.2.1, unless otherwise specified. The protection period may be reduced to 2 days if use of one or more of the following to alter the concrete mixture is accepted:

- Type III portland cement meeting the requirements of ASTM C 150
- A strength accelerating admixture meeting the requirements of ASTM C 494
- 100 lb/yd³ of additional cement

During periods not defined as cold weather, but when freezing temperatures may occur, protect concrete surfaces against freezing for the first 24 hr after placing. Any changes in the concrete mix proportions for reducing the duration of the protection period to prevent early freezing should be submitted for review or acceptance.

3.4.5 *Protection deficiency* - If the temperature requirements during the specified protection period are not met but the concrete was prevented from freezing, continue protection until twice the deficiency of protection in degree-hours is made up. Deficient degreehours may be determined by multiplying the average deficiency in temperature by the number of hours the temperature was below the values shown in Column 2 of Table 3.2.1.

APPENDIX - METRIC CONVERSIONS

<u>Inch-pound unit</u>	<u>Factor</u>	<u>S1 unit</u>
In.	x25.4	= mm
Lb/yd ³	x0.5933	=kg/m ¹
Psi	x0.006895	=Mpa
Temperature, °F	(°F-32)/1.8	=°C
Temperature interval °F	°F/1.8	=°C

END OF SECTION 321301

SECTION 321302 - ACI 305.1-06 - HOT WEATHER CONCRETING

SECTION 1—GENERAL

1.1—Scope

This Specification covers requirements for hot weather concrete construction. Provisions of this Specification shall govern, except where other provisions are specified in Contract Documents. This Specification shall not be used in conjunction with ACI 301 or ACI 530.1.

1.2—Referenced standards

1.2.1 Standards of ACI and ASTM referred to in this Specification are listed with serial designation, including year of adoption or revision, and are part of this Specification.

1.2.2 *ACI Standards*

308.1-98 Standard Specification for Curing Concrete

1.2.3 *ASTM Standards*

C 31/C31 M-03a	Practice for Making and Curing Concrete Test Specimens in the Field
C 39/C 39M-05	Test Method for Compressive Strength of Cylindrical Concrete specimens
C 78-02	Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading)
C 94/C 94M-05	Specification for Ready-Mixed Concrete
C 138/C 138M-01a	Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
C 143/C 143M-05a	Test Method for Slump of Hydraulic-Cement Concrete
C 171-03	Specification for Sheet Materials for Curing Concrete
C 173/C 173M- 01ε1	Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
C 192/C 192M-05	Practice for Making and Curing Concrete Test Specimens in the Laboratory
C 231-04	Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
C 293-02	Test Method for Flexural Strength of Concrete (Using Simple Beam With Center-Point Loading)
C 1064/C 1064M-05	Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete

1.2.4 Abbreviations for and complete names and addresses of organizations issuing documents referred to in this Specification are listed:

American Concrete Institute (ACI)
PO Box 9094
Farmington Hills, MI 48333-9094
Phone: (248) 848-3700
Fax: (248) 848-3701
website: www.concrete.org

ASTM International (ASTM)
100 Barr Harbor Dr
West Conshohocken, PA 19428-2959
Phone: (610) 832-9500
Fax: (610) 832-9555
website: www.astm.org

1.3—Definitions

day—a period of 24 consecutive hours.

evaporation retardant—a material that generates a continuous thin film when spread over water on the surface of fresh concrete and thus retards the evaporation of bleed water.

hot weather—job-site conditions that accelerate the rate of moisture loss or rate of cement hydration of freshly mixed concrete, including an ambient temperature of 27 °C (80 °F) or higher, and an evaporation rate that exceeds 1 kg/m²/h, or as revised by the Engineer.

hot weather concreting—operations concerning the preparation, production, delivery, placement, finishing, protection, and curing of concrete during hot weather.

moist—slightly damp but not quite dry to the touch; “wet” implies visible free water, “damp” implies less wetness than “wet,” and “moist” implies not quite dry.

protection period—the required time during which the concrete is protected against thermal cracking due to rapid temperature drops.

temperature of fresh concrete—the temperature measured during the discharge and placement in accordance with ASTM C 1064/C 1064M.

temperature of hardened concrete—the temperature measured at the concrete surface.

units—values stated in either U.S. Customary or SI units shall be regarded separately as standard. Values stated in each system might not be exact equivalents; therefore, each system must be used independently of the other, without combining values in any way.

1.4—Submittal of procedures

1.4.1 Before hot weather concreting and the preplacement conference, submit to Engineer for review and comment detailed procedures, including production, placement, finishing, curing and protection of concrete during hot weather concreting.

1.5—Preplacement conference

1.5.1 At least 15 days before the start of the concrete construction schedule, hold a preplacement conference for the purpose of reviewing hot weather concreting requirements and mix designs.

1.5.2 Send a preplacement conference agenda on hot weather operations and procedures to representatives of concerned parties not less than 10 days before the scheduled date of the conference.

1.5.3 Preplacement conference shall include, but is not limited to, representation of Contractor, Concrete Subcontractor, Testing Agency, Pumping Contractor, and Ready-Mixed Concrete Producer.

1.5.4 Distribute the minutes of the preplacement conference to representatives of concerned parties within 5 days after the preplacement conference.

1.6—Documents required on site

1.6.1 Copies of ACI 305R, ACI 305.1, and ACI 308.1 must be available at the project site during concrete construction.

SECTION 2—PRODUCTS**2.1—General**

2.1.1 Store all materials and equipment required for curing and protection at or near the project site before hot weather concreting commences.

2.1.2 *Initial site curing of strength test specimens for acceptance*—Provide facilities that ensure compliance with the initial curing requirements of ASTM C 31/C 31M.

2.2—Concrete mixture proportions

2.2.1 Submit concrete mixture proportions to Engineer for review. Include specific materials, manufacturer, and type for hot weather concreting. The submittal shall include concrete mixture adjustment parameters and methods to be implemented during changes in weather conditions.

SECTION 3—EXECUTION**3.1—General**

3.1.1 Do not place concrete against surfaces of absorbent materials that are dry. Do not place concrete against surfaces that have free water.

3.1.2 Prepare all materials required for accepted evaporation control measures and have them available on site so that specified measures can be executed as necessary.

3.1.3 Initiate accepted evaporation control measures when concrete and air temperatures, relative humidity of the air, and the wind velocity have the capacity to evaporate water from a free water surface at a rate that is equal to or greater than 1.0 kg/m²/h (0.2 lb/ft²/h), unless otherwise specified. Determine the evaporation rate of surface moisture by use of the Menzel Formula:

$$W = 0.315(e_o - e_a)(0.253 + 0.060V) \text{ [SI units]}$$

$$W = 0.44(e_o - e_a)(0.253 + 0.096V) \text{ [U.S. Customary units]}$$

where

W = mass of water evaporated in kg (lb) per m² (ft²) of water-covered surface per hour;

e_o = saturation water vapor pressure in kPa (psi) in the air immediately over the evaporating surface, at the temperature of the evaporating surface. Obtain this value from Table 3.1(a) or (b). The temperature of the evaporating surface shall be taken as the concrete temperature;

e_a = water vapor pressure in kPa (psi) in the air surrounding the concrete. Multiply the saturation vapor pressure at the temperature of the air surrounding the concrete by the relative humidity of the air. Air temperature and relative humidity are to be measured at a level approximately 1.2 to 1.8 m (4 to 6 ft) above the evaporating surface on the windward side and shielded from the sun's rays; and

V = average wind speed in km/h (mph), measured at 0.5 m (20 in.) above the evaporating surface.

3.1.3.1 Monitor site conditions (air temperature, humidity, wind speed) to assess the need for evaporation control measures beginning no later than 1 hour before the start of concrete placing operations. Continue to monitor site conditions at intervals of 30 minutes or less until specified curing procedures have been applied.

3.1.3.2 For measuring the rate of evaporation of surface moisture, use equipment or instruments that are certified by the manufacturer as accurate to within 1 °C (2 °F), 5% relative humidity, and 1.6 km/h (1 mph) wind speed. Use equipment in accordance with the product manufacturer recommendations.

Table 3.1(a)—Saturation water vapor pressure (kPa) over water (SI units)

Air and concrete temperature, °C	Saturation pressure, kPa	Air and concrete temperature, °C	Saturation pressure, kPa
4	0.813	28	3.78
5	0.872	29	4.01
6	0.934	30	4.24
7	1.00	31	4.49
8	1.07	32	4.75
9	1.15	33	5.03
10	1.23	34	5.32
11	1.31	35	5.62
12	1.40	36	5.94
13	1.50	37	6.28
14	1.60	38	6.63
15	1.70	39	6.99
16	1.82	40	7.38
17	1.94	41	7.78
18	2.06	42	8.20
19	2.20	43	8.64
20	2.34	44	9.10
21	2.49	45	9.58
22	2.64	46	10.1
23	2.81	47	10.6
24	2.98	48	11.2
25	3.17	49	11.7
26	3.36	50	12.3
27	3.56		

Data source: *CRC Handbook of Chemistry and Physics*, 68th Edition, 1987, mathematically converted into kPa.

Table 3.1(b)—Saturation water vapor pressure (psi) over water (U.S. Customary units)

Air and concrete temperature, °F	Saturation pressure, psi	Air and concrete temperature, °F	Saturation pressure, psi
40	0.121	81	0.523
41	0.127	82	0.542
42	0.132	83	0.559
43	0.137	84	0.577
44	0.143	85	0.595
45	0.147	86	0.615
46	0.153	87	0.637
47	0.159	88	0.658
48	0.166	89	0.679
49	0.171	90	0.698
50	0.178	91	0.722
51	0.185	92	0.746
52	0.192	93	0.769
53	0.199	94	0.789

54	0.206	95	0.816
55	0.214	96	0.843
56	0.222	97	0.870
57	0.231	98	0.896
58	0.238	99	0.920
59	0.247	100	0.951
60	0.257	101	0.981
61	0.267	102	1.01
62	0.277	103	1.04
63	0.285	104	1.07
64	0.296	105	1.10
65	0.308	106	1.13
66	0.319	107	1.17
67	0.327	108	1.20
68	0.339	109	1.24
69	0.352	110	1.27
70	0.366	111	1.31
71	0.378	112	1.35
72	0.388	113	1.39
73	0.403	114	1.43
74	0.418	115	1.47
75	0.433	116	1.52
76	0.443	117	1.56
77	0.459	118	1.60
78	0.476	119	1.65
79	0.494	120	1.70
80	0.510		

Data source: *CRC Handbook of Chemistry and Physics*, 68th Edition, 1987, mathematically converted into °F and psi.

3.2—Maximum allowable concrete temperature

3.2.1 Limit the maximum allowable fresh concrete temperature to 35 °C (95 °F), unless otherwise specified, or unless a higher allowable temperature is accepted by Engineer, based upon past field experience or preconstruction testing using a concrete mixture similar to one known to have been successfully used at a higher concrete temperature.

3.2.2 Measure the fresh concrete temperature at the point and time of discharge in accordance with ASTM C 1064/C 1064M. Frequency of temperature determination shall be in accordance with ASTM C 94/C 94M and at the option of the inspector.

3.3—Qualification of concrete mixture proportions

3.3.1 Approval of concrete mixture and proposed maximum allowable fresh concrete temperature, supported by past field experience of Section 3.2.1, shall be based, on similar climate and production conditions, materials, mixture proportions and temperatures, placing and finishing methods, and concrete delivery time.

3.3.2 Approval of concrete mixture and proposed maximum allowable fresh concrete temperature, supported by preconstruction testing of Section 3.2.1, shall require materials similar to those proposed for use in the project.

3.3.3 *Laboratory trial batch*—Batch the laboratory concrete trial mixture within 2 °C (3 °F) of the proposed maximum allowable concrete temperature and mix in accordance with ASTM C 192/C 192M, except as modified herein. If necessary, move the laboratory mixer into an enclosed,

heated and ventilated space, or use heated mixing water, or both, to achieve and maintain the proposed maximum allowable concrete temperature. For drum-type mixers, the concrete mixture shall remain in the mixer for 47 minutes after completion of the 3-minute initial mixing period unless specified otherwise. During the 50-minute period, cover the mixer opening with a non-absorbent material, such as plastic, to prevent moisture loss, and rotate the mixer continuously at an agitation speed of 6 to 8 rpm. For laboratory mixers without speed adjustments, simulate agitation by rotating the mixer continuously at a drum angle between 45 and 75 degrees from horizontal. At the end of 50 minutes, mix the concrete mixture at full mixing speed designated by the manufacturer (8 to 20 rpm) for 2 minutes. For pan-type mixers, the concrete mixture shall remain in the mixer for 41 minutes after completion of the initial 3-minute mixing period. During the 44-minute period, the mixer shall cycle through periods of rest for 5 minutes, and then mixing for 1 minute. During the rest period, cover the mixer opening with a non-absorbent material, such as plastic, to prevent moisture loss. At the end of 44 minutes, mix the concrete mixture at full mixing speed designated by the manufacturer (8 to 20 rpm) for 2 minutes. During mixing and agitation periods for both drum-type and pan-type mixers, the addition of water, chemical admixture, or both, to adjust slump is permitted provided that the specified concrete mixture *w/cm* is not exceeded. As needed, check and adjust the slump of the concrete mixture during the middle 1/3 of the 50- or 44-minute laboratory trial mixing period.

3.3.3.1 The proposed concrete mixture shall meet the specified slump range at the end of the laboratory mixing period and meet the required strength at the specified test age.

3.3.4 *Field trial batch*—Batch the field concrete trial mixture within 2 °C (3 °F) of the proposed maximum allowable concrete temperature in a truck-mixer with a minimum batch size of 3 m³ (4 yd³). If necessary, move the truck mixer into an enclosed, heated, and ventilated space to achieve a concrete temperature within the specified tolerance of the proposed maximum allowable concrete temperature. The concrete mixture shall be held in the mixer for 90 minutes, unless otherwise specified by the Engineer. During the entire 90-minute period, agitate the mixer at 1 to 6 rpm. At the end of 90 minutes, mix the concrete mixture at full mixing speed designated by the manufacturer (6 to 18 rpm) for 2 minutes. During mixing and agitation periods, the addition of water, chemical admixture, or both, to adjust slump is permitted provided that the specified concrete mixture *w/cm* is not exceeded. As needed, check and adjust the slump of the concrete mixture during the middle 1/3 of the 90-minute mixing period.

3.3.4.1 The proposed concrete mixture shall be within the specified slump range at the end of the 90-minute field mixing period and meet the required strength at the specified test age.

3.3.5 Test values obtained in accordance with the appropriate ASTM Standard shall include compressive strength (C 192/ C 192M or C 31/C 31M, and C 39/C 39M), flexural strength (C 192/C 192M and either C 78 or C 293; C 31/C 31M and either C 78 or C 293), or both; slump (C 143/C 143M); air content (C 231, C 173/C 173M, or C 138/C 138M); concrete density (unit weight) (C 138/ C 138M); and concrete temperature (C 1064/ C 1064M). Slump, air content, and concrete and air temperature measurements shall be performed after initial mixing, intermediately as needed or as desired, and at the conclusion of the mixing period along with the other specified tests.

3.3.6 *Acceptance of concrete mixture proportions*— Submit to the Engineer for acceptance a request for a specific higher maximum allowable concrete temperature. Include the constituent materials and proportions of the proposed concrete mixture and all values obtained from past field experience or preconstruction testing. Test results shall be within the Project Specification ranges and tolerances.

3.4—Concrete production and delivery

3.4.1 Concrete shall be produced at a temperature such that its maximum temperature at discharge will not exceed the specified maximum allowable concrete temperature. Acceptable

production methods to reduce the temperature of the concrete include: shading aggregate stockpiles, sprinkling water on coarse aggregate stockpiles; using chilled water for concrete production; substituting chipped or shaved ice for portions of the mixing water; and cooling concrete materials using liquid nitrogen. The submittals for hot weather concreting shall indicate which methods will be used and in what order they will be initiated when multiple methods are to be used. The substitution of other cooling methods will be considered by the Engineer when requested in the submittal and accompanied by satisfactory supporting data.

3.4.2 Unless otherwise specified, deliver concrete in accordance with ASTM C 94/C 94M, which requires the concrete to be discharged within 1-1/2 hours or before the truck-mixer drum has revolved 300 revolutions, whichever comes first.

3.5—Concrete placement and finishing

3.5.1 Concrete placement and finishing operations shall proceed as quickly as conditions will permit.

3.6—Concrete bleed-water evaporation

3.6.1 Control concrete surface bleed-water evaporation with application of evaporation reducers, plastic sheeting, fog spray, or wind breaks. Use these materials and methods in accordance with ACI 308.1. Submit for approval the desired method to be used when concreting during periods with evaporation rates higher than permitted.

3.7—Concrete curing

3.7.1 *Concrete curing*—Cure concrete in accordance with ACI 308.1.

3.8—Concrete protection

3.8.1 *Protection period*—Protect the concrete against thermal shrinkage cracking due to rapid drops in concrete temperature greater than 22 °C (40 °F) during the first 24 hours unless otherwise specified.

3.8.2 *Protection materials*—Acceptable protection materials to prevent excessive temperature drops are insulating blankets, batt insulation with moisture-proof covering, layers of dry porous material such as straw, hay, or multiple layers of impervious paper meeting ASTM C 171. These protection materials shall not be applied until the concrete surface temperature has become steady or is beginning to decline.

END OF SECTION 321302

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SECTION 321306 - SITE CONCRETE PAVING JOINTS

PART 1 GENERAL

1.1 DESCRIPTION

Work of this section generally includes provisions for joints for concrete paving; concrete sidewalks; curbs, and curb and gutter; and saw-cutting existing concrete or asphalt pavements for new joints.

1.2 RELATED WORK

- A. Earthwork: Section 310000
- B. Concrete Paving Curing: Section 321307
- C. Flexible Pavement: Section 321200
- D. Rigid Pavement: Section 321300

1.3 MEASUREMENT

- A. No measurement will be made for street pavement load transfer expansion joints. Include cost in unit price for concrete paving.
- B. No measurement will be made for saw-cutting existing concrete or asphalt pavement for new joints or existing concrete curbs. Include cost in unit price for concrete paving.
- C. No measurement will be made for formed or sawed street pavement contraction joints; longitudinal weakened plane joints and non-load transfer expansion joints regardless of material. Include cost in unit price for Concrete Paving.
- D. No measurement will be made for joint for Curb, Curb and Gutter; Concrete Sidewalks; and Concrete Driveways. Include cost in unit price for Curb and Gutter; Concrete Sidewalks; and Concrete Driveways.

1.4 REFERENCES

- A. ASTM A615 Standard Specification for Deformed and Plain Billet – Steel Bars for Concrete Reinforcement.
- B. ASTM D994 – Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
- C. ASTM D1751 – Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).
- D. ASTM D3405 – Standard Specification for Joint Sealant, Hot-Poured, for Concrete and Asphalt Pavements.

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- E. ASTM D5893 – Standard Specification for Cold Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements.
- F. ASTM C920 – Standard Specification for Elastomeric Joint Sealants.

1.5 SUBMITTALS

- A. Submit product data and samples in accordance with requirements of Section 013300 – Submittals.
- B. Submit product data for joint sealing compound and proposed sealing equipment for approval.
- C. Submit samples of dowel cup, metal supports, and deformed metal strip for approval.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Board Expansion Joint Material: Filler board of selected stock. Use wood of density and type as follows:
 - 1. Clear, all-heart cypress weighing no more than 40 pounds per cubic foot, after being oven dried to constant weight.
 - 2. Clear, all-heart redwood weighing no more than 30 pounds per cubic foot, after being oven dried to constant weight.
- B. Preformed Expansion Joint Material: Bituminous fiber and bituminous composition material conforming to ASTM D994 and ASTM D1751.
- C. Joint Sealing Compound: Silicon based mastic, color to match paving, conforming to ASTM D5893 or ASTM C920.
- D. Load Transmission Devices:
 - 1. Smooth, steel dowel bars conforming to ASTM A615, Grade 60. When indicated on drawings, encase one end of dowel bar in approved cap having inside diameter 1/16 inch greater than diameter of dowel bar.
 - 2. Deformed steel tie bars conforming to ASTM A615, Grade 60.
- E. Metal Supports for Reinforcing Steel and Joint Assembly: Employ metal supports of approved shape and size that will secure reinforcing steel and joint assembly in correct position during placing and finishing of concrete. Space supports as directed by the Engineer.

PART 3 EXECUTION

3.1 PLACEMENT

- A. When new work is adjacent to existing concrete, place joints at same location as existing joints in adjacent pavement.
- B. If the limit of removal of existing concrete or asphaltic pavement does not fall on existing joint, saw cut existing pavement minimum of 1 –1/2 inches deep to provide straight, smooth joint surface without chipping, spalling or cracks.

3.2 CONSTRUCTION JOINTS

- A. Place transverse construction joint wherever concrete placement must be stopped for more than 30 minutes. Place longitudinal construction joints at interior edges of pavement lanes using No. 4 epoxy coated deformed tie-bars for pavement less than 8" thick or No. 5 epoxy coated deformed tie-bars for pavements 8"-10" thick, 30 inches long and spaced 18 inches on centers.

3.3 EXPANSION JOINTS

- A. Place 1/2 inch expansion joints at radius points of curb returns for cross street intersections, or as located in adjacent pavement but no further than 60 feet apart on straight runs of concrete walks. Use no boards shorter than 6 feet. When pavement is 24 feet or narrower, use no more than 2 lengths of board. Secure pieces to form straight joint. Shape board filler accurately to cross-section of concrete slab. Use load transmission devices of type and size shown on drawings. Seal with joint sealing compound.

3.4 CONTRACTION JOINTS

- A. Place contraction joints at same locations as in adjacent pavement or at spaces indicated on drawings. Where indicated on the drawings, place epoxy coated and oiled dowels accurately and normal to joint. Where indicated on the drawings placed deformed, epoxy coated tie-bars accurately and normal to joint. Seal groove with joint sealing compound. Joints should not exceed 10' O.C.

3.5 LONGITUDINAL WEAKENED PLANE JOINTS

- A. Place longitudinal weakened plane joints at spaces indicated on drawings. Seal groove with joint sealing compound.

3.6 SAWED JOINTS

- A. Contractor may use sawed joints as an alternate to contraction and weakened plane joints. Circular cutter shall be capable of cutting straight line groove minimum of 1/2 inch wide. Depth shall be one quarter of pavement thickness plus 1/2 inch. Commence sawing as soon as concrete has hardened sufficiently to permit cutting without chipping, spalling or tearing and prior to initiation of cracks. Once sawing has commenced, it shall be continued until 24 hours of concrete

placement. Saw joints at required spacing consecutively in sequence in concrete placement.

- B. Concrete Saw: Provide sawing equipment adequate in power to complete sawing to required dimensions and within required time. Provide at least one standby saw in good working order. Maintain sawing operations. Sawing equipment shall be on job at all times during concrete placement.

3.7 JOINTS FOR CURB, CURB AND GUTTER

- A. Place 1/2 inch expansion joints through curb and gutters at locations of expansion joints in adjacent pavement or sidewalk; at end of radius returns at street intersections and driveways and at curb inlets. Maximum spacing shall be 60 foot centers.

3.8 JOINTS FOR CONCRETE SIDEWALKS

- A. Provide 1/2 inch expansion joints conforming to ASTM A1751 along and across sidewalks at back of curbs, at intersections with driveway, steps, walls and across walk at intervals not to exceed 60 feet. Provide expansion joint material conforming to ASTM D994 for small radius curves and around fire hydrants and utility poles. Extend the expansion joint material full depth of the slab.

3.9 JOINT SEALING

- A. Seal joints after concrete has cured for minimum 21 days and only when surface and joints are dry, ambient temperature is above 50 degrees F and less than 85 degrees F, and weather is not foggy or rainy.
- B. Joint sealing equipment shall be in first class working condition, and be approved by the Engineer. Use concrete grooving machine or power-operated wire brush and other equipment such as plow, brooms, blowers or hydro or abrasive cleaning as required to produce satisfactory joints.
- C. Clean joints of loose scale, dirt, dust and curing compound. Term joint includes wide joint spaces, expansion joints, dummy groove joints or cracks, either preformed or natural. Remove loose material from concrete surfaces adjacent to joints.
- D. Install backer rod as indicated on drawings. Fill joints neatly with joint sealer to depth shown. Pour sufficient joint sealer into joints so that, upon completion, surface of sealer within joint will be 1/4 inch below level of adjacent surface or at elevation as directed.

3.10 PROTECTION

- A. Maintain joints in good condition until completion of work.
- B. Replace damaged joints material with new materials as required by this Section.

END OF SECTION 321306

PART 1 GENERAL

1.1 DESCRIPTION

- A. Work in this section includes curing of Portland Cement Concrete Paving.

1.2 RELATED WORK

- A. Earthwork – Section 310000
- B. Rigid Pavement – Section 321300

1.3 REFERENCES

- A. ASTM C171 – Standard Specifications for Sheet Materials for Curing Concrete.
- B. ASTM C309 – Standard Specifications for Liquid Membrane-Forming Compounds for Curing Concrete.

1.4 SUBMITTALS

- A. Submit manufacturer's product data for cover materials and liquid membrane-forming compounds.

PART 2 PRODUCTS

2.1 COVER MATERIALS FOR CURING

- A. Curing materials shall conform to one of the following:
 - 1. Polyethylene Film: Opaque pigmented white film conforming to requirements of ASTM C171.
 - 2. Waterproofed Paper: Paper conforming to requirements of ASTM C171.
 - 3. Cotton Mats: Single layer of cotton filler completely enclosed in cover of cotton cloth. Mats shall contain not less than $\frac{3}{4}$ of a pound of uniformly distributed cotton filler per square yard of mat. Cotton cloth used for covering materials shall weigh not less than 6 ounces per square yard. Mats shall be stitched so that mat will contact surface of pavement at all points when saturated with water.

2.2 LIQUID MEMBRANE – FORMING COMPOUNDS

- A. Liquid membrane-forming compounds shall conform to ASTM C309. Membrane shall restrict loss of water to not more than 0.55 Kg/m² of surface in 72 hours.

PART 3 EXECUTION

3.1 GENERAL

- A. Concrete pavement shall be cured by protecting it against loss of moisture for period of not less than 72 hours immediately upon completion of finishing operations. Do not use membrane curing for concrete pavement to be overlaid by asphaltic concrete.
- B. Where curing requires use of water, curing shall have prior right to all water supply or supplies. Failure to provide sufficient cover material shall be cause for immediate suspension of concreting operations.

3.2 POLYETHYLENE FILM CURING

- A. Immediately after finishing surface, and after concrete has taken its initial set, apply water in the form of a fine spray. Cover surface with polyethylene film so film will remain in intimate contact with surface during specified curing period.
- B. Cover entire surface and both edges of pavement slab. Joints in film sheets shall overlap minimum of 12 inches. Immediately repair tears or holes occurring during curing period by placing acceptable moisture-proof patches or by replacing.

3.3 WATERPROOFED PAPER CURING

- A. Immediately after finishing surface, and after concrete has taken its initial set, apply water in form of fine spray. Cover surface with waterproofed paper so paper will remain in intimate contact with surface during specified curing period.
- B. Prepare waterproofed paper to form blankets of sufficient width to cover entire surface and both edges of pavement slab, and not be more than 60 feet in length. Joints in blankets caused by joining paper sheets shall lap not less than 5 inches and shall be securely sealed with asphalt cement having melting point of approximately 180 degrees F. Place blankets to secure an overlap of at least 12 inches. Tears or holes appearing in paper during curing period shall be immediately repaired by cementing patches over defects.

3.4 COTTON MAT CURING

- A. Immediately after finishing surface, and after concrete has taken its initial set, completely cover surface with cotton mats, thoroughly saturated before application, in such manner that they will contact surface of pavement equally at all points.
- B. Mats shall remain on pavement for specified curing period. Keep mats saturated so that, when lightly compressed, water will drip freely from them. Keep banked earth or cotton mat covering edges saturated.

3.5 LIQUID MEMBRANE – FORMING COMPOUNDS

- A. Immediately after finishing surface, and after concrete has taken its initial set, apply liquid membrane-forming compound in accordance with manufacturer's instructions.

END OF SECTION 321307

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SECTION 32 15 40 - CRUSHED STONE PAVING

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. The Work of this Section includes demolition, earthwork, grading, furnishing, and placement of crushed stone paving.
 - 1. Furnish and place crushed stone paving, bonded with fine aggregate, constructed on a prepared underlying base course in accordance with these specifications and in conformity with the dimensions, typical cross section, and the lines and grades shown on the Drawings. The locations where crushed stone paving will be used are shown on the Drawings.
- B. Related Sections:
 - 1. Division 01 Section 01 71 23 "Layout of Work and Surveys".
 - 2. Division 01 Section 01 32 19 "Submittals".
 - 3. Division 01 Section 01 45 16 "Contractor Quality Control".
 - 4. Division 01 Section 01 57 13 "Erosion and Sedimentation Control".
 - 5. Division 31 Section 31 20 00 "Earth Moving".

1.3 REFERENCES

- A. ASTM C117 – Test Method for Materials Finer than No. 200 (75-um) Sieve in Mineral Aggregates by Washing.
- B. ASTM C136 – Method for Sieve Analysis of Fine and Coarse Aggregates.
- C. ASTM D1557 – Moisture Density Relations of Soils and Soil-Aggregate Mixture using 10-lb. Rammer and 18-in. Drop.
- D. ASTM D4318 – Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
- E. USP – U.S. Pharmacopeial Convention (1995).

1.4 SUBMITTALS

- A. Material Analysis: Contractor shall provide copies of the following test data required by ASTM:
 - 1. ASTM C136 - Sieve Analysis.
 - 2. ASTM C127 - Specific Gravity and Absorption.
 - 3. ASTM C131 - L.A. Abrasion.

- B. Samples: Provide a 1-pound sample of material for approval.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer whose work has resulted in successful establishment of plants.
 - 1. Experience: Three years' experience in landscape installation in addition to requirements in Division 01."
 - 2. Installer's Field Supervision: Require installer to maintain an experienced full-time supervisor on Project site when work is in progress.
- B. Preinstallation Conference: Conduct conference at Project Site.

1.6 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 conformance 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. Rejection of material.
 - 1. Evidence of inadequate protection or improper handling or storage shall be cause for rejection.
 - 2. Any product or material exhibiting signs of damage due to nonconformity to specifications or due to delivery, storage or handling shall be rejected by the Project Manager. Contractor shall be responsible for hauling off-site and disposing of according to general conditions and codes of the governing jurisdiction.

1.7 PROJECT CONDITIONS

- A. Environmental requirements: Work shall occur only when weather and soil conditions permit in accordance with locally accepted practice.
- B. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with proposed crushed stone paving areas by field measurements before proceeding with work.
- C. Interruption of Existing Services or Utilities: Do not interrupt services or utilities to facilities occupied by OWNER or others unless permitted under the following conditions

and then only after arranging to provide temporary services or utilities according to requirements indicated:

1. Notify Project Manager no fewer than 2 days in advance of proposed interruption of each service or utility.
2. Do not proceed with interruption of services or utilities without Project Manager written permission.

D. Existing Conditions:

1. Utilities: Determine location of existing and proposed underground utilities. Perform work in a manner to avoid possible damage. Hand excavate, as required.
2. Excavation: Maintain grade stakes set by others until removal is mutually agreed upon by parties concerned.

E. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained.

1.8 MAINTENANCE SERVICE

A. General: Maintain Work in accordance with Division 1.

1. Maintenance Period: Begin maintenance immediately after Work is completed. Maintain areas until the end of the Warranty period.

1.9 WARRANTY

A. See Division 1 Section "Warranty".

PART 2 - PRODUCTS

2.1 CRUSHED STONE PAVING

1. Type: Crushed stone or Crusher Fines. Shall be unused material free of shale, lay, friable materials, organics and debris.
2. Size Range:

Sieve Size	Percent Passing
2 inch	100
3/8 inch	100
No. 4	85
No. 8	63
No. 16	50
No. 30	39
No. 50	29
No. 100	18

3. Color: Uniform grey color range acceptable to Architect for use in paths

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas where the Work of this Section will be performed for compliance with requirements and conditions affecting installation and performance.
 - 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 the work area.
 - 2. Verify that final grades are completed in accordance with the drawings.
- B. Proceed with installation only after unsatisfactory conditions have been corrected and approved by Project Manager.

3.2 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing landscape areas from damage caused by the Work of this Section.
- 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. Install edging of type and in locations shown on drawings. Obtain acceptance of layout by Project Manager before excavating or installing. Make minor adjustments as required.

3.3 PLACEMENT OF CRUSHED STONE PAVING

- A. Cut earthwork to width of trail/area to receive crusher fines paving to approximate depth section as specified on the Drawings and Details. Remove, haul and dispose of excess material off site, or use on-site with approval of Project Manager.
- B. Complete excavation required in sub-grade before fine grading and final compaction of sub-grade is performed. Extend sub-grade compaction 1 foot beyond proposed edge of crushed stone paving or as indicated on drawings.
 - 1. Where excavation must be performed in completed sub-grade subsequent backfill and compaction shall be as specified in Division 31: Earth Moving. Completed sub-grade after filling such areas shall be uniformly and properly graded and compacted.
 - 2. Keep areas being graded or compacted shaped and drained during construction. Ruts greater than or equal to 1 inch deep in sub-grade shall be graded out and reshaped as required, and re-compacted before crushed stone paving placement.
 - 3. If the trail is part of a cross slope it should drain in the direction of the slope no greater than 2%. Ensure that no low spots exist so that ponding does not occur.

- C. Prior to placement of Crushed Stone Paving material, the sub-grade shall be proof rolled. Where soft spots are detected, scarify subgrade beneath Crushed Stone Paving trail to a minimum of 6-inch depth. Moisture treat and compact to a minimum 95% proctor density as determined by ASTM D698 or AASHTO T-99. Take moisture density tests every 250 lineal feet of trail or proof roll. Treat and compact sub-grade, leaving it 5-inches below final grade for placement of Crushed Stone Paving. Compact material and retest by proof rolling to achieve approval of Project Manager.
- D. Install crushed stone paving only after excavation and construction work which might injure it have been completed, and after edging has been completely installed on the compacted sub-grade.
- E. Compact to 95% of maximum density as determined by ASTM D1557. Compact with vibratory plate compactor or method approved by Project Manager.
 - 1. Maintain surface course moisture content within $\pm 3\%$ of optimum. Add water to quarry fines paving as required to achieve optimum moisture content and a uniform, compacted surface conforming to the finish grades indicated.
 - 2. Compact areas inaccessible to rolling by mechanical tamping.
- F. Protect crushed stone paving from soil or other contaminants during and following installation.
- G. Spread and compact additional crushed stone paving to achieve the required minimum compacted thickness of 6 inches. Compact per 3.3.F above.
- H. Form a firm, uniform, accurate and unyielding crushed stone paving at required elevations, slopes and to required lines.
- I. Tolerances:
 - 1. Variations in slope and grade of finished gravel mulch shall be less than or equal to 1/8-in. when tested with a 10 ft. straightedge, applied both parallel and at right angles to centerline of paved areas.
 - 2. Variations in smoothness shall be less than 1/4 inch when tested with a 10 foot straightedge. Irregularities exceeding these amounts of which retain water on surface shall be corrected by removing defective work and replacing with new material conforming to this specification.

3.4 MAINTENANCE AND REPAIRS:

- A. Crusher Fines Paving:
 - 1. Maintain crusher fines paving. Areas that do not compact, become eroded or are degraded in visual quality and/or performance as determined by the Project Manager are to be removed and/or repaired. Obtain approval of repair methods from Project Manager prior to affecting repairs.

3.6 PLACEMENT

- A. Cut earthwork to width of trail and approximate depth for the 4-inch trail section as specified on the Drawings and Details. Remove, haul and dispose of excess material off site.

- B. Prior to placement of Crushed Stone Paving material, the sub-grade shall be proof rolled. Where soft spots are detected, scarify subgrade beneath Crushed Stone Paving trail to a minimum of 6-inch depth. Moisture treat and compact to a minimum 95% proctor density as determined by ASTM D698 or AASHTO T-99. Take moisture density tests every 250 lineal feet of trail or proof roll. Treat and compact sub-grade, leaving it 5-inches below final grade for placement of Crushed Stone Paving. Compact material and retest by proof rolling.
- C. Spread Crushed Stone Paving onto trail. Rake the Crushed Stone Paving smooth, roll and compact to meet proposed grade. Establish cross-slope for drainage across the trail as specified in the Drawings. If ground is level, crown the trail to have positive drainage off both sides.
 - 1. If the trail is part of a cross slope it should drain in the direction of the slope no greater than 2%. Ensure that no low spots exist so that ponding does not occur.

3.7 CLEANUP AND PROTECTION

- A. During installation, keep adjacent areas clean and work area in an orderly condition. All areas shall be clean at the end of each workday.
- B. Protect completed Crushed Stone Paving operations and operations from other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged paving.
 - 1. Erect temporary fencing or barricades and warning signs as required protecting newly planted grass areas from traffic, other trades, and trespassers. Maintain fencing and barricades throughout initial maintenance period and remove with approval of Project Manager.
- C. Project completion: All debris, soil, trash, and excavated and/or stripped material resulting from Crushed Stone Paving operations and unsuitable for or in excess of requirements for completing work of this Section shall be disposed of off-site.
- D. Maintain protection during installation and maintenance periods. See Division 1. Treat, repair or replace damaged work as required.

END OF SECTION 32 15 40

SECTION 321723 - PAVEMENT MARKING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Layout and paint lines and direction arrows, signs, handicapped designations, etc. at:
 - a. Parking garage slabs
 - b. Asphaltic and concrete vehicular paving
2. Paint curbs as indicated

B. Related Sections:

1. Asphalt Paving: Section 321200 Flexible Paving
2. Cement Paving: Section 321300 Rigid Pavement

1.2 QUALITY ASSURANCE

- A. Applicator Qualifications: Company specializing in pavement marking with proper equipment for pavement marking project of this size.

1.3 PROJECT CONDITIONS

- A. Environmental Requirements: Do not apply pavement marking in wet weather or when temperature is below 50 degrees F.

PART 2 PRODUCTS

2.1 STRIPING PAINT

- A. Paint: Alkyd paint complying with Colorado State Highway Department Specifications.
1. Color: Yellow or as directed by Architect and Civil Engineer.

PART 3 EXECUTION

3.1 MARKING

A. Preparation and Layout:

1. After paving is fully cured, broom sweep paving clean.
2. Clean pavement with high pressure air or high pressure wash.
3. Layout: Layout and paint symbols, direction arrows, signs, etc., on asphalt paving, concrete paving and parking garage slabs as indicated on Drawings.

4. Verify marking layouts with Engineer / Architect before proceeding.

B. Markings:

1. Lines: Four inches wide painted by mechanical striping machine.
2. Markings: Apply lining and other markings sufficient quantity to produce completely opaque lines and markings.
3. Inlaid Markings: As noted on plans (all markings in CDOT right of way shall be inlaid). Grooved width shall be the pavement marking width plus 1 inch, with a tolerance of $\pm \frac{1}{4}$ inch. The depth of the grooves shall be 130 mils $\pm$ 5 mils. Groove position shall be a minimum of 2 inches from the edge of the pavement marking to the longitudinal pavement joint. The bottom of the groove shall have a smooth, flat finished surface. The spacers between blade cuts shall be such that there will be less than a 10 mil rise in the finished groove between the blades. Grooves shall be clean, dry and free of laitance, oil, dirt, grease, paint or other foreign contaminants. The Contractor shall prevent traffic from traversing the grooves, and re-clean grooves, as necessary, prior to application of the preformed plastic pavement markings.

END OF SECTION 321723

SECTION 32 18 16 - PLAYGROUND PROTECTIVE SURFACING**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. Unitary synthetic poured rubber seamless surface.
 - 2. Sand Play Surface
- B. Related Sections:
 - 1. Division 01 Section "Layout of Work and Surveys".
 - 2. Division 01 Section "Submittals".
 - 3. Division 01 Section "Contractor Quality Control".
 - 4. Division 01 Section "Erosion and Sedimentation Control".
 - 5. Division 01 Section "Material and Equipment".
 - 6. Division 01 Section "Tree Retention and Protection".
 - 7. Division 03 Section "Cast-In-Place Concrete".
 - 8. Division 31 Section "Earth Moving".
 - 9. Division 31 Section "Crushed Stone Paving".
 - 10. Division 31 Section "Concrete Walks, Curbs, and Miscellaneous Flatwork".
 - 11. Division 33 Section "Subdrainage"

1.3 DEFINITIONS

- A. Critical Height: Standard measure of shock attenuation. According to CPSC No. 325, this means "the fall height below which a life-threatening head injury would not be expected to occur."
- B. SBR: Styrene-butadiene rubber.

1.4 PERFORMANCE REQUIREMENTS

- A. Impact Attenuation: According to ASTM F 1292.
- B. Accessibility of Surface Systems: According to ASTM F 1951.
- C. Minimum Characteristics for Organic Loose-Fill Surfaces: According to ASTM F 2075.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each playground surface system, include materials, plans, cross sections, drainage, installation, penetration details, and edge termination (including

loose fill edgings). Samples for Initial Selection: For each type of playground surface system indicated.

1. Include similar samples of playground surface system and accessories involving color selection.
- C. Samples for Verification: For each type of playground surface system indicated.
1. Minimum 1-quart loose-fill surface sealed in a container.
 2. Minimum 6-by-6-inch Sample of synthetic rubber seamless surface.
 3. Minimum 12-by-12-inch Sample of geosynthetic fabric.
 4. Minimum 6-by-6-inch Sample of geosynthetic, molded-sheet drainage panel.
 5. Subdrainage materials as required by Division 33 Section "Subdrainage".
- D. Product Schedule: For playground surface systems.
- E. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:
1. Extent of surface systems and use zones for equipment.
 2. Critical heights for playground surfaces and fall heights for equipment.
- F. Material Certificates: For each type of playground surface system, from manufacturer.
- G. Material Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each playground surface system.
- H. Product Certificates: For each type of unitary synthetic playground surface system, from manufacturer.
- I. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each unitary synthetic playground surface system.
- J. Field quality-control reports.
- K. Warranty: Sample of special warranty.
- L. Maintenance Data: For playground surface system to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer. Installer's Site Superintendent is to have a minimum of 5 years of experience installing similar materials on similarly scaled projects.
- B. Source Limitations: Obtain playground surface system materials, including primers and binders, from single source from single manufacturer.
1. Provide secondary materials including adhesives, primers, geosynthetics, and repair materials of type and from source recommended by manufacturer of playground surface system materials.
- C. Standards and Guidelines: Comply with CPSC No. 325, "Handbook for Public Playground Safety"; ASTM F 1292; and ASTM F 1487.

1.7 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit playground surface system installation to be performed according to manufacturers' written instructions and warranty requirements.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of playground surface system that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Reduction in impact attenuation.
 - b. Deterioration of surface and other materials beyond normal weathering.
 - 2. Warranty Period: Three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 UNITARY SYNTHETIC DUAL-DENSITY SEAMLESS SURFACE

- A. Surface System: Poured-in-place, two-layer system with wearing course over cushion course. Provide manufacturer's standard thickness for each layer as required for overall thickness indicated, tested for impact attenuation according to ASTM F 1292 and for accessibility according to ASTM F 1951.
 - 1. Products: Subject to compliance with requirements, provide one of the following, but are not limited to, the following:
 - a. PebbleFlex Playground Surfacing; Landscape Structures, Inc.
 - 2. Wearing Course: Formulation of EPDM rubber particles, with minimum of 20 percent and maximum of 26 percent of ethylene propylene-diene-saturated polymethylene main chain along with other organic and inorganic components.
 - 3. Cushion Course: Manufacturer's standard formulation of SBR particles and polyurethane, site mixed and applied.
 - 4. Binder: Weather-resistant, UV-stabilized, flexible, nonhardening, 100 percent solids polyurethane complying with requirements of authorities having jurisdiction for nontoxic and low VOC content.
 - 5. Lacquer Top Coat: Manufacturer's standard polyurethane-based formulation.
 - 6. Critical Height: As indicated.
 - 7. Overall Thickness: Not less than as required for critical height indicated.
 - 8. Primer/Adhesive: Manufacturer's standard primer and weather-resistant, moisture-cured polyurethane adhesive suitable for unit, substrate, and location indicated.
 - 9. Wearing Course Color(s): As selected by Project Manager from manufacturer's full range and as indicated on plans and details
 - a. Color As indicated on Drawings.
- B. Leveling and Patching Material: Portland cement-based grout or epoxy- or polyurethane-based formulation suitable for exterior use and approved by playground surface system manufacturer.

- A. Play Sand: The sand shall be a natural, washed sand of rounded particles, free of fines, clay, silt, stones, or other debris and a designated play sand
- a. Sand shall meet the following gradation specifications.
- | Sieve Size | Percent Passing |
|------------|-----------------|
| 9.5 mm | 100 |
| 6.7 mm | 100 |
| 4.75 mm | 99.9 |
| 2.36 mm | 97-100 |
| 1.18 mm | 70-90 |
| 600 um | 25-60 |
| 300 um | 5-25 |
| 150 um | 0-3 |
| 75 um | 0-1 |
- B. Testing and Quality
- a) The contractor is to supply a 1 kg. sample of the installed sand control plus gradation test results from an independent consultant when requested by the Project Manager. If the installed sand fails the gradation test, the contractor will be responsible for removing the failed sand from the site and replacing it with approved City of Denver Playground Sand. All damage to the site and park equipment, as a result of sand removal, will be reinstated by the contractor. Test costs borne by the City of material found to be substandard shall be charged against the contractor.

2.3 GEOSYNTHETICS

- A. Drainage/Separation Geotextile: Nonwoven, needle-punched geotextile, manufactured for subsurface drainage applications and made from polyolefins or polyesters. Complying with the following minimum properties determined according to ASTM D 4759 and referenced standard test methods:
1. Weight: 4 oz./sq. yd. according to ASTM D 5261.
 2. Water Flow Rate: 100 gpm/sq. ft. according to ASTM D 4491.
- B. Weed-Control Barrier: Composite fabric geotextile consisting of woven, needle-punched polypropylene substrate bonded to a nonwoven polypropylene fabric, weighing not less than 4.8 oz./sq. yd..

2.4 DRAINAGE

- A. See Division 33 Section "Subdrainage Systems".

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for maximum moisture content, subgrade and substrate conditions, drainage, and other conditions affecting performance of the Work.

surface system installation and that substrate surfaces are dry, cured, and uniformly sloped to drain within recommended tolerances according to playground surface system manufacturer's written requirements for cross-section profile.

1. Concrete Substrates: Verify that substrates are dry, free from surface defects, and free of laitance, glaze, efflorescence, curing compounds, form-release agents, hardeners, dust, dirt, loose particles, grease, oil, and other contaminants incompatible with playground surface system or that may interfere with adhesive bond. Determine adhesion, dryness, and acidity characteristics by performing procedures recommended in writing by playground surface system manufacturer.

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

3.2 PREPARATION

- A. General: Prepare substrates to receive surfacing products according to playground surface system manufacturer's written instructions. Verify that substrates are sound and without high spots, ridges, holes, and depressions.
- B. Concrete Substrates: Provide sound surface free of laitance, efflorescence, curing compounds, and other contaminants incompatible with playground surface system.
 1. Repair unsatisfactory surfaces and fill holes and depressions.
 2. Mechanically scarify or otherwise prepare concrete substrates to achieve recommended degree of roughness.
 3. Saw cut concrete for terminal edges of playground surface systems as indicated.
 4. Treat control joints and other nonmoving substrate cracks to prevent telegraphing through playground surface system.

3.3 INSTALLATION, GENERAL

- A. General: Comply with playground surface system manufacturer's written installation instructions. Install playground surface system over area and in thickness indicated.

3.4 DRAINAGE SYSTEMS

- A. Install drainage systems as indicated on Drawings, Details, and per Division 33 Section "Subdrainage Systems".

3.5 GEOSYNTHETIC INSTALLATION

- A. General: Install geosynthetics according to playground surface system manufacturer's and geosynthetic manufacturer's written instructions.
 1. Geotextiles: Completely cover area indicated, overlapping sides and edges a minimum of 8 inches with manufacturer's standard treatment for seams.
 - a. Perimeter: Adhere edges on all sides to top of perimeter curb or footing.

3.6 INSTALLATION OF SEAMLESS PLAYGROUND SURFACE SYSTEMS

- A. Seamless Surface: Mix and apply components of playground surface system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface and impact-attenuating system of total thickness indicated.

1. Substrate Primer: Apply over prepared substrate at manufacturer's standard spreading rate for type of substrate.
2. Poured Cushion Course: Spread evenly over primed substrate to form a uniform layer applied at manufacturer's standard spreading rate in one continuous operation, with a minimum of cold joints.
3. Intercoat Primer: Over cured cushion course, apply primer at manufacturer's standard spreading rate.
4. Wearing Course: Spread over primed base course to form a uniform layer applied at manufacturer's standard spreading rate in one continuous operation and, except where color changes, with a minimum of cold joints. Finish surface to produce manufacturer's standard wearing-surface texture.
 - a. Where colored pattern is indicated, place adjacent colored material as soon as placed colored material is sufficiently cured, using primer or adhesive if required by manufacturer's written instructions.
5. Lacquer Topcoat: Spray or roller applied at manufacturer's standard coating rate in one continuous operation.
6. Edge Treatment: Flush. Fully adhere edges to substrate with full coverage of substrate. Maintain fully cushioned thickness required to comply with safety performance requirements.

3.7 INSTALLATION OF PLAY SAND PLAYGROUND SURFACE SYSTEMS

- A. Edgings: Place as indicated and detailed, and permanently secure in place and attach to each other according to edging manufacturer's written instructions and/or as shown on drawings.
- B. Play Sand: Place playground surface system materials including manufacturer's standard amount of excess material for compacting naturally with time to required depths after Installation of playground equipment support posts and foundations.
- C. Stabilizing Mats: Coordinate installation of mats and mat anchoring system with placing and compacting of loose fill.
- D. Compacting and Grading: Uniformly compact and grade loose fill to an even surface free from irregular surface changes as indicated.
- E. Finish Grading: Hand rake to a smooth finished surface and to required elevations.

3.8 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Testing Services: Testing and inspecting of completed applications of playground surface system shall take place according to ASTM F 1292.
- C. Remove and replace applications of playground surface system where test results indicate that it does not comply with requirements.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with requirements.

- A. Seamless Systems: Prevent vehicular traffic in total and pedestrian traffic over play surfacing for not less than 48 hours after installation or per manufacturer's recommendations, whichever is longer.
- B. Protect play areas from construction debris, including dust, dirt, runoff, trash and equipment following installation for the duration of construction.

3.10 CLEAN UP

- A. Maintain a neat and orderly work site at all times.
- B. Upon completion of site work, clean up area, remove tools, equipment, materials and debris.

END OF SECTION 32 18 16

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SECTION 323113 - CHAIN LINK FENCES AND GATES**PART 1 - GENERAL****1.1 SUMMARY**

- A. Section includes chain-link fences and swing gates.

1.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design chain-link fences and gates, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Chain-link fence and gate framework shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to ASCE/SEI 7:
 - 1. Minimum Post Size: Determine according to ASTM F 1043 for framework up to 12 feet (3.66 m) high, and post spacing not to exceed 10 feet (3 m).
 - 2. Minimum Post Size and Maximum Spacing: Determine according to CLFMI WLG 2445.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- C. Samples: For each polymer-coated product and for each color and texture specified, in 6-inch (150-mm) lengths for components and on full-sized units for accessories.
- D. Delegated-Design Submittal: For chain-link fences and gate framework indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of chain-link fence and gate, from manufacturer.
- B. Product Test Reports: For framing strength according to ASTM F 1043.
- C. Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which Installer agrees to repair or replace components of chain-link fences and gates that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CHAIN-LINK FENCE FABRIC

- A. General: Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist. Comply with CLFMI Product Manual and with requirements indicated below:
 - 1. Fabric Height: As indicated on Drawings.
 - 2. Steel Wire Fabric as indicated on drawings.
 - 1) Color: Black, complying with ASTM F 934.
 - 3. Selvage: Knuckled at both selvages.
 - 4. Polymer-Coated Fabric: ASTM F 668, **Class 2b** over **Zn-5-Al-MM-alloy**-coated steel wire.
 - 1) Color: **Black**, complying with ASTM F 934.

2.2 FENCE FRAMING

- A. Posts and Rails: Comply with ASTM F 1043 for framing, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thickness according to ASTM F 1043 or ASTM F 1083 based on the following:
 - 1. Fence Height: As indicated on Drawings.
 - 2. Light Industrial Strength: Material Group IC-L, round steel pipe, electric-resistance-welded pipe.
 - a. Line Post: 1.9 inches (48 mm) in diameter.
 - b. End, Corner and Pull Post: 2.375 inches (60 mm).
 - 3. Heavy Industrial Strength: Material Group IA, round steel pipe, Schedule 40.

- a. Line Post: 1.9 inches (48 mm) in diameter.
 - b. End, Corner and Pull Post: 2.375 inches (60 mm) in diameter.
4. Horizontal Framework Members: Intermediate, top, and, bottom rails complying with ASTM F 1043.
 5. Brace Rails: Comply with ASTM F 1043.
 6. Polymer coating over metallic coating.
 - a. Color: Black, complying with ASTM F 934.

2.3 TENSION WIRE

- A. Polymer-Coated Steel Wire: 0.148-inch- (3.8-mm-) diameter, tension wire complying with ASTM F 1664, Class 1 over Zn-5-Al-MM-alloy-coated steel wire.
 1. Color: Black, complying with ASTM F 934.

2.4 SWING GATES

- A. General: Comply with ASTM F 900 for gate posts and single and double swing gate types.
 1. Gate Leaf Width: As indicated.
 2. Gate Fabric Height: As indicated.
- B. Pipe and Tubing:
 1. Aluminum: Comply with ASTM B 429/B 429M; manufacturer's standard. Black powder coat finish.
 2. Gate Posts: Round tubular steel.
 3. Gate Frames and Bracing: Round tubular steel.
- C. Frame Corner Construction: assembled with corner fittings.
- D. Hardware:
 1. Hinges: 180-degree outward swing.
 2. Latches permitting operation from both sides of gate, with provision for padlocking accessible from both sides of gate.
 3. Padlock and Chain: Owner furnished.
 4. Lock: Manufacturer's standard.
 5. Closer: Manufacturer's standard.

2.5 FITTINGS

- A. General: Comply with ASTM F 626.
- B. Finish:

1. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz. /sq. ft. (366 g /sq. m) zinc.
 - a. Polymer coating over metallic coating.
2. Aluminum: Mill finish.

2.6 GROUT AND ANCHORING CEMENT

- A. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout, recommended in writing by manufacturer, for exterior applications.
- B. Erosion-Resistant Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with potable water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended in writing by manufacturer, for exterior applications.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for a verified survey of property lines and legal boundaries, site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.
 1. Do not begin installation before final grading is completed unless otherwise permitted by Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet (152.5 m) or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.
- D. Install chain-link fencing to comply with ASTM F 567 and more stringent requirements indicated.
- E. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.
- F. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.
 1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.

2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
 - a. Exposed Concrete: Extend 2 inches (50 mm) above grade; shape and smooth to shed water.
 - b. Concealed Concrete: Top 2 inches (50 mm) below grade as indicated on Drawings to allow covering with surface material.
 - c. Posts Set into Concrete in Sleeves: Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions, and finished sloped to drain water away from post.
 - d. Posts Set into Voids in Concrete: Form or core drill holes not less than 5 inches (125 mm) deep and 3/4 inch (20 mm) larger than OD of post. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions, and finished sloped to drain water away from post.
- G. Terminal Posts: Locate terminal end, corner, and gate posts per ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment of as indicated on Drawings.
- H. Line Posts: Space line posts uniformly at 10 feet (3 m) o.c.
- I. Tension Wire: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Provide horizontal tension wire at the following locations:
 1. Extended along top and bottom of fence fabric.
- J. Chain-Link Fabric: Apply fabric to inside of enclosing framework. Leave 1 inch (25.4 mm) between finish grade or surface and bottom selvage unless otherwise indicated.
- K. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.
- L. Gates: Adjust gates 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.

END OF SECTION 323113

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SECTION 323200.05 - BOULDER RETAINING WALL

PART 1. GENERAL

1.1 DESCRIPTION

- A. The work shall consist of providing and installing all components of the work specified herein and shown on the drawings, and performing all work items related to boulder retaining wall (boulder wall) construction.
- B. The wall type shall be dry-stacked, quarried rock boulders (without grout), of less than to four feet in height.
- C. Related Work:
 - 1. Earthwork: Section 310000
 - 2. Site Clearing: Section 311000
 - 3. Erosion and Sediment Control: Section 312500

1.2 SUBMITTALS

- A. Prior to start of construction, Contractor shall provide the Owner with a sample of indicated stone, for review and approval by Owner and Owner's Representatives, with proposed range of color, texture, workmanship to be expected in the completed work, and material properties referenced under Part 2 of this specification.

1.3 PROJECT CONDITIONS

1.3.1 Cold Weather Conditions

- A. Contractor shall not place boulders for wall construction on frozen ground.
- B. Contractor shall remove boulders determined by the Engineer to be frozen or damaged by freezing conditions, and shall replace boulders at no additional cost to the Owner.

PART 2. MATERIALS

2.1 BOULDERS

- A. Boulders furnished by the Contractor should be angular to subangular in shape and from approximately 2 to 4 feet in diameter.
- B. Boulders used in the wall shall be hard, strong, sound, durable, with roughly squared edges, and sufficiently angular to provide effective interlocking between individual boulders, with approval of the Engineer.

2.2 FILTER FABRIC

- A. Contractor shall provide 4 oz, non-woven geotextile filter fabric, such as Mirafi 140 N, or approved equivalent.

2.3 DRAIN PIPE

- A. Contractor shall provide 4-inch nominal diameter, perforated, corrugated, HDPE pipe, product N-12 produced by Advanced Drainage Systems, Inc., or approved equivalent.

2.4 AGGREGATE

- A. Contractor shall provide ¾-inch maximum, clean, crushed rock, with less than 12 percent passing a #200 sieve (0.074 mm) for placement between back of boulder wall and excavation cut face.

2.5 RELATIVELY IMPERMEABLE BACKFILL

- A. Contractor shall provide relatively impermeable backfill, such as on-site low plastic soils, as approved by the Engineer.

PART 3. CONSTRUCTION

3.1 PREPARATION

- A. Contractor shall fine grade areas to receive boulder wall.
- B. Contractor shall moisture condition, prepare, and compact, as required, the subgrade under the boulder wall to at least 95 percent of the maximum standard Proctor dry density, in accordance with ASTM D698.

3.2 INSTALLATION

3.2.1 General

- A. Contractor shall construct wall at location and elevations shown on plans.
- B. Contractor shall place filter fabric, drain pipe, and aggregate between boulders and excavated cut face, as applicable, and as shown on the drawings.
- C. Filter fabric-wrapped drain pipe and boulders shall be placed as shown on the drawings, to minimize the quantity of aggregate required between boulders and excavated cut face or soil nail wall. Contractor shall verify that drain pipe is not damaged or deformed by boulder placement.
- D. Contractor shall verify that the drain pipe drains by gravity to a suitable outlet.
- E. Fill slopes or other slopes behind completed boulder walls shall not exceed a slope of 2H:1V from the top, rear edge of the wall.
- F. Finished grade in front of boulder wall shall be graded to drain water away from the wall.

3.2.2 Boulder Wall

- A. Contractor shall key the wall base a minimum of one foot below final grade in front of the wall, as shown on the drawings.
- B. Boulders shall be placed to provide sufficient interlocking between boulders over the height, width, and length of the wall, as approved by the Engineer.
- C. The Contractor shall place boulders to form substantial masonry presenting a neat, finished appearance.
- D. Boulder wall face shall be uniformly battered along the length of the wall, and meet the batter requirements shown on the drawings.

3.2.3 Backfilling

- A. Upon completion of individual layers of boulder wall stone, Contractor shall place aggregate in voids between back of boulders and the filter fabric. Placement of aggregate shall fill said voids, to the satisfaction of the Engineer.
- B. Filter fabric may be tacked to cut slope using nails during construction.
- C. Relatively impermeable backfill shall be placed between final grade behind the wall and underlying aggregate materials, as shown on the drawings.
- D. Aggregate and relatively impermeable backfill shall be compacted as specified in Section 02300 if the dimensions of the backfilled zones accommodate operation of hand-held compaction equipment, as determined and approved by the Engineer. Contractor shall verify that compaction does not damage the wall.

END OF SECTION 323200.05

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SECTION 328423 - IRRIGATION**PART 1 - GENERAL****1.1 WORK INCLUDED** - Work of this Section generally includes provisions for the installation of an underground landscape irrigation system including the following:

- A. Static pressure verification and coordination of irrigation system installation with landscape material installation.
- B. Trenching, stockpiling excavation materials, refilling and compacting trenches.
- C. Complete irrigation system including but not limited to piping, backflow preventer assemblies, valves, fittings, heads, controllers and wiring, and final adjustments to insure complete coverage.
- D. Water connections.
- E. Replacement of unsatisfactory materials.
- F. Clean-up, Consultant Reviews, and Project Acceptance.
- G. Tests.

1.2 RELATED SECTIONS

- A. Examine all sections related to project work.

1.3 REFERENCES

- A. Perform Work in accordance with requirements of Conditions of the Contract and Division 01 - General requirements as well as provisions of all applicable laws, codes, ordinances, rules, and regulations.
- B. Conform to requirements of reference information listed below except where more stringent requirements are shown or specified in Contract Documents.
 - 1. American Society for Testing and Materials (ASTM) - Specifications and Test Methods specifically referenced in this Section.
 - 2. Underwriters Laboratories (UL) - UL Wires and Cables.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications - Installer shall have had considerable experience and demonstrate ability in the installation of irrigation system(s) of specific type(s) in a neat orderly, and responsible manner in accordance with recognized standards of workmanship. To demonstrate ability and experience necessary for this Project,

and financial stability, submit if requested by Consultant, prior to contract award the following:

1. List of 3 projects completed in the last 2 years of similar complexity to this Project. Description of projects shall include:
 - a. Name of project.
 - b. Location.
 - c. Owner.
 - d. Brief description of work and project budget.

B. Special Requirements:

1. Work involving substantial plumbing for installation of copper piping, backflow preventer(s), and related work shall be executed by licensed and bonded plumber(s). Secure a permit at least 48 hours prior to start of installation.
2. Tolerances - Specified depths of mains and laterals and pitch of pipes are minimums. Settlement of trenches is cause for removal of finish grade treatment, refilling, compaction, and repair of finish grade treatment.
3. Coordination with Other Contractors - Protect, maintain, and coordinate Work with Work under other Section.
4. Damage To Other Improvements - Contractor shall replace or repair damage to grading, soil preparation, seeding, sodding, or planting done under other Sections during Work associated with installation of irrigation system at no additional cost to Owner.

C. Pre-Construction Conference - Contractor shall schedule and conduct a conference to review in detail quality control and construction requirements for equipment, materials, and systems used to perform the Work. Conference shall be scheduled not less than 10 days prior to commencement of Work. All parties required to be in attendance shall be notified no later than 7 days prior to date of conference. Contractor shall notify qualified representatives of each party concerned with that portion of Work to attend conference, including but not limited to Architect, Consultant, Contractor's Superintendent, and Installer.

1. Minutes of conference shall be recorded and distributed by Contractor to all parties in attendance within five days of conference.

1.5 SUBMITTALS - Prepare and make submittals in accordance with conditions of the Contract.

A. Materials List - Submit six copies of a complete materials list indicating manufacturer, model number, and description of all materials and equipment to be used. Show appropriate dimensions and adequate detail to accurately portray intent of construction.

B. Record Drawings (As-Builts):

1. At onset of irrigation installation secure Autocadd files of original irrigation design from Owner. At the end of every day, revise as-built prints for work accomplished that day in red ink. As-built field prints shall be brought up-to-

date at the close of the working day every Friday by a qualified draftsman. A print of record plan(s) shall be available at Project Site. Indicate zoning changes on weekly as-built drawings. Indicate non-pressure piping changes on as-built. Upon completion of Project, but prior to scheduling of substantial acceptance walk-through, submit for review a final set of as-built mylars and an Autocadd disk copy. Dimensions, from two permanent points of reference (building corners, sidewalk, road intersections or permanent structures), location of following items:

- a. Connection to existing water lines.
- b. Routing of sprinkler pressure lines (dimension maximum 100 feet along routing).
- c. Sprinkler control valves.
- d. Quick coupling valves.
- e. Manual drains and stop and waste valves.
- f. Drip line blow-out stubs.
- g. Control wire routing if not with pressure mainline.
- h. Gate valves.
- i. Control wire and communication cable splices
- j. Water meters
- k. Locations of all sleeving including size, quantity and depth of sleeve
- l. Flow sensors
- m. Pressure regulating valves

2. Owner's Representative will not certify any pay request submitted by the Contractor if the as-built drawings are not current, and processing of pay request will not occur until as-builts are up-dated.

- C. Operation Instructions - Submit 3 written operating instructions including winterization procedures and start-up, with cut sheets of products, and coordinate controller/watering operation instruction with Owner maintenance personnel.

1. Controller Charts:
 - a. Do not prepare charts until Consultant has reviewed record (as-built) drawings.
 - b. Provide one controller chart for each automatic controller installed.
 - 1) Chart may be reproduction of record drawing, if scale permits fitting of controller door. If photo reduction prints are required, keep reduction to maximum size possible to retain full legibility.
 - 2) Chart shall be blue-line print of actual "as-built" system, showing area covered by that controller.
 - c. Identify area of coverage of each remote control valve, using a distinctly different pastel color drawing over entire area of coverage.
 - d. Following review of charts by Consultant, they shall be hermetically sealed between two layers of 20-mm thick plastic sheet
 - e. Charts shall be completed and reviewed prior to final review of irrigation system.

- 1.6 DELIVERY, STORAGE, AND HANDLING - Deliver, unload, store, and handle materials, packaging, bundling, products in dry, weatherproof, condition in manner to prevent damage, breakage, deterioration, intrusion, ignition, and vandalism. Deliver in original unopened

packaging containers prominently displaying manufacturer's name, volume, quantity, contents, instructions, and conformance to local, state, and federal law. Remove and replace cracked, broken, or contaminated items or elements prematurely exposed to moisture, inclement weather, snow, ice, temperature extremes, fire, or jobsite damage.

- A. Handling of PVC Pipe - Exercise care in handling, loading and storing, of PVC pipe. All PVC pipe shall be transported in a vehicle that allows length of pipe to lie flat so as not to subject it to undue bending or concentrated external loads. All sections of pipe that have been dented or damaged shall be discarded, and if installed, shall be replaced with new piping.

1.7 JOBSITE CONDITIONS:

- A. Protection of Property:

- 1. Preserve and protect all trees, plants, monuments, structures, and paved areas from damage due to Work of this Section. In the event damage does occur, all damage to inanimate items shall be completely repaired or replaced to satisfaction of Owner, and all injury to living plants shall be repaired by Owner. All costs of such repairs shall be charged to and paid by Contractor.
 - 2. Protect buildings, walks, walls, and other property from damage. Flare and barricade open ditches. Damage caused to asphalt, concrete, or other building material surfaces shall be repaired or replaced at no cost to Owner. Restore disturbed areas to original condition.

- B. Existing Trees:

- 1. All trenching or other Work under limb spread of any and all evergreens or low branching deciduous material shall be done by hand or by other methods so as to prevent damage to limbs or branches.
 - 2. Where it is necessary to excavate adjacent to existing trees use all possible care to avoid injury to trees and tree roots. Excavation, in areas where 2 inch and larger roots occur, shall be done by hand. Roots 2 inches or larger in diameter, except directly in the path of pipe or conduit, shall be tunneled under and shall be heavily wrapped with burlap to prevent scarring or excessive drying. Where a trenching machine is operated close to trees having roots smaller than 2 inches in diameter, wall of trench adjacent to tree shall be hand trimmed, making clean cuts through roots. Trenches adjacent to trees shall be closed within 24 hours, and when this is not possible, side of trench adjacent to tree shall be kept shaded with moistened burlap or canvas.

- C. Protection and Repair of Underground Lines:

- 1. Request proper utility company to stake exact location (including depth) of all underground electric, gas, or telephone lines. Take whatever precautions are necessary to protect these underground lines from damage. If damage does occur, Utility Owner shall repair all damage. Contractor shall pay all costs of such repairs unless other arrangements have been made.
 - 2. Request Owner, in writing, to locate all private utilities (i.e., electrical service

to outside lighting) before proceeding with excavation. If, after such request and necessary staking, private utilities that were not staked are encountered and damaged by Installer, Owner shall repair them at no cost to Installer. If Contractor damages staked or located utilities, they shall be repaired by Utility Owner at Contractor's expense unless other arrangements have been made.

- D. Replacement of Paving and Curbs - Where trenches and lines cross existing roadways, paths, curbing, etc., damage to these shall be kept to a minimum and shall be restored to original condition.

1.8 **WARRANTY/GUARANTY:** - Manufacturer shall warrant materials against defects for a period of one year from date of Substantial Completion. Installer(s) shall guaranty workmanship for similar period.

- A. Settling of backfilled trenches that may occur during guaranty period shall be repaired at no expense to Owner, including complete restoration of damaged property.
- B. Expenses due to vandalism before substantial completion shall be borne by Contractor.
- C. Owner will maintain turf and planting areas during warranty period, so as not to hamper proper operation of irrigation system.

1.9 **MAINTENANCE:**

- A. Furnish the following maintenance items to Owner prior to final Acceptance:
 - 1. Two Sets of special tools required for removing, disassembling, and adjusting each type of sprinkler head and valve supplied on this Project.
 - 2. One eight foot valve key for operation of stop and waste valve.
 - 2. Two six foot valve keys for operation of gate valves.
 - 3. Two keys for each automatic controller.
 - 4. Two quick coupler keys and two matching hose swivels for each type of quick coupling valve installed.
 - 5. Two aluminum drain valve keys of sufficient length for operation of drain valves.
- B. Winterization - include cost in bid for winterizing complete system at conclusion of sprinkling season (in which system received final acceptance) within 3 days notification by the Owner. System shall be voided of water using compressed air or similar method reviewed by Consultant. Reopen, operate, and adjust system malfunctions accordingly during April of following season within 3 days of notification by Owner.

1.10 **EXTRA STOCK** - In addition to installed system furnish the following items to Owner:

- A. 10 Pop-up spray heads with nozzles of each type used.
- B. 4 Rotor heads of each type used.

- C. 30 Drip emitters of each type used.
- D. 2 Single Station Decoders

PART 2 - PRODUCTS

2.1 MATERIALS:

A. General Piping:

- 1. Pressure Supply Line (from point of connection through backflow prevention unit) - Type "k" Hard Copper (3/4" – 2 1/2") and ductile iron (3" and larger).
- 2. Pressure Supply Lines (downstream of backflow prevention units) - Class 200 PVC BE (1" - 2 1/2") and Class 200 PVC RT (3" and larger).
- 3. Non-pressure Lines - Class 200 PVC BE.
- 4. PVC Sleeving - Class 160 PVC..
- 5. Drip Tubing - Toro Dura-Pol EHD 1645 3/4" with .050 inch wall thickness.
- 6. Emitter Tubing - As recommended by emitter manufacturer.

B. Copper Pipe and Fittings:

- 1. Copper Pipe - Type K, hard tempered.
- 2. Fittings - Wrought copper, solder joint type.
- 3. Joints - Soldered with solder, 45% silver, 15% copper, 16% zinc, and 24% cadmium and solidus at 1125~F and liquids at 1145~F.

C. Brass Pipe and Fittings:

- 1. Brass Pipe - 85% red brass, ANSI Schedule 40 screwed pipe.
- 2. Fittings - Medium brass, screwed 125-pound class.

D. Ductile Iron Pipe and Fittings:

- 1. Ductile Iron Pipe – Centrifugal cast ductile iron in metal molds for water pipe in accordance with ANSI C151 and AWWA A21.51 with asphaltic exterior coating and interior lining and coating in accordance with ANSI C151 and AWWA A21.
- 2. Fittings – Mechanical joint as supplied by the pipe manufacturer and rated for working pressures of 350 psi.
- 3. Gaskets – Furnish in accordance with ANSI C111 and AWWA A21.11.

E. Plastic Pipe and Fittings:

- 1. Identification Markings:
 - a. Identify all pipe with following indelible markings:
 - 1) Manufacturer's name.
 - 2) Nominal pipe size.
 - 3) Schedule of class.

- 4) Pressure rating.
 - 5) NSF (National Sanitation Foundation) seal of approval.
 - 6) Date of extrusion.
2. Solvent Weld Pipe - Manufactured from virgin polyvinyl chloride (PVC) compound in accordance with ASTM D2241 and ASTM D1784; cell classification 12454-B, Type 1, Grade 1.
 - a. Fittings - Standard Wright, Schedule 40, injection molder PVC; complying with ASTM D1784 and D2466, cell classification 12454-B.
 - 1) Threads - Injection molded type (where required).
 - 2) Tees and ells - Side gated.
 - b. Threaded Nipples - ASTM D2464, Schedule 80 with molded threads.
 - c. Teflon Tape – All PVC male threaded fittings and nipples, excluding marlex fittings, shall receive wrapping of Teflon tape applied to threaded surfaces per pipe manufacturer's recommendations.
 - d. Joint Cement and Primer - Type as recommended by manufacturer of pipe and fittings..
3. Gasketed End Pipe - Manufactured from virgin Polyvinyl Chloride compound in accordance with ASTM D2241 and ASTM D1784; cell classification 1254-B, Type 1, Grade 1.
 - a. Fittings and Services Tees (3" and larger) - Ductile iron, grade 70-55-05 in accordance with ASTM A-536. Fittings shall have deep bell push-on joints with gaskets meeting ASTM F-477.
 - b. Gaskets - Factory installed in pipe and fittings, having a metal or plastic support within gasket or a plastic retainer ring for gasket.
 - c. Lubricant - As recommended by manufacturer of pipe fittings..
4. Flexible Plastic Pipe - Manufactured from virgin polyethylene in accordance with ASTM D2239, with a hydrostatic design stress of 630 psi and designated as PE 2306.
 - a. Fittings – Insert type manufactured in accordance with ASTM D2609; PVC Type 1 cell classification 12454-B.
 - b. Clamps - All stainless steel worm gear screw clamps. Use 2 clamps per joint on 1-1/2 inch and 2 inch fittings..

F. Drip and Sub-Surface Irrigation Systems:

1. Drip Tubing - Manufactured of flexible vinyl chloride compound conforming to ASTM D1248, Type 1, Class C, Category 4, P14 and ASTM D3350 for PE 122111C.
2. Fittings - Type and diameter recommended by tubing manufacturer.
3. Drip Valve Assembly - Type and size shown on Drawings.
 - a. Wye Strainer - Plastic construction with 150 mesh nylon screen and 1/2 inch blowout assembly.
 - b. Control Valve - 2 way, solenoid pilot operated type made of synthetic, non-corrosive material; diaphragm activated and slow closing. Include freely pivoted seat seal; retained (mounted) without attachment to diaphragm.
 - c. Pressure Reducing Valve - Plastic construction as detailed.
 - d. Single station decoder
4. Emitters - Single port, pressure compensating, press on type.
5. Sub-Surface tubing - Size and type shown on Drawings; installed as

detailed.

G. Gate Valves:

1. Gate Valves for 3/4 inch through 2-1/2 Inch Pipe - Brass construction; solid wedge, IPS threads, and non-rising stem with wheel operating handle.
2. Gate Valves for 3 Inch and Larger Pipe - Iron body, brass or bronze mounted AWWA gate valves with a clear waterway equal to full nominal diameter of valve; rubber gasket or mechanical joint-type only. Valves shall be able to withstand a continuous working pressure of 200 psi and be equipped with a square operating nut and resilient wedge. Provide pipe restraints on gate valves 3 inches or larger as detailed.

H. Quick Coupling Valves - Brass two-piece body designed for working pressure of 150 PSI; operable with quick coupler. Equip quick coupler with locking rubber cover.

I. Valve Boxes:

1. Gate Valves, Quick Coupling Valves, Drain Valves, Drip Line Blow-out Stubs, and Wire Splice or Stub Box - Carson Brooks #910-10, box, with T-Covers, as detailed.
2. 1 inch through 2 inch Control Valves, Master Valves, Pressure Regulating Valves and Communication Cable Splice box - Carson Brooks #1419-12 box with T-Covers, as detailed.
3. Drip Valve Assemblies and Flow Sensors - Carson Brooks #1220-12 box, with T-Covers, as detailed.

J. Electrical Control Wiring:

1. Low Voltage:
 - a. Electrical Control Wire - UFUL approved No. 14/14 (2-wire Paige #170116RB or as per manufactures requirements) direct burial copper wire to operate system as designed.
 - b. If multiple controllers are utilized, refer to wire routing plan for individual wire runs.
 - c. Control Wire connections and splices shall be made with 3M DBR-6 direct bury splice.
 - d. Loop five (5) feet minimum of 2-wire cable into all valve boxes.
 - e. If multiple controllers are utilized, each controller shall have it's own 2-wire cable run, controllers can not be connected with same 2-wire run.
2. High Voltage - Type required by local codes and ordinances, of proper size to accommodate needs of equipment serviced.

J. Automatic Controller (2-Wire) - Size and type shown on Drawings; mounted as detailed.

1. Single Station Decoders (2-Wire) - Size and type shown on Drawings; mounted as

detailed.

- a. Install decoders and wire per manufacture recommendations and requirements.
 - b. Grounding for all decoders and 2-wire cable, to be per manufactures recommendations and requirements. Minimum one grounding assembly per every 1000' of wire and/or every 12th decoder and at all ends of the wire runs.
- L. Electric Control Valves - Size and type shown on Drawings having manual flow adjustment and manual bleed nut, single station decoder.
- M. Sprinkler Heads - As indicated on Drawings. Fabricated riser units in accordance with details on Drawings - with fittings and nipples of equal diameter as riser inlet in sprinkler body.
- N. Master Valve - Size and type indicated on Drawings.
- O. Flow Sensor - Size and type indicated on Drawings.
- Q. Backflow Preventer - Size and type indicated on Drawings; Brass or iron construction with 150 psi working pressure.

PART 3 - EXECUTION

3.1 SITE CONDITIONS, LANDSCAPE PLAN REVIEW AND COORDINATION

- A. Contractor will be held responsible for coordination between landscape and irrigation system installation. Landscape material locations shown on the Landscape Plan shall take precedence over the irrigation system equipment locations. If irrigation equipment is installed in conflict with the landscape material locations shown on the Landscape Plan, the Contractor will be required to relocate the irrigation equipment, as necessary, at Contractor's expense.
- B. Contractor is responsible to notify Consultant of any field conditions that vary from the conditions shown on the Irrigation Construction Documents. If Contractor fails to notify Consultant of these conditions, Contractor will be held responsible for all costs associated with system adjustments required due to the change in field conditions.

3.2 STATIC PRESSURE VERIFICATION - Contractor shall field verify the static pressure at the project site, prior to commencing work or ordering irrigation materials, and submit findings, in writing, to Consultant. If Contractor fails to verify static water pressure prior to commencing work or ordering irrigation materials, Contractor shall assume responsibility for all costs required to make system operational and the costs required to replace any damaged landscape material. Damage shall include all required material costs, design costs and plant replacement costs.

3.3 INSPECTION: - Examine areas and conditions under which Work of this Section is to be performed. Do not proceed with Work until unsatisfactory conditions have been corrected.

- A. Grading operations, with the exception of final grading, shall be completed and approved by Owner before staking or installation of any irrigation system begins.
- B. Underground Utilities shall be installed prior to installation of irrigation system. If irrigation installation takes place prior to utility installation, Contractor shall notify Owner of this condition in writing prior to commencement of irrigation installation.

3.4 PREPARATION:

- A. Staking shall Occur as Follows:
 - 1. Mark, with powdered lime, routing of pressure supply line and flag heads for first few zones. Contact Consultant 48 hours in advance and request review of staking. Proposed locations of all trees shall be field staked by Contractor and approved by Owner/Landscape Architect prior to Consultant review of irrigation staking. Consultant will advise installer as to the amount of staking to be prepared. Consultant will review staking and direct changes if required. Review does not relieve installer from coverage problems due to improper placement of heads after staking.
 - 2. Contractor shall contact Consultant if field spacing varies by +/- 10% of the spacing shown on the irrigation plans. If Contractor fails to notify Consultant of variances exceeding 10%, Contractor assumes full responsibility for the costs associated with any required system modifications deemed necessary by the Consultant or Owner.
 - 3. If Project has significant topography, freeform planting beds, or other amenities, which could require alteration of irrigation equipment layout as deemed necessary by Consultant, do not install irrigation equipment in these areas until Consultant has reviewed equipment staking.
- B. Install sleeving under asphalt paving and concrete walks, prior to concreting and paving operations, to accommodate piping and wiring. Compact backfill around sleeves to 95% Modified Proctor Density within 2% of optimum moisture content in accordance with STM D1557.
- C. Trenching - Trench excavation shall follow, as much as possible, layout shown on Drawing. Dig trenches straight and support pipe continuously on bottom of trench. Trench bottom shall be clean and smooth with all rock and organic debris removed.
 - 1. Clearances:
 - a. Piping 3 Inches and Larger - Make trenches of sufficient width (14 inches minimum) to properly assemble and position pipe in trench. Minimum clearance of piping 3 inches or larger shall be 5 inches horizontally on both sides of the trench.
 - b. Piping Smaller than 3 Inches - Trenches shall have a minimum width of 7 inches.
 - c. Line Clearance - Provide not less than 6 inches of clearance between each line and not less than 12 inches of clearance between lines of other trades.
 - 2. Pipe and Wire Depth:
 - a. Pressure Supply Piping – 24-30 inches from top of pipe.
 - b. PVC Sleeving – To match depth of sleeved material.

- c. Non-pressure Piping (rotor) - 18 inches from top of pipe.
- d. Non-pressure Piping (pop-up) - 12 inches from top of pipe.
- e. Control Wiring/Communication Cable - Side of pressure main or at 18 inch depth if installed in a separate trench with no mainline piping..
- f. Drip Tubing - 12 inches from top of pipe.
- g. Emitter Tubing (Micro-tubing) - 8 inches from top of pipe.
- 3. Boring will be permitted only where pipe must pass under obstruction(s) which cannot be removed. In backfilling bore, final density of backfill shall match that of surrounding soil. It is acceptable to use sleeves of suitable diameter installed first by jacking or boring, and pipe laid through sleeves. Observe same precautions as though pipe were installed in open trench.
- 4. Vibratory Plow - Non-pressure piping may be installed through use of vibratory plow method if consultant determines soil conditions are satisfactory for this method of installation. Vibratory plowing does not relieve installer of minimum pipe depths.D.

3.5 **INSTALLATION** - Locate other equipment as near as possible to locations designated. Consultant shall review deviations prior to installation.

A. **PVC Piping** - Snake pipe in trench as much as possible to allow for expansion and contraction. Do not install pipe when air temperature is below 40 degrees F. Place manual drain valves at low points and dead ends of pressure supply piping to insure complete drainage of system. When pipe installation is not in progress, or at end of each day, close pipe ends with tight plug or cap. Perform Work in accordance with good practices prevailing in piping trades.

- 1. **Solvent Weld PVC Pipe** - Lay pipe and make all plastic to plastic joints in accordance with manufacturer's recommendations.
- 2. **Gasketed End Pipes:**
 - a. Lay pipe and make pipe to fitting or pipe to pipe joint, following OR70 recommendations (Johns-Manville Guide for Installation of Ring-Tite Pipe), or pipe manufacturer's recommendations.
 - b. Construct concrete thrust blocks behind all gasketed fittings, tees, bends, reducers, line valves, and caps in accordance with pipe manufacturer's recommendations. Contact Consultant prior to placing thrust blocks, for observation of thrust block excavation and initial placement. Thrust block bearing surface shall be calculated based on tables below. All bearing surfaces shall be undisturbed soil:

THRUST BLOCK SIZING GUIDE:

Thrust developed per 100 PSI pressure (lbs. force) for various fitting configurations.

Pipe Size	Fitting 90° Elbow	Fitting 45° Elbow	Valves, Tees Dead Ends
3	1,000	600	800
4	1,800	1,100	1,300
6	4,000	2,300	2,900
8	7,200	4,100	5,100
10	11,200	6,300	7,900
12	16,000	9,100	11,300

Approximate bearing strength of typical soils.

Soil Type	lbs/ft 2
Mulch, Peat, etc.	0
Soft Clay	500
Sand	1,000
Sand And Gravel	1,500
Sand And Gravel With Clay	2,000
Sand And Gravel Cemented With Clay	4,000
Hard Pan	5,000

Example Calculation: 6 inch 90 degree elbow in sand and gravel soil

$$\begin{aligned}\text{Bearing Surface Area (square feet)} &= 4,000 \text{ lbs} / 1,500 \text{ lbs/ft}^2 \\ &= 2.67 \text{ square feet bearing surface area} \\ &\text{on undisturbed soil}\end{aligned}$$

3. Flexible Plastic (Polyethylene) Pipe - Lay pipe and assemble fittings following manufacturer's recommendations.

B. Drip Tubing:

1. Make all fitting connections as per manufacturers recommendations.
2. Use only manufacturer provided or recommended hole punch when making penetrations in drip tubing for insert fittings. Use of any other hole punch shall be cause for immediate removal and replacement of all installed drip tubing.
3. Install drip line blow-out stubs at all dead ends of drip tubing.

C. Control Wiring:

1. Low Voltage Wiring:
The wire paths shall be twisted pair, solid-core, color-coded red/blue pairs with each conductor in a polyethylene jacket suitable for direct burial. The two-wire paths shall be UL approved No. 14/14 (2-wire Paige #170116RB). The two-wire paths may be spliced, or "teed", permitting extensions of the path in multiple directions. In general, the distance from the controller to the end of any one end of a "tee" or wire run shall not exceed the maximum for the gauge of wire, even if the total of all wire exceeds that number. For example, a path comprised of No.14/14 (rated for 10,000ft./3km) could extend 5000 ft./1.5km to a "tee" splice, and each arm of the tee could extend an additional 5000 ft./1.5km. The total wire connected would equal 15,000 ft./4.5km, but the distance from the controller, to the end of each run, would be 10,000ft./3km or less, meeting the specification. All wire splices must be made in a valve box with DBR-6 or equal direct-burial waterproof connectors.
2. High Voltage Wiring for Automatic Controller:

- a. Provide 120 volt power connection to automatic controller.
- b. All electric work shall conform to local codes, ordinances, and authorities having jurisdiction. All high voltage electrical work shall be performed by licensed electrician.

D. Automatic Controller:

1. Install controller in accordance with manufacturer's instructions as detailed and where shown on Drawings.
2. Connect remote control valves to controller in numerical sequence as shown on Drawings.
3. Owner shall approve final location of controller prior to installation.
4. Each controller shall be a dedicated separate ground wire and grounding rod as detailed. Earth grounding shall be connected via a factory supplied copper ground lug inside the controller, for connection to earth ground hardware via 6 AWG(4mm dia.) copper wire (see ASIC Earth Grounding Guideline 100-2002 for details of earth grounding irrigation control systems available online at www.asic.org). Ground wire shall be extended underground, at right angles to any communications wiring, to approved direct burial earth grounding hardware at least 6 ft./2m from the controller location. Earth Ground shall be have an impedance of 10 Ohms or less, or shall meet the standards of the Earth Grounding Guideline cited above
5. All above ground conduit shall be rigid galvanized with appropriate fittings. All below ground conduit shall be schedule 40 PVC.

E. Electric Control Valves - Install cross-handle four inches below finished grade where shown on Drawings as detailed. When grouped together, allow minimum of 12 inches between valve box sides. Install each remote control valve in a separate valve box. Install valve box flush with grade or when present flush with surfacing material (rock mulch). When parallel to roadway, sidewalk or other permanent element or structure, control valve and box to be installed perpendicular to element or structure, spaced equally.

1. All connections in the two-wire paths (outside the controller enclosure) shall be made with 3M DBR-6 waterproof, strain-relieving direct burial connectors, or exact equals. Decoder output to solenoid connections shall be made with 3M DBY waterproof, strain-relieving connectors, or exact equals. No substitution of wire or wire connector specifications is permissible. All connections, tees, and splices shall be positioned in valve boxes for future location and service.
2. The installer shall provide adequate earth ground (not to exceed 10 Ohms, or in compliance with practices as defined in American Society of Irrigation Consultants Earth Grounding Guideline 100-2002, available at www.asic.org) and connect it to one of the decoder ground leads every 1000 ft.(330m), or every 12th decoder module, whichever is shorter. Minimum ground hardware shall be a 4" x 36" (100 x 915mm) copper plate with at least 10AWG/2.5mm dia. copper wire. In high lightning areas, grounding may be increased to every 500 ft./150m or 10 decoders.
Ground connections from decoder ground lead to grounding hardware shall be made by joining the 12AWG (2mm dia.) decoder ground wire with a 10AWG (2.5mm dia.) solid copper lead in an approved wire nut of appropriate size, inserted in a DBR-6 waterproof direct burial connector, or with an approved wire

clamp. Ground hardware shall extend at right angles from the two-wire red/blue path, and ground hardware shall be located at least 6ft./2m away from the two-wire path.

- F. Quick Coupling Valves - Install quick couplers on swing-joint assemblies as indicated on construction details; plumb and flush to grade. Angled nipple relative to pressure supply line shall be no more than 45 degrees and no less than 10 degrees.
- G. Drip and Sub-Surface Valve Assemblies - Install valve assembly as detailed
- H. Drip Emitters - Stake all surface emitters as detailed and staked with acceptable tubing stakes.
- I. Drain Valves - Install one manual drain valve on pressure supply line directly downstream of backflow preventer as detailed. Provide a three cubic foot drainage sump for drain valve as detailed.
- J. Valve Boxes:
 - 1. Install one valve box for each type of valve installed as detailed. Valve box extensions are not acceptable except for master valves and flow sensors. Install gravel sump after compaction of all trenches. Place final portion of gravel inside valve box after valve box is backfilled and compacted.
 - 2. Brand controller letter and station number on lid of each valve box. Letter and number size shall be no smaller than 1 inch and no greater in size than 1 1/2 inches. Depth of branding shall be no more than 1/8 inch into valve box lid.
- K. Gate Valves - Install where shown on Drawings as detailed.
- L. Sprinkler Heads - Install sprinkler heads where designated on Drawings or where staked. Set to finish as detailed. Spacing of heads shall not exceed the maximum indicated on Drawing unless re-staked as directed by Consultant. In no case shall the spacing exceed maximum recommended by manufacturer. Install heads on swing joints or riser assemblies as detailed. Adjust part circle heads for proper coverage. Adjust heads to correct height after sod is installed. Plant placement shall not interfere with intended sprinkler head coverage, piping, or other equipment. Consultant may request nozzle changes or adjustments without additional cost to the Owner.
- M. Backflow Preventer - Install as detailed at location designated on Drawings.
- N. Master Valve - Install where shown on Drawings as detailed.
- O. Flow Sensor - Install where shown on Drawings as detailed.
- P. Backfilling - Do not begin backfilling operations until required system tests have been completed. Backfill shall not be done in freezing weather except with review by Consultant. Leave trenches slightly mounded to allow for settlement after backfilling is completed. Trenches shall be finish graded prior to walk-through of system by Consultant.

1. Materials - Excavated material is generally considered satisfactory for backfill purposes. Backfill material shall be free of rubbish, vegetable matter, frozen materials, and stones larger than 1 inch in maximum dimension. Do not mix subsoil with topsoil. Material not suitable for backfill shall be hauled away. Contractor shall be responsible for providing suitable backfill if excavated material is unacceptable or not sufficient to meet backfill, compaction, and final grade requirements.
2. Do not leave trenches open for a period of more than 48 hours. Open excavations shall be protected in accordance with OSHA regulations.
3. Compact backfill to 90% maximum density, determined in accordance with ASTM D155-7 utilizing the following methods:
 - a. Mechanical tamping.
 - b. Puddling or ponding. Puddling or ponding and/or jetting is prohibited within 20'-0" of building or foundation walls.

Q. Piping Under Paving:

1. Provide for a minimum cover of 18 inches between the top of the pipe and the bottom of the aggregate base for all pressure and non-pressure piping installed under asphaltic concrete or concrete paving.
2. Piping located under areas where asphalt or concrete paving will be installed shall be bedded with sand (a layer 6" below pipe and 6" above pipe).
3. Compact backfill material in 6" lifts at 90% maximum density determined in accordance with ASTM D155-7 using manual or mechanical tamping devices.
4. Set in place, cap, and pressure test all piping under paving, in presence of Owner prior to backfilling and paving operations.
5. Piping under existing walks or concrete pavement shall be done by jacking, boring, or hydraulic driving, but where cutting or breaking of walks and/or concrete is necessary, it shall be done and replaced at not cost to Owner. Obtain permission to cut or break walks and/or concrete from Owner.

R. Water Supply and Point of Connection - Water supply shall be extended as shown from water supply lines.

3.6 FIELD QUALITY CONTROL:

- A. Flushing - After piping, risers, and valves are in place and connected, but prior to installation of sprinkler heads, quick coupler assemblies, and hose valves, thoroughly flush piping system under full head of water pressure from dead end fittings. Maintain flushing for 5 minutes through furthestmost valves. Cap risers after flushing.
- B. Pressure Testing - Conduct test in presence of Consultant. Arrange for presence of Consultant 48 hours in advance of testing. Supply force pump and all other test equipment. Compressed air shall not be used for pressure testing system.
 1. After backfilling, and installation of all control valves, fill pressure supply line with water, and pressurize to 40 PSI over the designated static pressure or 120 PSI, whichever is greater, for a period of 2 hours.

2. Leakage, Pressure Loss - Test is acceptable if no loss of pressure is evident during the test period.
3. Leaks - Detect and repair leaks.
4. Retest system until test pressure can be maintained for duration of test.
5. Before final acceptance, pressure supply line shall remain under pressure for a period of 48 hours.
6. Pressure test shall be scheduled and passed prior to scheduling of Substantial Completion Walk-through.

C. Walk-Through for Substantial Completion:

1. Arrange for Consultant's presence 48 hours in advance of walk-through.
2. Entire system shall be completely installed and operational prior to scheduling of walk-through.
3. Operate each zone in its entirety for Consultant at time of walk-through and additionally, open all valve boxes if directed.
4. Generate a list of items to be corrected prior to Final Completion.
5. Furnish all materials and perform all work required to correct all inadequacies of coverage due to deviations from Contract Documents.
6. During walk-through, expose all drip emitters under operations for observation by Consultant to demonstrate that they are performing and installed as designed, prior to placing of all mulch material. Schedule separate walk-through if necessary.
7. Supply Consultant with prints of irrigation as-builts prior to scheduling substantial completion walk-through.

D. Walk-Through for Final Completion:

1. Arrange for Consultant's presence 48 hours in advance of walk-through.
2. Show evidence to Consultant that Owner has received all accessories, charts, record drawings, and equipment as required before Final Completion walk-through is scheduled.
3. Operate each zone, in its entirety for Consultant at time of walk-through to insure correction of all incomplete items.
4. Items deemed not acceptable by Consultant shall be reworked to complete satisfaction of Consultant.
5. If after request to Consultant for walk-through for Final Completion of irrigation system, Consultant finds items during walk-through which have not been properly adjusted, reworked, or replaced as indicated on list of incomplete items from previous walk-through, Contractor shall be charged for all subsequent walk-throughs. Funds will be withheld from final payment and/or retainage to Contractor, in amount equal to additional time and expenses required by Consultant to conduct and document further walk-throughs as deemed necessary to insure compliance with Contract Documents.

- 3.7 ADJUSTING - Upon completion of installation, fine-tune entire system by adjusting patterns and break-up pins, and setting pressure reducing valves at proper and similar pressure to provide optimum and efficient coverage. Flush and adjust all sprinkler heads for optimum performance and to prevent overspray onto walks, roadways, and buildings as much as possible. Heads of same type shall be operating at same pressure +/- 10%.

- A. If it is determined that irrigation adjustments will provide proper coverage, and improved water distribution as determined by Consultant, contractor shall make such adjustments prior to Final Acceptance, as directed, at no additional cost to Owner. Adjustments may also include changes in nozzle sizes, degrees of arc, and control valve throttling.
 - B. All sprinkler heads shall be set perpendicular to finish grade unless otherwise noted on Construction Plans or directed by Consultant.
 - C. Areas which do not conform to designated operation requirements due to unauthorized changes or poor installation practices shall be immediately corrected at no additional cost to the Owner.
- 3.8 CLEANING - Maintain continuous cleaning operation throughout duration of work. Dispose of, off-site at no additional cost to Owner, all trash or debris generated by installation of irrigation system.

END OF SECTION 328423

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SECTION 329113 - SOIL PREPARATION**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

1.2 SUMMARY

- A. The Work of this Section includes preparation of soil for the purpose of amending the soil for irrigation sod and shrub bed areas.
 - 1. Soil preparation consists of ripping, fertilizing, soil conditioning and fine grading the topsoil. Soil preparation as specified herein MUST precede all seeding, sodding, and planting.

- B. Related Work:
 - 1. Section 310000 - Earthwork
 - 2. Section 329220 - Native Seeding
 - 3. Section 329223 - Sodding
 - 4. Section 329300 - Plants

1.3 SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include recommendations for application and use.
 - 2. Include test data substantiating that products comply with requirements.
 - 3. Include sieve analyses for aggregate materials.
 - 4. Material Certificates: For each type of soil amendment and fertilizer before delivery to the site, according to the following:
 - a. Manufacturer's qualified testing agency's certified analysis of standard products.
- B. Samples: For each bulk-supplied material, 1-gallon volume of each in sealed containers labeled with content, source, and date obtained. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of composition, color, and texture.
- C. Quality Control Submittals:
 - 1. Certificates: State, Federal and other inspection certificates shall accompany invoice for materials showing source or origin. Submit to Owners Representative prior to acceptance of material.
 - 2. Material Analysis: Provide soil conditioner analysis performed no more than three months prior to delivery to site.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Fertilizer: Deliver inorganic or chemical fertilizer to site in original unopened containers bearing manufacturer's guaranteed chemical analysis, chemical name, trade name, trademark and conformance to state law, bearing name and warranty of producer.
- B. Notify Owners Representative of delivery schedule in advance so material can be inspected upon arrival at project site. Immediately remove unacceptable material from project site.

1.5 PROJECT/SITE CONDITIONS

- A. General: Do not perform work when climate and existing site conditions will not provide satisfactory results.
- B. Vehicular site access shall be limited to the area(s) indicated on the drawings or as defined by the Owners Representative.
- C. Damage to lawns, natural areas, pavements, irrigation systems, underground utilities, and other improvements shall be repaired by the contractor at no additional cost to the Client.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent, state-operated, or university-operated laboratory; experienced in soil science, soil testing, and plant nutrition; with the experience and capability to conduct the testing indicated; and that specializes in types of tests to be performed.
 - 1. Laboratories: Subject to compliance with requirements:
 - a. Colorado Analytical, Brighton, Colorado 303.659.2313. or approved equal
 - 2. Multiple Laboratories: At Contractor's option, work may be divided among qualified testing laboratories specializing in physical testing, chemical testing, and fertility testing.

1.7 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified testing agency approved by the Owners Representative to perform preconstruction soil analyses on existing imported soil.
- B. Imported Soil Analyses: For each unamended imported soil source, perform testing on soil samples and furnish soil analysis and a written report containing soil-amendment and fertilizer recommendations by a qualified testing agency performing the testing according to "Soil-Sampling Requirements" and "Testing Requirements" articles.
 - 1. Have testing agency identify and label samples and test reports according to sample collection and labeling requirements.

1.8 SOIL-SAMPLING REQUIREMENTS

- A. General: Extract soil samples according to requirements in this article.
- B. Sample Collection and Labeling: Have samples taken and labeled by Contractor in presence of Architect under the direction of the testing agency.
 - 1. Number and Location of Samples: Minimum of 8 representative soil samples from varied locations in Grant Frontier Park.
 - 2. Procedures and Depth of Samples: According to USDA-NRCS's "Field Book for Describing and Sampling Soils."
 - 3. Division of Samples: Split each sample into two, equal parts. Send half to the testing agency and half to Owner for its records.
 - 4. Labeling: Label each sample with the date, location keyed to a site plan or other location system, visible soil condition, and sampling depth.

1.9 TESTING REQUIREMENTS

- A. General: Perform tests on soil samples according to requirements in this article.
- B. Physical Testing:
 - 1. Soil Texture: Soil-particle, size-distribution analysis by one of the following methods according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods":
 - a. Sieving Method: Report sand-gradation percentages for very coarse, coarse, medium, fine, and very fine sand; and fragment-gradation (gravel) percentages for fine, medium, and coarse fragments; according to USDA sand and fragment sizes.
 - b. Hydrometer Method: Report percentages of sand, silt, and clay.
 - 2. Total Porosity: Calculate using particle density and bulk density according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
 - 3. Water Retention: According to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
 - 4. Saturated Hydraulic Conductivity: According to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods"; at 85% compaction according to ASTM D 698 (Standard Proctor).
- C. Chemical Testing:
 - 1. CEC: Analysis by sodium saturation at pH 7 according to SSSA's "Methods of Soil Analysis - Part 3- Chemical Methods."
 - 2. Clay Mineralogy: Analysis and estimated percentage of expandable clay minerals using CEC by ammonium saturation at pH 7 according to SSSA's "Methods of Soil Analysis - Part 1- Physical and Mineralogical Methods."
 - 3. Metals Hazardous to Human Health: Test for presence and quantities of RCRA metals including aluminum, arsenic, barium, copper, cadmium, chromium, cobalt, lead, lithium, and vanadium. If RCRA metals are present, include recommendations for corrective action.
 - 4. Phytotoxicity: Test for plant-available concentrations of phytotoxic minerals including aluminum, arsenic, barium, cadmium, chlorides, chromium, cobalt,

copper, lead, lithium, mercury, nickel, selenium, silver, sodium, strontium, tin, titanium, vanadium, and zinc.

- D. Fertility Testing: Soil-fertility analysis according to standard laboratory protocol of SSSA NAPT NCR-13, including the following:
1. Percentage of organic matter.
 2. CEC, calcium percent of CEC, and magnesium percent of CEC.
 3. Soil reaction (acidity/alkalinity pH value).
 4. Buffered acidity or alkalinity.
 5. Nitrogen ppm.
 6. Phosphorous ppm.
 7. Potassium ppm.
 8. Manganese ppm.
 9. Manganese-availability ppm.
 10. Zinc ppm.
 11. Zinc availability ppm.
 12. Copper ppm.
 13. Sodium ppm and sodium absorption ratio.
 14. Soluble-salts ppm.
 15. Presence and quantities of problem materials including salts and metals cited in the Standard protocol. If such problem materials are present, provide additional recommendations for corrective action.
 16. Other deleterious materials, including their characteristics and content of each.
- E. Organic-Matter Content: Analysis using loss-by-ignition method according to SSSA's "Methods of Soil Analysis - Part 3- Chemical Methods."
- F. Recommendations: Based on the test results, state recommendations for soil treatments and soil amendments to be incorporated to produce satisfactory planting soil suitable for healthy, viable plants indicated. Include, at a minimum, recommendations for nitrogen, phosphorous, and potassium fertilization, and for micronutrients.
1. Fertilizers and Soil Amendment Rates: State recommendations in weight per 1000 sq. ft.
 2. Soil Reaction: State the recommended liming rates for raising pH or sulfur for lowering pH according to the buffered acidity or buffered alkalinity in weight per 1000 sq. ft.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and compliance with state and Federal laws if applicable.
- B. Bulk Materials:
1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.

2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Do not move or handle materials when they are wet or frozen.
4. Accompany each delivery of bulk fertilizers and soil amendments with appropriate certificates.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Install soil amendments as required in Section 310000 - Earthwork
- B. Soil Conditioner:
 1. Composted material shall consist of aged organic matter, free of weed or other noxious plant seeds, lumps, stones, or other foreign contaminants harmful to plant life, and having the following characteristics based on a nutrient test performed no longer than 3 months prior to its incorporation into the project:
 - a. Organic matter: 25% maximum.
 - b. Salt content: 5.0 mmhos/cm maximum.
 - c. pH: 7.5, maximum.
 - d. Carbon to nitrogen ratio shall be less than 20:1.
 2. Mountain peat, aspen humus, gypsum and sand will not be accepted.
 3. Acceptable product: Class I compost, such as Ecogro or Bio-comp, as produced by A1 Organics, Eaton, CO, or approved equal.
 4. If a site is unable to be tilled as determined by the Owners Representative, then the following products shall be used as a soil conditioner:
 - a. Organic slow release fertilizer (6-1-1), acceptable product: "Biosol" or approved equal.
 - b. Granular Humic Acid soil conditioner, acceptable product: "Menefee Humate Soil Conditioner".
 - c. Mycorrhizal Granular Inoculum. Acceptable product: "MycoApply Endo Granular".
 - d. Mycorrhizal Fungi: Dry, granular inoculant containing at least 5300 spores per lb (0.45 kg) of vesicular-arbuscular mycorrhizal fungi and 95 million spores per lb (0.45 kg) of ectomycorrhizal fungi, 33 percent hydrogel, and a maximum of 5.5 percent inert material.
 - e. Mycorrhizal Inoculant: AM-120, as manufactured by Reforestation Technologies International, locally available from Pawnee Buttes Seed, Greeley, CO, (970)356-7002.

2.2 SOIL CONDITIONER APPLICATION RATES

- A. Irrigated Sod:
 1. 4 cubic yards of compost per 1000 SF
- B. Native Seed:
 1. Compost at a rate of 100 CY per Acre, more if recommended as per soils tests and agronomy report. Submit recommended amendment mixture and

applications rates to Project Manager for approval prior to soil amendment operations.

2. Biosol at a rate of 1500 Pounds per Acre, more or less if recommended as per soils tests and agromomy report. Submit recommended amendment mixture and applications rates to Project Manager for approval prior to soil amendment operations.
3. Humate at a rate of 250 Pounds per Acre, more if recommended as per soils tests and agromomy report. Submit recommended amendment mixture and applications rates to Project Manager for approval prior to soil amendment operations.
4. Mycorryzal at a rate of 25 Pounds per Acre, more if recommended as per soils tests and agromomy report. Submit recommended amendment mixture and applications rates to Project Manager for approval prior to soil amendment operations.

C. Riparian Seed/Shrub Areas:

1. Same soil conditioners as Native Seed.

2.3 FERTILIZER

A General:

5. Fertilizer shall conform to applicable State fertilizer laws. It shall be uniform in composition, dry, and free flowing, and shall be delivered to the site in the original, unopened containers, each bearing the manufacturer's guaranteed analysis. Fertilizer that has become caked or damaged will not be accepted.

B Turf Grass Lawns:

1. Diamonium phosphate (18-46-0). Nitrogen shall be composed of sulphur-coated Urea only. Provide in sufficient quantity to apply at the rate of 100 pounds nitrogen per acre, unless otherwise indicated by the soils tests.

C. Native Grass Areas:

1. Fertilizer shall not be applied to areas to receive native grass seeding.

2.4 HERBICIDE

- A. Post Emergent Herbicide: Roundup (Glyphosate) or approved equal as manufactured by Monsanto Company or approved equal.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. General: Verify that existing site conditions are as specified and indicated on drawings before beginning work under this Section.

1. Grades: Inspect to verify rough grading is within +/- 0.1-foot of grades indicated and specified.
2. Damaged Earth: Inspect to verify that soil rendered unfit to support planting due to concrete, water, mortar, limewater or any other contaminant dumped on it has

been removed and replaced with clean soil from a source approved by the Owners Representative.

- B. Unsatisfactory Conditions: Report in writing to General Contractor with copy to Owners Representative.
- C. Acceptance: Beginning of installation means acceptance of existing conditions by installer.

3.2 PREPARATION

- A. Areas of Newly Placed Topsoil:
 - 1. Protection:
 - a. Locate sewer, water, irrigation, gas, electric, phone and other pipelines or conduits and equipment prior to commencing work.
 - b. Contractor shall be responsible for proper repair to landscape, utilities, walls, pavements and other site improvements damaged by operations under this section.
- B. Weed Control: Perform herbicide treatment over the entire area to be planted. Allow sufficient time to successfully complete the entire herbicide treatment process before proceeding with planting.
 - 1. Herbicide treatment must be completed during the growing season.
 - 2. Water surface 1/2" per week for two weeks prior to application if natural precipitation does not supply this amount to encourage weed seed germination.
 - 3. Treat site with "Roundup" herbicide in accordance with manufacturer's recommendations.
 - a. Two days after application water surface 1/2" per week if natural precipitation does not supply this amount to encourage weed seed germination.
 - b. Ten (10) days after the first "Roundup" application, review surface for evidence of plant growth.
 - c. Repeat steps 2, 3, 4, and 5, for a total of three (3) applications, until there is no evidence of plant growth after a 10-day period.
 - d. Obtain Owners Representative approval of surface conditions fourteen (14) days after last herbicide application.
 - e. Herbicide treatments beyond the 3 applications shall be considered additional to the contract and will be performed at the directed of the Owners Representative, after cost has been approved. Additional herbicide treatments required for imported topsoil shall be borne solely by the Contractor.
 - f. Remove plant debris from treated area.
 - g. Contact Owners Representative 48 hours in advance to review the site after each herbicide treatment. Do not proceed with additional planting until the results are approved and accepted by the Owners Representative.
 - 4. Surface Grade: Establish grades as indicated on drawings, and as required in Division 31 Section "Earth Moving".
 - 5. Remove weeds, debris, clods and rocks larger than one 1-inch. Remove and dispose of accumulated materials at direction of Owners Representative.
 - 6. Erosion Control: Take measures and furnish equipment and labor necessary to control the flow, drainage and accumulation of water, and prevent soil erosion,

blowing soil and accumulation of wind-deposited material on the site throughout duration of work. Insure that all excess water will run off the grades or will percolate within 12 hours.

7. Soil Testing: Soil amendments shall meet the minimum amounts as specified in Article 3.3, "Installation", below. Unless determined by the Owners Representative the Contractor shall be responsible for performing horticultural soil tests on a minimum of 4 current soil samples for each source of topsoil to be used in the project. Soil test will be used to determine the type and amount of soil organic amendment and fertilizer to be applied prior to seeding, sodding and planting. Locations for testing shall be approved by the Owners Representative.

8. Timing: Perform soil preparation just prior to planting operations and in accordance with final planting schedule. Coordinate with irrigation system installation to avoid damage.

- C. Areas of Compacted Topsoil: Areas within the work limits or as defined on Drawings or by the Owners Representative that have vegetation that is sparse, stunted, anemic, weedy or was used as a construction staging, parking area and/or subjected to heavy use will require ripping to prepare the soil for revegetation. Scarify compacted soil to a 6-inch depth minimum to loosen topsoil.
- D. Areas of Disturbed Topsoil: Areas disturbed but not severely compacted as determined by the Owners Representative, shall be deep tine aerated or shattered to prepare the soil for revegetation.
- E. Areas of Undisturbed Natural Topsoil: Undisturbed sites that are or were supporting healthy plant growth need only surface seedbed preparation prior to sowing seed.

3.3 INSTALLATION

- A. Install soil amendments as required in Section 310000 - Earthwork
- B. Soil Preparation in Turf Grass Areas:
 1. Apply amendments at the following rates:
 - a. Soil conditioner: 4 cubic yards per 1000 square feet. If a granular soil conditioner is being utilized the product shall be applied per the manufacturer's recommendations.
 - b. Diamonium phosphate: 2 pounds of nitrogen per 1000 square feet.
 2. After applying soil conditioner and fertilizer, thoroughly till area to depth of 6-inches minimum by plowing, rototilling, harrowing, or disking until soil is well pulverized and thoroughly mixed.
- C. Soil Preparation in Native Grass Areas and Shrub Bed Areas:
 1. For bidding purposes only:
 - a. Topsoil (on-site or imported): Two (2) cubic yards per thousand (1000) square feet.
 2. For actual installation:
 - a. Apply topsoil only as directed by per soils tests performed for the areas to be seeded at the rate of 2 cubic yards per 1000 square feet. Based on agronomy report, submit recommended amendment mixture and

application rate to Engineer for approval prior to landscape operations begin.

3. Thoroughly till the area to depth of 6-inches minimum by plowing, rototilling, harrowing, or disking until soil is well pulverized and thoroughly mixed. If a soil conditioner is to be applied ensure that the product is spread evenly across the area to be seeded and mixed thoroughly into the soil.

D. Fine Grading in all Landscape Areas:

1. Complete fine grading for all areas prior to seeding or planting. Allow for natural settlement.
2. For ground surface areas surrounding buildings to be landscaped, maintain required positive drainage away from buildings.
3. Establish finish grades to within plus or minus 0.10-foot of grades indicated, in order to prevent “bird-baths” or ponding.
4. Finish grade shall be below edge of pavement prior to sodding, seeding or planting.
 - a. Sodded Areas: Allow 1-1/2-inches for sod.
 - b. Seeding Areas: Allow 1-inch for seed.
 - c. Shrub Beds: Allow 4-inch for mulch.
5. Noxious weeds or parts thereof shall not be present in the surface grade prior to seeding.
6. Compaction of Surface Grade Prior to Landscape Installation: Firm, but not hard, 85% standard Proctor density within 2% optimum moisture.
7. Hand Raking:
 - a. Turfgrass Lawn Areas: Prior to acceptance of grades, hand rake to smooth, even surface, free of debris, clods, rocks and organic matter greater than 1-inch.
 - b. Native Seed Areas: Area shall not be raked smooth but left in a uniform condition after tilling. Rough raking may occur parallel to the contours only.
8. Restore planting areas to specified condition if eroded or otherwise disturbed after fine grading and prior to planting.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Contractor is responsible for specified tests.
- C. Perform the following tests:
 1. Compaction: Test planting-soil compaction after placing each lift and at completion using a densitometer or soil-compaction meter calibrated to a reference test value based on laboratory testing according to ASTM D 698. Space tests at no less than one for each 1000 sq. ft.
- D. Soil will be considered defective if it does not pass tests.
- E. Prepare test reports.

- F. Label each sample and test report with the date, location keyed to a site plan or other location system, visible conditions when and where sample was taken, and sampling depth.
- G. Inspection: Provide notice to the Owners Representative requesting inspection at least 7 days prior to anticipated date of completion.
- H. Deficiencies: The Owners Representative will specify deficiencies to Contractor who shall make satisfactory adjustments and shall again notify Owners Representative for final inspection.

3.5 CLEANING

- A. Protect areas adjacent to planting-soil preparation and placement areas from contamination. Keep adjacent paving and construction clean and work area in an orderly condition.
- B. Remove debris and excess materials from site. Clean out drainage inlet structures. Clean paved and finished surfaces soiled as a result of work under this Section, in accordance with Section 208 of the General Specifications or as directed by the Owners Representative.

3.6 PROTECTION

- A. Provide and install barriers as required and as directed by Owners Representative to protect completed areas against damage from pedestrian and vehicular traffic until acceptance by Client.
- B. Protect areas of in-place soil from additional compaction, disturbance, and contamination. Prohibit the following practices within these areas except as required to perform planting operations:
 - 1. Storage of construction materials, debris, or excavated material.
 - 2. Parking vehicles or equipment.
 - 3. Vehicle traffic.
 - 4. Foot traffic.
 - 5. Erection of sheds or structures.
 - 6. Impoundment of water.
 - 7. Excavation or other digging unless otherwise indicated.
- C. If planting soil or subgrade is overcompacted, disturbed, or contaminated by foreign or deleterious materials or liquids, remove the planting soil and contamination; restore the subgrade as directed by Owners Representative and replace contaminated planting soil with new planting soil.

END OF SECTION 32 91 13

SECTION 329220 - NATIVE SEEDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. The Work of this Section includes installation of native grass seed and specified mulch, straw matting if applicable
- B. Related Sections:
 - 1. Section 329113 - Soil Preparation
 - 2. Section 329300 - Plants

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. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It 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. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
- D. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.
- E. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or top surface of a fill or backfill before planting soil is placed.
- F. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.
- G. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil, but in disturbed areas such as urban environments, the surface soil can be subsoil.
- H. Weeds: Including but not limited to Goathead, Bindweed, Twitch, Dandelion, Jimsonweed, Knapweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard,

Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Weed, Bent Grass, Wild Garlic, Perennial Sorrel, and Broom Grass.

1.4 REFERENCES

- A. Comply with U.S. Department of Agriculture Rules and Regulations under the Federal Seed Act and be equal to or better in quality than the standards for Certified Seed.
- B. Colorado Department of Transportation (CDOT) – Standards Specifications for Road and Bridge Construction.

1.5 SUBMITTALS

- A. See Section 013300 – Submittal Procedures for submittal requirements.
- B. Product Data: For each type of product indicated.
 - 1. Pesticides and Herbicides: Include product label and manufacturer's application instructions specific to this Project.
- C. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture stating the botanical and common name, percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.
- D. Qualification Data: For qualified landscape Installer.
- E. Product Certificates: For soil amendments and fertilizers, from manufacturer.
- F. Material Test Reports: For existing in-place surface soil.
 - 1. Soil analysis for each topsoil to be used.
 - 2. Analysis for manufactured topsoil.
 - 3. Analysis for each soil amendment.
 - 4. Analysis for each amended planting soil.
- G. Analysis and standards: Wherever applicable, for non-packaged materials, provide two copies of analysis by recognized laboratory made in accordance with methods established by the Association of Official Agriculture Chemists.
- H. Planting schedule: Submit in writing two copies of proposed planting schedule, indicating dates for topsoil placing, site preparation, herbicide treatments, soil preparation, sodding, seeding, and coordination with plant procurement, planting soil preparation, plant delivery and planting. Schedule all Work during specified planting seasons. Once accepted, revise dates only as approved in writing, after documentation of reasons for delays.
- I. Maintenance Instructions: Recommended procedures for maintenance of turf and dryland grasses during a calendar year. Submit before expiration of required initial maintenance periods.
- J. Contract Closeout Submittals:

1. Operating and Maintenance Data: At completion of work, submit 1 digital copy and 2 hard copies to the Owners Representative in accordance with Division 01 Section "Contract Closeout". Include directions for irrigation, aeration, mowing, fertilizing, and spraying as required for continued and proper maintenance through full growing season and dormant period.
 2. Warranty for Native Seed Areas: At completion of work, furnish written warranty to Owners Representative based upon specified requirements.
- K. The Owners Representative reserves the right to reject the seed at any time prior to acceptance and that fails to meet specification requirements. Promptly remove rejected seed from the site.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful turf and dryland grass establishment.
1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
 2. Experience: Five years' experience in turf installation in addition to requirements in Division 01 Section "Quality Control."
 3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
 4. Sod Producer: Company specializing in sod production and harvesting with minimum 5 years' experience, and certified by the State of Colorado Department of Agriculture.
 5. Personnel Certifications: Installers shall have certification the following categories from the Professional Landcare Network:
 - a. Certified Landscape Technician - Exterior, with installation maintenance irrigation specialty area(s), designated CLT-Exterior.
 6. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.
 7. Pesticide Applicator: State licensed, commercial.
- B. Soil-Testing Laboratory Qualifications: An independent laboratory or university laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.
- C. Soil Analysis: See Sections 329113 - Soil Preparation and 310000 – Earthwork.
- D. Preinstallation Conference: Conduct conference at Project site to coordinate the process with other trades, to coordinate equipment movement within planting areas and to avoid soil compaction, to review proposed methods of installation, performance criteria, and maintenance procedures. Review underground utility location maps and plans. This meeting shall be coordinated by the Contractor, and comply with requirements in Division 1.

- E. Standards: All materials and methods used during this portion of the work shall meet or exceed applicable federal, state, county, and local laws and regulations. All seed shall be free from insects and disease. Species shall be true to their scientific name as specified.
- F. Materials: The Contractor shall submit to the Owners Representative for approval a complete list of all materials to be used during this portion of the work prior to delivery of any materials to the site. Include complete data on source, amount and quality. This submittal shall in no way be construed as permitting substitution for specific items described on the plans or in these specifications unless approved in writing by the Owners Representative.
- G. Plant species substitutions shall be submitted to and approved by the Owners Representative prior to construction.
- H. All native grass species shall be supplied as pure live seed. Submit to the Owners Representative lab germination test results for all grass species. Submit an affidavit that describes estimated purity for all forb species that are not typically tested.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Seed and other Packaged Materials: Deliver seed and packaged materials in original unopened containers bearing weight, analysis and name of supplier. Store in a manner to prevent the materials from becoming wet and deteriorating.
- B. Fertilizer: Deliver organic or chemical fertilizer to site in original unopened container bearing manufacturer's guaranteed chemical analysis, name, trade name, trademark and conformance to state law, and bearing name and warranty of producer.
- C. 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 fertilizers and soil amendments with appropriate certificates.
 - 4. Seed: Deliver seed materials in original unopened containers, showing bearing weight, analysis and name of supplier. Store in a manner to prevent the materials from wetting and deterioration.
 - 5. Fertilizer: Deliver inorganic or chemical fertilizer to site in original unopened container bearing manufacturer's guaranteed chemical analysis, name, trade name, trademark and conformance to state law, and bearing name and warranty of producer.
- D. Material will be inspected upon arrival at project site. The Owners Representative will reject any opened or unacceptable materials as described above.
- E. Immediately remove unacceptable material from job site.

- A. Work scheduling: Proceed with and complete landscape work as rapidly as portions of the site become available, working within the specified planting season and approved schedule.
- B. Planting Restrictions: Planting is preferred in spring but may be performed during one of the following periods. Variance from the schedule shall be permitted only with written approval from the Engineer. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of Substantial Completion.
- C. Vehicular accessibility on site shall be as directed by the Owners Representative. Repair damage to prepared topsoil and existing surfaces, caused by vehicular access and movement during work under this section, to original condition at no additional cost to the client.
- D. Do not drill or sow seed during windy, rainy weather or when ground is frozen or otherwise unable to be tilled.
- E. Seeding Season: Seeding shall occur as specified below. The following are typical Colorado schedules. Modify the following for appropriate region. Verify with local producers and contractors prior to finalizing.

<u>Seed Type</u>	<u>Irrigated Areas Only</u>	<u>Non-irrigated Areas</u>
Dryland Grasses	April 15-Sept.1	April 1-May 15 Oct 15-Nov15

- F. Existing conditions:
 - 1. Existing Plants: Install seed only after all other landscape and irrigation items have been installed and accepted by the Owners Representative.
 - 2. Utilities: Determine location of underground utilities. Perform work in a manner to avoid possible damage. Hand excavate, as required.
 - 3. Excavation: Maintain grade stakes set by others until removal is mutually agreed upon by parties concerned. When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, noxious materials or obstructions, notify Owners Representative before planting.
 - 4. If weeds are present on site, treat with herbicide prior to preparing soil for installing seed as specified below.
- G. Coordination:
 - 1. Coordinate with construction of utilities on site. Do not begin placing topsoil until underground work is completed in the area.
 - 2. Coordinate with seeding and landscape Contractor(s) approved schedule. Limit construction access to areas where topsoil has been placed if placement is completed more than 3 days prior to commencement of landscaping in the area. Limit fine grading to areas that can be prepared for planting within 24 hours after fine grading.

3. Coordinate with Contractors work requiring access to site over seeded areas.
4. Coordinate with installation of underground irrigation system.

1.9 WARRANTY

- A. Warranty for Native Seed Areas: Warrant areas in seed to be in a healthy, vigorous growing condition, and for consistency and completion of coverage for a period of 2 years from date of substantial acceptance as a full stand of grass. After seed germination, re-seed any spots where seed has not germinated within the total seeded area. Continue this procedure until a successful stand of grass is growing and accepted by the Owners Representative.
 1. During the original warranty period, reseed at once with comparable blend/mix, those areas that have failed to achieve a stand of grass or which in the Owners Representative's opinion are unhealthy.
 2. Reseeding will not be allowed in any season considerable unfavorable for seeding by the Owners Representative.
 3. Reseed in a manner to achieve quality as originally specified.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Topsoil: See Section 310000 - Earthwork.
- B. Soil Preparation: See Section 329113 - Soil Preparation.
- C. General:
 1. The selected seed mix must be approved by the Owners Representative prior to its incorporation into the project.
 2. All seed shall be furnished in bags or containers clearly labeled to show the name and address of the supplier, the seed name, the lot number, net weight, origin, the percent of weed seed content, the guaranteed percentage of purity and germination, pounds of pure live seed (PLS) of each seed species, and the total pounds of PLS in the container. All brands shall be free from Colorado prohibited noxious weed seeds as Russian or Canadian Thistle, European Bindweed, Johnson Grass, and Leafy Spurge. The Contractor shall furnish to the Owners Representative a signed statement certifying that the seed is from a lot that has been tested by a recognized laboratory for seed testing within six months prior to the date of delivery. Seed that has become wet, moldy or damaged in transit or in storage will not be acceptable.
 3. Computation for quantity of seed required on the project is based on Pure Live Seed (PLS).
 4. The formula used for determining the quantity of PLS shall be:

$$\text{Pounds of Seed} \times (\text{Purity} \times \text{Germination}) = \text{Pounds of PLS}.$$
 5. If seed available on the market does not meet the minimum purity and germination specified, the Contractor must compensate for a lesser percentage of purity or germination by furnishing sufficient additional seed to equal the

specified product. Product comparison shall be made on the basis of PLS in pounds, stated on each seed bag.

D. Seed Mixes:

1. Short Grass Upland Seed Mix

Common Name	Scientific Name	PLS Full Seed Rate	%	PLS lbs/Acre
Blue Grama	Bouteloua gracilis	3.0	25	0.75
Bottlebrush Squirrel-tail	Elymus elymoides	15.0	5	0.75
Buffalograss	Buchloe dactyloides	16.0	25	4
Green Needlegrass	Nassella viridula	10.0	5	0.5
Prairie Junegrass	Koeleria cristata	4.0	5	0.2
Sand Dropseed	Sporobolus cryptandrus	0.6	5	0.03
Sideoats Grama	Bouteloua curtipendula	9.0	20	1.8
Western wheatgrass	Pascopyrum smithii	16.0	10	1.6
			100	9.63

Drill Seeded Rate: 9.63 PLS#/Acre
 Mechanical Broadcast Rate: 19.26 PLS#/Acre
 Hand Broadcast Areas Rate: 38.52 PLS#/Acre

E. Mulch:

1. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.
2. Sphagnum Peat Mulch: Partially decomposed sphagnum peat moss, finely divided or of granular texture, and with a pH range of 3.4 to 4.8
3. Muck Peat Mulch: Partially decomposed moss peat, native peat, or reed-sedge peat, finely divided or of granular texture, with a pH range of 6 to 7.5, and having a water-absorbing capacity of 1100 to 2000 percent, and containing no sand.
4. 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:

F. Fertilizer: None required unless otherwise specified by soils test.

- G. Water: Contractor to utilize the existing irrigation system and or quick coupler(s) when available. If irrigation or quick coupler(s) are not available then the contractor is responsible for watering. Water shall be free of substances that may be harmful to seed growth. Hoses and other watering equipment necessary to water the seed to be furnished by Contractor.

2.2 HERBICIDES

- A. General: Herbicide, registered and approved by 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 herbicides unless authorized in writing by Owners Representative and authorities having jurisdiction.
- B. Pre-Emergent Herbicide (Selective and Non-Selective): Journey herbicide, as manufactured by BASF, 800-545-9525, or equal as approved by Owners Representative. Use only with approval by Owners Representative and in strict compliance with manufacturer's instructions.
- C. Post-Emergent Herbicide. "Round-up" by Monsanto, or approved equal.

2.3 EROSION-CONTROL MATERIALS

- A. Erosion-Control Blankets: Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a photodegradable plastic mesh. Include manufacturer's recommended steel wire staples, 6 inches long.
- B. Erosion-Control Fiber Mesh: Biodegradable burlap or spun-coir mesh, a minimum of 0.92 lb/sq. yd., with 50 to 65 percent open area. Include manufacturer's recommended steel wire staples, 6 inches long.
- C. Erosion-Control Mats: Cellular, non-biodegradable slope-stabilization mats designed to isolate and contain small areas of soil over steeply sloped surface, of 3-inch (75-mm) nominal mat thickness. Include manufacturer's recommended anchorage system for slope conditions.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Invisible Structures, Inc.; Slopetame 2.
 - b. Presto Products Company, a business of Alcoa; Geoweb.
 - c. Tenax Corporation - USA; Tenweb.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine areas to be planted for compliance with requirements and other conditions affecting performance.
 - 1. Verify that finish grades are consistent with the slopes and grades indicated on the Drawings. Verify grades are in conformance with Division 31 Section "Earth Moving".

2. 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.
 3. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
 4. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
 5. Uniformly moisten excessively dry soil that is not workable and which is too dusty.
- B. Proceed with installation only after unsatisfactory conditions have been corrected and approved by the Owners Representative.
- C. 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 Engineer and replace with new planting soil.
- D. Acceptance: Beginning of installation means acceptance of existing conditions by the Contractor.

3.2 PROTECTION

- A. Protect existing utilities, paving and other facilities from damage caused by seeding operations, Contractor shall repair any damage at no additional cost to the Client.
- B. Restrict vehicular and pedestrian traffic from seeded areas until grass is established. Erect signs and barriers as required or directed by the Owners Representative at no additional cost to the Client.
- C. Locate, protect and maintain the irrigation system during seeding operations. Repair irrigation system components damaged during seeding operations shall be replaced or repaired to current City irrigation standards at Contractor's expense.
- D. Erosion Control: Take measures and furnish equipment and labor necessary to control and prevent soil erosion, blowing soil and accumulation of wind-deposited materials on the site throughout the duration of work.

3.3 PREPARATION

- A. Work notification: Notify the Owners Representative at least 7 working days prior to start of seeding operations.
- B. Utilize equipment having low unit pressure ground contact within planting areas.
- C. Limit preparation to areas that can be seeded within 24 hours of preparation.
- D. The Contractor shall prepare the soil of all areas to be seeded in accordance with the requirements of Division 32 Section "Soil Preparation". When completed, the soil shall be firmed by float dragging, followed by steel raking, to provide for the proper seeded

surface. The seed bed shall be totally free from rock or clay clods over 1-inch in diameter.

- E. Fine Grading: See Division 31 Section “Earth Moving” and Division 32 Section “Soil Preparation”. Maintain positive drainage, prevent ponding and direct run-off into catch basins, drainage structures, etc., and provide well-contoured surface prior to proceeding. A firm weed-free seed bed is required. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations. Obtain Owners Representative’s approval of finished grade prior to proceeding with seeding operations.
 - 1. Protect adjacent and adjoining areas from hydromulching overspray.
 - 2. Protect grade stakes set by others until directed to remove them.
- F. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
- G. Verify that all areas are graded to drain at a minimum of 2% or as indicated on the drawings. Verify that subsurface drainage system and drain inlets if any, are operative.
- H. Verify that irrigation system is operable and provides adequate coverage prior to planting.

3.4 PREPARATION FOR EROSION-CONTROL MATERIALS

- A. Review erosion control measures with Owners Representative prior to installation.
- B. For erosion-control mats, install planting soil in two lifts, with second lift equal to thickness of erosion-control mats. Install erosion-control mat and fasten as recommended by material manufacturer.
- C. Fill cells of erosion-control mat with planting soil and compact before planting.
- D. For erosion-control blanket or mesh, install from top of slope, working downward, and as recommended by material manufacturer for site conditions. Fasten as recommended by material manufacturer.

3.5 INSTALLATION

- A. Seed within 24 hours after preparation of seed bed. Seeding at other times may only be done if approved by the Owners Representative.
- B. Areas outside Contract Limits disturbed as a result of construction operations shall be seeded at Contractor’s expense.
- C. Seed shall be uniformly applied at the specified rate, (half in one direction and the other half at right angles to the first application). The direction of the final application shall always be at right angle to the slope or running in the direction of the contour. Seed shall be installed at a depth between 1/4-inch and 1/2-inch. Accomplish seeding by a rangeland grass drill with double disk openers and depth bands.

- D. Areas that are too small or steep for mechanical seeding may be hand seeded. Seed shall be uniformly applied at the specified rate utilizing a broadcast spreader and then hand rake in to a depth of no more than 1/2-inch, then roll seed bed to ensure proper contact to the soil.
- E. Dormant Seeding: Upon approval of the Owners Representative, dormant seeding may be accomplished between October 15 and March 31. No seeding shall be done when the ground is frozen, muddy, covered with snow, or otherwise in a condition unsuitable for seeding. Dormant seeding will not relieve the Contractor from the warranty or the acceptance requirements specified elsewhere in this section.

3.6 MULCHING.

- A. Hydromulch Application: Utilize an approved hydromulcher to apply cellulose fiber at a rate of 2,000 pounds per acre. Apply tackifier to comply with CDOT Section 213.02 – Mulching. Contractor shall provide verification of application rates in the form of ship tickets.
- B. Mulching shall not be installed when surface water is present resulting from rains, melting snow irrigation or other causes.
- C. Areas not properly mulched, or any damage that may occur during construction is the responsibility of the Contractor and shall be repaired and re-mulched in an acceptable manner at the Contractor's expense. Mulching removed by wind, rain or other causes prior to acceptance shall be re-established by the Contractor at his own expense.
- D. The seeded area shall be mulched within 8 hours of seeding. Areas not mulched within 24 hours after seeding must be re-prepped and re-seeded with the specified seed mix at the Contractor's expense.
- E. Contractor shall remove all hydromulch from and surface area not specified for seeding, including but not limited to plant materials, fences, paved areas, signs, mulch beds, irrigation components and all other objects as directed by the Owners Representative.

3.7 EROSION CONTROL BLANKET

- A. Install erosion control blanket on slopes exceeding 4:1, and in swales or other areas of concentrated runoff. As shown on the drawings or as directed by the Owners Representative, install in accordance with manufacturer's instructions.

3.8 PROTECTION

- A. Protect existing utilities, paving and other facilities from damage caused by seeding operations, Contractor shall repair any damage at no additional cost to the Client
- B. Restrict vehicular and pedestrian traffic from seeded areas until grass is established. Erect signs and barriers as required or directed by the Owners Representative at no additional cost to the Client.

- C. Locate, protect and maintain the irrigation system during seeding operations. Repair irrigation system components damaged during seeding operations shall be replaced or repaired to current City irrigation standards at Contractor's expense.
- D. Erosion Control: Take measures and furnish equipment and labor necessary to control and prevent soil erosion, blowing soil and accumulation of wind-deposited materials on the site throughout the duration of work.

3.9 SATISFACTORY DRYLAND GRASSES

- A. Dryland grass seed installations shall be minimally established to meet the following criteria by Substantial Completion as determined by Owners Representative:
 - 1. Within three months, total vegetation cover in all zones seeded with cover crop shall exceed 70% (by aerial cover). Dryland grass shall be free of weeds, foreign grasses, disease and harmful insects.
 - 2. By the end of the first full growing season after seeding, total vegetation cover including cover crop shall exceed 90% (by aerial cover) and 10% of all species present shall be native.
 - 3. By the end of the first full growing season, seedling from 20% of planted forb species shall be present.
 - 4. At any time during the contract period no more than 10% (by aerial cover) of the seeded area should be dominated by aggressive exotic species such as, but not limited to, red clover (*Trifolium* spp.), white or yellow sweet clover (*Melilotus* spp.), Canada thistle (*Cirsium arvense*), tall fescue (*Festuca elatior*), bindweed (*Convolvulus arvensis*) etc. At the end of the fifth year no more than 50% (by aerial cover) of the seeded area shall be dominated by non-natives.
 - 5. Until final acceptance seeded areas that fail after having been replaced previously, shall be replaced until it meets establishment as required above. Replacement materials shall be identical to those originally specified. Provide seed tags to the Owners Representative for verification.
 - 6. Remedial action: If seeded areas greater than 10 square feet fail to meet the terms of the guarantee shown above, the Landscape Contractor will develop and submit to the Owners Representative a remedial action plan that takes into consideration the site goals and specific deficiencies causing the remedial action. Contractor will implement the remedial action plan and submit a report that describes the remedial action taken. If remedial seeding or planting is required, Contractor will not be required to perform additional remedial seeding or planting in the same area for a minimum of two growing seasons. After two growing seasons following the remedial planting, the performance criteria must be met for the second growing season or additional remedial action must be taken. This guarantee remains in effect until all zones meet the third growing season criteria.
 - 7. Seeded areas will not be accepted in parts. Each time any portion or section of the entire seeded area requires replacement or remedial action, the maintenance period shall extend until all seeded areas meet the minimum establishment requirements stated above.
 - 8. All expense incurred including repairs from vandalism for the replacement and or establishment of the seed areas are the responsibility of the Contractor.
 - 9. If seeded in the fall, review for establishment shall be no later than June 15 of the following year.

3.10 CLEANING

- A. Perform cleaning during installation of the work and upon completion of the work. Remove from all excess materials, debris and equipment from site. Repair any damage resulting from seeding operations.
- B. 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.
- C. Remove nondegradable erosion-control measures after grass establishment period.

END OF SECTION 32 92 20

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SECTION 329223 - SODDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. The Work of this Section includes furnishing and installation of bluegrass sod, and maintenance of sodded areas.
- B. Related Sections:
 - 1. Section 328400 – Planting Irrigation
 - 2. Section 329113 - Soil Preparation
 - 3. Section 329300 - Plants

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. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It 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. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
- D. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.
- E. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or top surface of a fill or backfill before planting soil is placed.
- F. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.
- G. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil, but in disturbed areas such as urban environments, the surface soil can be subsoil.

- H. Weeds: Including but not limited to Goathead, Bindweed, Twitch, Dandelion, Jimsonweed, Knapweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Weed, Bent Grass, Wild Garlic, Perennial Sorrel, and Broom Grass.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
1. Pesticides and Herbicides: Include product label and manufacturer's application instructions specific to this Project.
- B. Sod Certificates:
1. State, Federal and other inspection certificates for sod shall be provided to the Owners Representative a minimum of 10 working days prior to anticipated date of sod delivery.
 2. Submit a list of varieties contained in the sod, and include the source and origin for approval by the Owners Representative.
- C. Qualification Data: For qualified landscape Installer.
- D. Product Certificates: For soil amendments and fertilizers, from manufacturer.
- E. Material Test Reports: For existing in-place surface soil.
1. Soil analysis for each topsoil to be used.
 2. Analysis for manufactured topsoil.
 3. Analysis for each soil amendment.
 4. Analysis for each amended planting soil.
- F. Analysis and standards: Wherever applicable, for non-packaged materials, provide two copies of analysis by recognized laboratory made in accordance with methods established by the Association of Official Agriculture Chemists.
- G. Planting schedule: Submit in writing two copies of proposed planting schedule, indicating dates for topsoil placing, site preparation, herbicide treatments, soil preparation, sodding, seeding, and coordination with plant procurement, planting soil preparation, plant delivery and planting. Schedule all Work during specified planting seasons. Once accepted, revise dates only as approved in writing, after documentation of reasons for delays.
- H. Maintenance Instructions: Recommended procedures for maintenance of turf and dryland grasses during a calendar year. Submit before expiration of required initial maintenance periods.
- I. Contract Closeout Submittals:
1. Operating and Maintenance Data: At completion of work, submit one digital copy and two hard copies to the Owners Representative in accordance with Division 01 Section "Contract Closeout". Include directions for irrigation, aeration, mowing, fertilizing and spraying as required for continued and proper maintenance through full growing season and dormant period.

2. Warranty for Turfgrass Sod Areas: At completion of work, furnish written warranty to Owners Representative based upon specified requirements.

- J. The Owners Representative reserves the right to reject the sod at any time prior to acceptance and that fails to meet specification requirements.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful turf and dryland grass establishment.
 1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
 2. Experience: Five years' experience in turf installation in addition to requirements in Division 01 Section "Quality Control."
 3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
 4. Sod Producer: Company specializing in sod production and harvesting with minimum 5 years' experience, and certified by the State of Colorado Department of Agriculture.
 5. Personnel Certifications: Installers shall have certification the following categories from the Professional Landcare Network:
 - a. Certified Landscape Technician - Exterior, with installation maintenance irrigation specialty area(s), designated CLT-Exterior.
 6. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.
 7. Pesticide Applicator: State licensed, commercial.
- B. Soil-Testing Laboratory Qualifications: An independent laboratory or university laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.
- C. Soil Analysis: See Section 329113 - Soil Preparation.
- D. Preinstallation Conference: Conduct conference at Project site to coordinate the process with other trades, to coordinate equipment movement within planting areas and to avoid soil compaction, to review proposed methods of installation, performance criteria, and maintenance procedures. Review underground utility location maps and plans. This meeting shall be coordinated by the Contractor, and comply with requirements in Division 1.
- E. Standards: All materials and methods used during this portion of the work shall meet or exceed applicable federal, state, county, and local laws and regulations. All sod shall be free from insects and disease. Species shall be true to their scientific name as specified.
- F. Materials: The Contractor shall submit to the Owners Representative for approval a complete list of all materials to be used during this portion of the work prior to delivery of any materials to the site. Include complete data on source, amount and quality. This submittal shall in no way be construed as permitting substitution for specific items

described on the plans or in these specifications unless approved in writing by the Owners Representative

G. Source Quality Control:

1. Sod Materials: Subject to inspection and acceptance. The Owners Representative reserves the right to reject at any time or place prior to acceptance, any work and sod which in the Owners Representative's opinion fails to meet these specification requirements.
2. Inspection will be made periodically during sodding, at completion and at end of warranty period by the Owners Representative. Primarily for quality; however, other requirements are not waived even though visual inspection results in acceptance.
3. Promptly remove rejected sod from site.

H. Sod Standards:

1. Sod shall consist of healthy, thick turf having undergone a program of regular fertilization, mowing and weed control; free of weeds; uniform in green color, leaf texture and density; healthy, vigorous root system; inspected and found free of disease, nematodes, pests and pest larvae by the State Department of Agriculture.
2. Each piece of Sod shall consist of a sandy-loam soil base that will not break, crumble or tear during sod installation.
3. Sod thickness shall be a minimum 3/4-inch thick, excluding top growth and thatch.
4. Thatch layer shall not exceed 1/2-inch, uncompressed.
5. Sod shall be delivered and installed within 24 hours of being cut.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Sod: Harvest, deliver, store, and handle sod according to requirements in "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" in TPI's "Guideline Specifications to Turfgrass Sodding." Deliver on pallets properly loaded on vehicles with root system protected from exposure to sun, wind, and heat in accordance with standard practice. Sod that has been damaged by poor handling or improper storage is subject to rejection by the Owners Representative.
1. Protect from dehydration, contamination, freezing and heating at all times. Keep stored sod moist and under shade or covered with moistened burlap.
 2. Do not drop sod rolls from carts, trucks or pallets.
 3. Do not deliver more sod than can be installed within 24 hours.
- B. Fertilizer: Deliver inorganic or chemical fertilizer to site in original unopened container bearing manufacturer's guaranteed chemical analysis, name, trade name, trademark, warranty and conformance to state law.
- C. 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 fertilizers and soil amendments with appropriate certificates.
 4. Fertilizer: Deliver inorganic or chemical fertilizer to site in original unopened container bearing manufacturer's guaranteed chemical analysis, name, trade name, trademark and conformance to state law, and bearing name and warranty of producer.
- D. Material will be inspected upon arrival at project site. Owners Representative will reject any opened or unacceptable materials as described above.
- E. Immediately remove unacceptable material from job site.

1.7 PROJECT/SITE CONDITIONS

- A. Work scheduling: Proceed with and complete landscape work as rapidly as portions of the site become available, working within the specified planting season and approved schedule.
- B. Vehicular accessibility on site shall be as directed by Owners Representative. Repair damage to prepared topsoil and existing surfaces, caused by vehicular access and movement during work under this section, to original condition at no additional cost to the Client.
- C. Install sod between April 15 and October 1 or when irrigation is available for 21 days per Denver Water's guidelines for sod establishment.
- D. Schedule work for periods of favorable weather. Do not install sod on saturated or frozen soil. The Owners Representative reserves the right to deny sod installation on days that are deemed to be unfavorable for installation.
- E. Existing conditions:
1. Existing Plants: Install sod only after all other landscape and irrigation items have been installed and accepted by the Owners Representative
 2. Utilities: Determine location of underground utilities. Perform work in a manner to avoid possible damage. Hand excavate, as required.
 3. Excavation: Maintain grade stakes set by others until removal is mutually agreed upon by parties concerned. When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, noxious materials or obstructions, notify Owners Representative before planting.
 4. If weeds are present on site, treat with herbicide prior to preparing soil for installing sod as specified in this or other Sections.
- F. Coordination:
1. Coordinate with construction of utilities on site. Do not begin placing topsoil and sod until underground work is completed in the area.
 2. Coordinate sodding with Contractor(s) approved schedule. Limit construction access to areas where topsoil has been placed if placement is completed more than 3 days prior to commencement of landscaping in the area. Limit fine grading to areas that can be prepared for planting within 24 hours after fine grading.
 3. Coordinate with Contractors work requiring access to site over sodded areas.

4. Coordinate with installation of underground irrigation system.

1.8 WARRANTY

- A. Warranty for Sod Areas: Warrant areas in sod to be in a healthy, vigorous growing condition, and for consistency and completion of coverage for a period of one year from date of Substantial Completion as a full stand of grass. Re-sod any spots larger than 12" square where sod has failed to establish, as defined in this Section. Continue this procedure until a successful stand of grass is growing and accepted by the Owners Representative.
 1. During the original warranty period, re-sod at once with comparable blend/mix, those areas that have failed to achieve a stand of grass or which in the Owners Representative's opinion are unhealthy.
 2. Re-sodding will not be allowed in any season considerable unfavorable for sodding by the Owners Representative
- B. Re-sod in a manner to achieve quality as originally specified per the Owners Representative's direction

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Soil Preparation: See Section 329113 - Soil Preparation.
- B. Sod:
 1. Colorado grown Bandera Hybrid Bluegrass blend having a healthy, vigorous root system.
 2. Sod to be produced in accordance with requirements in "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" in TPI's "Guideline Specifications to Turfgrass Sodding."
 3. Harvesting: Sod shall be fertilized 2–3 weeks prior to harvesting. Mow sod to a height of 1-1/2 inches before the sod is lifted. Sod shall be harvested in rolls, and shall not be cut more than 24 hours prior to planting.
 4. Size: Machine cut to a minimum pad thickness of 3/4 inch, excluding top growth and thatch. Provide sod of uniform pad sizes 18" maximum width by 24" minimum length, with maximum 5% deviation in either length or width. Broken pads or pads with uneven ends will not be acceptable. Sod pads incapable of supporting their own weight when suspended vertically from upper 10% of pad will be rejected. Sod which has dried out, sod with adhering soil which breaks, tears, or crumbles away will not be accepted. Sod cut for more than twenty-four (24) hours will not be accepted.
 5. Plastic netting: Sod to be free of plastic netting used during establishment by sod grower.
- C. Fertilizer: Inorganic mixture with following chemical composition: (20-5-10) with 50% sulfur coated urea (no iron), or as recommended by testing lab based on soil sample results.

- D. Water: Contractor to utilize the existing irrigation system and or quick coupler(s) when available. If irrigation or quick coupler(s) are not available, then the contractor is responsible for watering. Refer to Section 328400 – Planting Irrigation. Water shall be free of substances that may be harmful to sod growth. Hoses and other watering equipment necessary to water the sod to be furnished by Contractor.

2.2 HERBICIDES

- A. General: Herbicide, registered and approved by 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 herbicides unless authorized in writing by Owners Representative and authorities having jurisdiction.
1. Pre-Emergent Herbicide (Selective and Non-Selective): Use only with approval by Owners Representative. Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.
 2. Post-Emergent Herbicide. "Round-up" by Monsanto, or approved equal.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to be planted for compliance with requirements and other conditions affecting performance.
1. Verify that finish grades are consistent with the slopes and grades indicated on the Drawings. Verify grades are in conformance with Division 31 Section "Earth Moving".
 2. 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.
 3. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
 4. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
 5. Uniformly moisten excessively dry soil that is not workable and which is too dusty.
- B. Proceed with installation only after unsatisfactory conditions have been corrected and approved by the Owners Representative.
- C. 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 Engineer and replace with new planting soil.
- D. Acceptance: Beginning of installation means acceptance of existing conditions by the Contractor.

3.2 PREPARATION

- A. Work notification: Notify the Owners Representative at least 7 working days prior to start of sodding operations.
- B. Limit turf subgrade preparation to areas that can be sodded within 24 hours.
- C. Newly Graded Subgrades: Prepare soil as required by Section 329113 - Soil Preparation.
- D. Unchanged Subgrades: If turf is to be planted in areas unaltered or undisturbed by excavating, grading, or surface-soil stripping operations, prepare surface soil as follows:
 - 1. Remove existing grass, vegetation, and turf. Do not mix into surface soil.
 - 2. Loosen surface soil to a depth of at least 8 inches. Apply soil amendments and fertilizers according to planting soil mix proportions and mix thoroughly into top 4 inches (100 mm) of soil. Till soil to a homogeneous mixture of fine texture.
 - 3. Remove stones larger than ½ inch in any dimension and sticks, roots, trash, and other extraneous matter.
 - 4. Legally dispose of waste material, including grass, vegetation, and turf, off property.
- E. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
- F. Verify that all areas are graded to drain at a minimum of 2% or as indicated on the drawings. Verify that subsurface drainage system and drain inlets if any, are operative.
- G. Verify that irrigation system is operable and provides adequate coverage prior to planting.
- H. Adjustment: Adjust irrigation heads to proper watering height according to depth of sod material but lower than compacted blade height to enable lawn mowers to cut grass freely without damage to the sprinkler system.
- I. When completed, the soil shall be firmed by float dragging, followed by steel raking, to provide for the proper sodded subgrade. The sod bed shall be totally free from rock or clay clods over 1/2-inch in diameter.
- J. Repair: Re-establish grade and specified conditions to damaged sod areas prior to placing sod.

3.3 INSTALLATION

- A. Sodding:
 - 1. Sod within 24 hours after preparation of bed.
 - 2. If plastic netting is present within sod, remove all netting during sod installation.
 - 3. Subgrade on which sod is laid shall be slightly moist during installation.
 - 4. Lay sod with longest dimension parallel to contours and in continuous rows.
 - 5. Tightly butt ends and sides of sod together. Stagger and compact vertical joints between sod strips.

6. Sod shall not be overlapped or stretched during placement. Exposed joints due to shrinkage will require replacement of sod in affected areas.
 - B. Topsoil: Where new sod abuts an existing turf area topsoil shall be placed along seams and or joints to provide a smooth transition.
 - C. Rolling: Sod shall be rolled after installation to ensure proper contact with the subgrade, and to ensure tight joints between adjacent pieces. Sod shall be moist prior to rolling. Once rolling is complete additional watering shall occur. Roller shall weigh 100 pounds.
 - D. Drainage: Contractor shall ensure that finished areas are graded so that positive drainage of storm and irrigation water is achieved.
 - E. Water thoroughly with a fine spray as laying progresses and immediately after planting. 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.
 - F. After sod and soil have dried, roll sodded areas to ensure a good bond between sod and soil and to remove minor depressions and irregularities. Roller shall not exceed 100 pounds.
- 3.4 FERTILIZING
- A. Distribute (20-5-10) fertilizer uniformly at the rate of 5 pounds of material per 1,000 square feet, 1 pound of actual nitrogen per 1,000 square feet or 60 days after initial sodding operations and every 60 days thereafter until Final Acceptance of project by the Owners Representative.
- 3.5 PROTECTION
- A. Protect existing utilities, paving and other facilities from damage caused by sodding operations, Contractor shall repair any damage at no additional cost to the Client.
 - B. Restrict vehicular and pedestrian traffic from sodded areas until grass is established. Erect signs and barriers as required or directed by the Owners Representative at no additional cost to the Client.
 - C. Locate, protect and maintain the irrigation system during sodding operations. Repair irrigation system components damaged during sodding operations shall be replaced or repaired to current City irrigation standards at Contractor's expense.
 - D. Erosion Control: Take measures and furnish equipment and labor necessary to control and prevent soil erosion, blowing soil and accumulation of wind-deposited materials on the site throughout the duration of work.

3.6 CLEANING

- A. General: Provide and install barriers as required and as directed by Owners Representative to protect sodded areas against damage from pedestrian and vehicular traffic until Final Acceptance.

END OF SECTION 32 92 23

SECTION 329300 - PLANTS**PART 1 - GENERAL****1.1 SUMMARY****A. Section Includes:**

1. Plants.
2. Tree-watering devices.

1.2 DEFINITIONS

- A. Backfill: The earth used to replace or the act of replacing earth in an excavation.
- 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 include substances or mixtures intended for use as a plant regulator, defoliant, or desiccant. Some sources classify herbicides separately from pesticides.
- C. 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.
- D. 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.

1.3 PREINSTALLATION MEETINGS

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

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples of each type of mulch.

1.5 INFORMATIONAL SUBMITTALS

- A. Product certificates.
- B. Sample warranty.

- A. Maintenance Data: Recommended procedures to be established by Owners Representative for maintenance of plants during a calendar year.

1.7 QUALITY ASSURANCE

- A. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
 - 1. Pesticide Applicator: State licensed, commercial.
- B. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. 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.
- B. Handle planting stock by root ball.
- C. Store bulbs, corms, and tubers in a dry place at 60 to 65 deg F (16 to 18 deg C) until planting.
- D. 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.

1.9 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.
 - 2. Warranty Periods: From date of Substantial Completion.
 - a. Trees, Shrubs, Vines, and Ornamental Grasses: 12 months.
 - b. Ground Covers, Biennials, Perennials, and Other Plants: 12 months.

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.
- B. 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.

2.2 FERTILIZERS

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

2.3 MULCHES

- A. Organic Mulch: Shredded western red cedar.
- B. Rock Mulch: Rounded riverbed gravel or smooth-faced stone.
 - 1. Rounded riverbed rock shall be screened 1-1/2" to 2" diameter, natural color range of greys and browns.
 - 2. Cobble shall be 6" to 8" diameter, smooth and with a minimum (5% maximum) of fractured pieces, natural color range of greys and browns.
- C. Salvaged Cobble Mulch
 - 1. Rounded cobbles found onsite during excavation work to be reused within landscape areas as noted on plans. Cobbles to be washed and cleaned prior to placement.

2.4 WEED-CONTROL BARRIERS

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

- B. Composite Fabric: Woven, needle-punched polypropylene substrate bonded to a nonwoven polypropylene fabric, 4.8 oz./sq. yd. (162 g/sq. m).

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.

2.6 LANDSCAPE EDGINGS

- A. Steel Edging: Refer to plans and specifications for detail.

PART 3 - EXECUTION

3.1 PLANTING AREA ESTABLISHMENT

- A. General: Prepare planting area for soil placement and mix planting soil according to Section 329113 - Soil Preparation.
- B. Placing Planting Soil: Place and mix planting soil in-place over exposed subgrade.
- C. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.2 EXCAVATION FOR TREES AND SHRUBS

- A. Planting Pits and Trenches: Excavate circular planting pits.
 - 1. Excavate planting pits with sides sloping inward at a 45-degree angle. Excavations with vertical sides are unacceptable. Trim perimeter of bottom leaving center area of bottom raised slightly to support root ball and assist in drainage away from center. Do not further disturb base. Ensure that root ball will sit on undisturbed base soil to prevent settling. Scarify sides of planting pit smeared or smoothed during excavation.
 - 2. Excavate approximately three times as wide as ball diameter.
 - 3. Excavate at least 12 inches (300 mm) 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.
- B. Backfill Soil: Subsoil and topsoil removed from excavations may be used as backfill soil unless otherwise indicated.

3.3 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. Set each plant plumb and in center of planting pit or trench with root flare 1 inch (25 mm) above finish grades.
 - 1. Backfill: Planting soil for trees, use excavated soil for backfill.
 - 2. Balled and Burlapped Stock: 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. Container-Grown Stock: Carefully remove root ball from container without damaging root ball or plant.
 - 4. 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.
 - 5. Place planting tablets equally distributed around each planting pit when pit is approximately one-half filled. Place tablets beside the root ball about 1 inch (25 mm) from root tips; do not place tablets in bottom of the hole.
 - 6. Continue backfilling process. Water again after placing and tamping final layer of soil.
- D. Slopes: When planting on slopes, set the plant so the root flare on the uphill side is flush with the surrounding soil on the slope; the edge of the root ball on the downhill side will be above the surrounding soil. Apply enough soil to cover the downhill side of the root ball.

3.4 TREE, SHRUB, AND VINE PRUNING

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

3.5 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. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.
- E. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.
- F. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

3.6 PLANTING AREA MULCHING

- A. Install weed-control barriers before mulching according to manufacturer's written instructions. Completely cover area to be mulched, overlapping edges a minimum of 6 inches (150 mm) and secure seams with galvanized pins.
- B. Mulch backfilled surfaces of planting areas and other areas indicated.
 - 1. Trees in Turf Areas: Apply organic mulch ring of 3-inch (75-mm) average thickness, with 24-inch (600-mm) radius around trunks or stems. Do not place mulch within 3 inches (75 mm) of trunks or stems.

3.7 EDGING INSTALLATION

- A. Steel Edging: Install steel edging where indicated according to plans and details.

3.8 PLANT MAINTENANCE

- A. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings.
- B. Fill in, as necessary, soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.
- C. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use integrated pest management practices when possible to minimize use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.

- D. Apply pesticides and other chemical products and biological control agents according to authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's Representative operations and others in proximity to the Work. Notify Owners Representative before each application is performed.
- E. 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.
- F. At time of Substantial Completion, verify that tree-watering devices are in good working order and leave them in place. Replace improperly functioning devices.

3.9 MAINTENANCE SERVICE

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

END OF SECTION 329300

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SECTION 32 94 13 – LANDSCAPE EDGING

FA

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. Landscape edging.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Section 310000 - Earthwork
 - 2. Section 329220 - Native Seeding
 - 3. Section 329300 - Plants

”

1.3 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Samples of each of the following:
 - 1. Edging materials and accessories.
 - 2. All items requested by Contractor for Substitution or as an Approved Equal.
- C. Qualification data for firms and persons specified in the "Quality Assurance" article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and address of architects, owners, and other information specified.
- D. Three (3) copies of a written warranty stating all items included in the warranty, conditions of the warranty, and beginning and ending of warranty period(s).

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer who has completed landscaping work similar in material, design, and extent to that indicated for this Project and with a record of successful landscape establishment.
 - 1. Installer's Field Supervision: Require Installer to maintain an experienced full-time

supervisor on the Project site during times that landscaping is in progress.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaged Materials: Deliver packaged materials in containers showing weight, analysis, and name of manufacturer. Protect materials from deterioration during delivery and while stored at site. The Landscape Architect reserves the right to inspect containers before or after installation to verify compliance with Specifications.

1.6 PROJECT CONDITIONS

- A. Utilities: Determine location of above grade and underground utilities and perform work in a manner which will avoid damage. Hand excavate, as required. Maintain grade stakes until removal is mutually agreed upon by parties concerned. Contractor shall be responsible for utility locating, repair of utilities damaged by Contractor, and establishment of grade controls.

1.7 WARRANTY

- A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
- B. Inadequate or improper maintenance by the Owner shall not be cause for replacement, provided the Contractor shall have submitted a letter or report to the Owner on improper or inadequate maintenance practices and recommended remedial actions.
- C. The warranty shall not be enforced should any plant die due to vandalism after final acceptance.

PART 2 - PRODUCTS

2.1 LANDSCAPE EDGING

- A. Steel Edging: Pro-steel edging, 4 inch depth, 3/16 inch thick with line stakes and splicer stakes as recommended by manufacturer. Color: Steel. Duraedge, as manufactured by The J. D. Russell Company, Tucson, Arizona; Ryerson Steel Edging, as manufactured by J.T. Ryerson and Sons, Inc., Chicago, Illinois; or approved equal.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive landscape edging for compliance with requirements and for conditions affecting performance of work of this Section. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF EDGING

- A. Steel Edging: Install steel edging where indicated according to manufacturer's recommendations. Anchor with steel stakes spaced approximately 30-inches (760-mm) apart, driven below top elevation of edging.

END OF SECTION 32 94 13

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SECTION 334000 - STORM DRAINAGE

PART 1 GENERAL

1.1 DESCRIPTION

- A. Work included: Excavation, backfill, bedding, and installation of culverts, pipe, manholes, catch basins, inlets, outlets, underdrains, irrigation ditches, channelization, detention storage, siphons and all necessary appurtenances.
- B. Related Work:
 - 1. Site clearing: Section 311000
- C. Definition:
 - 1. Trench Excavation: Excavation of all material encountered along trench other than rock excavation.
 - 2. Rock Excavation: All solid rock formations which cannot be reasonably broken by a backhoe with 3/4 cubic yard bucket with bucket curling force and stick crowd force of 35,000 lbs. each, and requiring drilling and blasting.

1.2 SUBMITTAL

- A. Submit shop drawings or product data showing specific dimensions and construction materials for:
 - 1. Precast Manholes
 - 2. Precast Catch Basins
 - 3. Frames, Grates, Covers
- B. Test Reports: Submit laboratory gradation tests for bedding and trench stabilization materials, concrete mix design, and compression test.

1.3 JOB CONDITIONS

Environmental Requirements: Except by specific written authorization, cease concreting when descending air temperature in shade and away from artificial heat falls below 35 degrees F. and there is frost in subgrade. When concreting is permitted during cold weather, temperature of mix shall not be less than 60 degrees F. at time of placing.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

- A. Non-Reinforced Concrete Pipe: ASTM C14

- B. Reinforced Concrete Pipe: ASTM C76, circular; ASTM 506, arch; ASTM 507, vertical or horizontal elliptical. Class pipe as shown on drawings.
- C. Concrete End Section: Same ASTM specification as pipe. Equivalent in area as circular pipe.
- D. Corrugated Steel Pipe and Arches: AASHTO M36, 16-gauge or as shown on drawings. Bands shall conform to following:

Pipe Size	Corrugations		Number Bolts
Inches	2-2/3" x 1/2"		3" x 1"
6-30	7"	-	2 ea
36-60	12"	14"	3 ea
66-120	24"	20"	5 ea

Thickness of band one gauge less than pipe but not less than 16 gauge.

- E. Corrugated Steel Pipe End Section: Sizes and dimensions shown on drawings. Materials same as corrugated steel pipe.
- F. Bituminous Coating: Where required on corrugated steel pipe and fittings, AASHTO M190, Type A, with minimum thickness of 0.03". Coupling bands fully coated.
- G. HDPE Pipe: ADS N-12 WT. Pipe shall have a smooth interior and annular corrugations. AASHTO M274, Type S or ASTM F2306.

2.2 PREFABRICATED INLETS AND OUTLETS

- A. Precast Concrete Units: In accordance with drawings, ASTM C478 and C1433, wall "B", wall thickness 1/12 internal diameter. Steps precast into units.

2.3 MANHOLE

- A. Manhole Bases: Precast concrete. Manhole base and first barrier section cast monolithic per ASTM - C478.
- B. Manhole Sections: ASTM C478. Precast concrete with minimum wall thickness 1/12 of internal diameter. Cones eccentric.
- C. Manhole Ring and Cover: Cast iron, ASTM A48. Ring and cover combined weight greater than 400 lbs., machined to fit securely. Non-rocking cover. Hot dipped in asphalt.
- D. Manhole Steps: Two non-skid grooves in the surface of step and capable of carrying load of 1,000 lbs. 6" from face of manhole.

- E. Manhole Joint Sealant: RubberNek.

2.4 FRAMES, GRATES, COVERS, AND STEP

Metal units conform to drain dimensions and to following for designated material.

- A. Gray Iron Castings: AASHTO M105.
- B. Carbon-Steel Castings: AASHTO M103.
- C. Ductile Iron Castings: ASTM A536.
- D. Structural Steel: AASHTO M183 and ASTM A283, Grade B. Galvanizing, where specified, AASHTO M111.

2.5 BEDDING

- A. Pipe and culvert - roadbase, percent by weight passing square mesh sieves: 3/4", 100; No.4, 30-65; No. 8, 25-55; No. 200, 3-12.
- B. Underdrain - washed gravel: percent by weight passing square mesh sieves: 1", 100%; 3/4", 95-100%; No.4, 0-5%.

2.6 CONCRETE MATERIALS

- A. General: All materials furnished from sources approved by Engineer.
- B. Cement: ASTM C150 for Portland Cement, Type II. Cement which has become partially set or contains lumps, caked cement and have been exposed to inclement weather shall be rejected.
- C. Aggregate: ASTM C33.
- D. Water: Water used in mixing or curing concrete shall be clean and free from oil, acids, salt, alkali, or organic materials harmful to concrete.

2.7 CONCRETE MIX

- A. Design Mix:
 - 1. Proportions:
 - Cement 5-1/2 sacks per cubic yard
 - Coarse aggregate 43%
 - Water 5.5 Gallons per sack
 - Maximum size aggregate 3/4"
 - 2. Slump: 4" maximum
 - 3. Strength: Minimum 3,000 psi at 28 days
 - 4. Air Content: 5%-7%

- B. Job Mixed Concrete: Mixed in drum mixer conforming to Concrete Paving Mixer Standards of Mixer Manufacturers Bureau of Associated General Contractors of America. Mixer shall be capable of combining aggregates, cement, and water into thoroughly mixed and uniform mass. Discharge entire contents of drum before recharging. Continue mixing of each batch for not less than 10 minutes after all materials are in drum.
- C. Ready Mixed Concrete: Proportioned, mixed, and transported in accordance with ASTM C94. Any concrete not plastic and workable when it reaches project shall be rejected.

PART 3 EXECUTION

3.1 TRENCHING

- A. Trench Excavation: Excavate to depths required. Confine excavation to work limits.
- B. Rock Excavation: Prior to removal, notify Engineer of areas requiring rock excavation.
- C. Blasting: In general blasting will be allowed in order to expedite the work if a permit by the local authority having jurisdiction is granted. All explosives and appurtenances shall be transported, handled, stored and used in accordance with the laws of the local, state and federal governments, as applicable.

All blasting shall be controlled so as not to injure any existing structure or facility. The protection of life and property and all liability for blasting shall be placed solely on the person or persons conducting the blasting operation. The hours of blasting shall be in accordance with the permit of the local authority. Prior to blasting, provide minimum 24 hour notification to Engineer.

3.2 UNSTABLE TRENCH BOTTOM, EXCAVATION IN POOR SOIL

If the bottom of the excavation at subgrade is found to be soft or unstable or to include ashes, cinders, refuse, vegetable or other organic material, or large pieces or fragments of inorganic material that cannot satisfactorily support the pipe or structure, then the Contractor shall further excavate and remove such unsuitable material. Before the pipe or structure is installed, the subgrade shall be accepted by the Engineer.

3.3 BEDDING

- A. Pipe: Install in conformance with drawings. Place from minimum of 4" below bottom of pipe to centerline for full width of trench.
- B. Culvert: Install in conformance with drawings. Place from minimum of 6" below bottom of pipe to centerline of pipe for entire width of trench.

3.4 PIPE INSTALLATION

- A. General: For new embankments, place fill so width each side of pipe is at least five (5) times pipe diameter. After embankment is placed, proceed with trenching.

Begin all pipe installation at downstream end. Bell or groove ends of rigid conduit and outside circumferential laps of flexible conduit facing upstream. Place flexible conduits with longitudinal laps or seams at sides.

- B. Corrugated Steel Pipe: Remove all loose excavated materials from bottom of trench and install bedding to required thickness. Install pipe true to line and grade. Install remaining bedding material along sides of pipe to avoid any voids. Repair bituminous coating damage using similar coating material. Lubricate coupler bands. Vertical elongation caused by backfill operation shall not exceed 3% of pipe diameter. Compact backfill to 90% AASHTO T99 and continue to 1' over top of pipe.
- C. Concrete Pipe: Extend bedding around bell where bell and spigot pipe is used. Place pipe on bedding as shown on drawings. Place remaining bedding along pipe sides with no voids. Compact backfill to 95% AASHTO T99 and continue to 1' over pipe.
- D. HDPE Pipe: Installation shall be in accordance with ASTM D2321 and ADS recommended installation guidelines, with the exceptions that minimum cover in traffic areas for 24-inch through 48-inch shall be one foot and for 60-inch diameters, the minimum cover shall be 2-feet in single run applications. Backfill for minimum cover situations shall consist of ADS Class 1 or Class 2 (minimum 98% SPD) material.

3.5 MANHOLE CONSTRUCTION

- A. Manhole: Construct in accordance with drawings. Extend concrete manhole base at least 8" below pipe barrel. Slope floor of manhole from centerline of pipe to maximum of 2" above top of pipe at face of manhole. Shape invert after manhole is set. Construct side branches with as large radius of curvature as possible to connect to main invert. Inverts shall be smooth and clean with no obstructions, allowing insertion of expandable plug in pipe. Place complete and continuous roll of joint sealant on base ring in sufficient quantity, so there will be no spaces allowing infiltration. Join each succeeding manhole section in similar manner. Trim away all excess material and repair all lifting holes. Turn eccentric cone and steps away from roadway ditch.
- B. Manhole Ring and Cover: Install at grade of finished surface. Where surface will be completed after manhole construction, set top of cone so maximum of six - two inch thick reinforced concrete rings will adjust ring and cover to final grade.

3.6 CONNECTION TO EXISTING MANHOLE

Make connections to existing manholes, where no pipe is stubbed out, in similar manner as new manhole. Break small opening in existing manhole as necessary to insert new pipe and attain watertight seal. Chip existing concrete bench inside manhole to provide enough thickness for mortar bed to make new smooth continuous invert. Place expandable waterstop around portion of sewer pipe inserted into existing manhole. Use expandable grout to completely fill hole in manhole to create watertight repair.

3.7 CONCRETE WORK

- A. Placement: Place to required depth and width conforming to drawings. Place concrete as uniformly as possible to minimize amount of additional spreading. Place and consolidate with suitable tools to avoid formations of voids, honeycomb, or pockets. Well vibrated and tamped against forms.
- B. Retempering: Do not retemper concrete or mortar which has partially hardened by remixing with or without additional cement, aggregate, or water. Provide concrete in such quantity as is required for immediate use.
- C. Curing: Protect against loss of moisture, rapid temperature change, rain, or flowing water, for not less than two days from placement of concrete. Immediately after finishing, cover concrete surface with curing medium which is applicable to local conditions as approved by Engineer. Protect exposed edge of concrete slabs by removing forms immediately to provide these surfaces with continuous curing treatment.

3.8 BACKFILL

- A. One Foot Over Pipe: Use 3/4" road base for cover material and backfill by approved mechanical methods. Cover material shall be clean, free from organic materials, chunks of soil, frozen material, debris or other unsuitable materials. Place and compact starting at top of pipe bedding extending upwards to 1' above top of pipe. Place in lifts to a density of 95% AASHTO T99, at a point 6" above top of pipe.
- B. Remainder of Trench: Backfill with same materials excavated from work limits unless unsuitable. No rocks over 6" in diameter in top 12" of trench. No backfill material with rocks larger than 12" in diameter.

3.9 COMPACTION

- A. Demonstrate method of compaction. Engineer will test compacted demonstration section for uniform density throughout depth of each lift. Alter construction methods until providing one acceptable to Engineer. Continue same procedure until significant change in soils occurs, or required compaction is not being achieved, then demonstrate new method.

B. Compaction requirements for all trenches:

1. Predominantly of cohesive soils where AASHTO T99 procures are applicable: Compact uniformly throughout each lift to 95% AASHTO T99. Moisture content shall be within 2% of optimum. For clay soils the moisture content shall be 0 to 2% of optimum. For fills over 8' compact each lift to 100% AASHTO T99, moisture content within 2% of optimum.
2. Predominantly of rock, to 8" in diameter: Place in loose lifts up to average rock dimension. Placing of occasional boulders of sizes larger than maximum layer thickness may be agreed to by Engineer, provided material is carefully placed and large stones well distributed with voids completely filled with smaller stones, earth, sand, or gravel. Level and smooth each layer to distribute soils and finer fragments of earth. Wet each loose layer as necessary to facilitate compaction prior to placing additional lifts.

3.10 CONCRETE STRUCTURES

- A. General: Cast-in-place concrete conforming to dimensions shown on the drawings and accurate to tolerances of 1/4". Install forms so all finished lines will be true and straight. Install reinforcing steel with the spacing between the forms and between bars as shown on drawings. Keep excavation dry during construction. Compaction requirements same as above.
- B. Inlets and Outlets: Either cast-in-place or precast units, in accordance with drawings. When required, set castings accurately to grade with adjustment courses of brick in full mortar beds. Construct pipe inverts or smooth concrete inverts same size as pipe up to centerline of pipe, with bench to stand on.
- C. Frames, Grates, Covers, and Steps: Install accurately according to drawings. Anchor castings in place and set in adjustment mortar to assure firm foundation.
- D. Trash Guards: Install in accordance with drawings and manufacturer's recommendations.

3.11 PAVEMENT REMOVAL AND REPLACEMENT

Score existing surface with cutting wheel to create clean break line. Remove and dispose of existing surface and aggregate base course. Leave 6" undisturbed subgrade lip on each side of trench. After trench has been backfilled and properly compacted, place aggregate base course in accordance with permit requirements or minimum thickness in these specifications. Compact aggregate base course to 95% AASHTO T180 moisture content shall be within 2% of optimum. Replace pavement in accordance with permit requirements or minimum thickness in these specifications. Compact asphalt to 95% ASTM D1559; consolidate concrete with vibrators.

3.12 FIELD QUALITY CONTROL

Notify Engineer at least 24 hours in advance of pipe being laid in any trench. Cover no pipes until observed by Engineer.

3.13 TESTING

The Contractor shall video camera (TV) all installed storm sewer pipe prior to final paving and/or other final surface treatments being completed. A copy of the videotaping with a listing of the type and location of all irregularities shall be provided for review and approval.

3.14 CLEANUP AND RESTORATION

Restore all pavements, curbs, gutters, utilities, fences, irrigation ditches, yards, lawns, and other structures or surfaces to condition equal to or better than before work began, and to satisfaction of Engineer. Remove and dispose of all waste materials off site.

3.15 ASBUILTS

Contractor shall provide field surveyed As-constructed drawings of the drainage system to the standards and format of the Owner.

The Contractor shall field survey the storm sewer and drainage facilities and appurtenances after installation but prior to burying the facilities.

Contractor shall certify in writing to Engineer that the installation has been accomplished in accordance with the plans and specifications approved by the Owner and that the As-constructed drawings represent an accurate representation of such work.

END OF SECTION 334000

SECTION 33 46 00 - SUBDRAINAGE SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. The Work of this Section includes furnishing and installation of sub-drainage systems as shown on the Drawings, as specified herein, or as required to complete the work.
- B. Related Work:
 - 1. Division 01 Section "Layout of Work and Surveys".
 - 2. Division 01 Section "Submittals".
 - 3. Division 01 Section "Contractor Quality Control".
 - 4. Division 01 Section "Erosion and Sedimentation Control".
 - 5. Division 01 Section "Materials and Equipment".
 - 6. Division 01 Section "Tree Retention and Protection".
 - 7. Division 31 Section "Excavation and Backfilling of Trenches".
 - 8. Division 32 Section "Sodding".
 - 9. Division 32 Section "Playground Protective Surface".
 - 10. Division 32 Section "Play Structures".

1.3 SUBMITTALS

- A. See Division 01 Section "Submittals" for submittal requirements.
- B. Product Data: For each type of product for approval prior to construction.
 - 1. Piping: Submit 12" length of each type of underdrain piping to be used.
 - 2. Geotextile Fabric: Submit 12" x 12" sample.
 - 3. Bedding material: Submit 1 quart sample.
 - 4. Filter material: Submit 1 quart sample.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer who has completed subdrainage work similar in material, design, and extent to that indicated for this Project and with a record of successful project completion and operation.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Materials: Deliver materials in original containers with tags showing genus, species and size. Protect materials from damage during delivery and while stored at site. The Project Manager reserves the right to inspect containers before or after installation to verify compliance with Specifications.

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.
4. Protect piping and geotextile fabric from damage or contamination with soil or other construction materials from time of deliver to installation.

1.6 PROJECT/SITE CONDITIONS

- A. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and related construction contiguous with proposed subdrainage installations by field measurements before proceeding with planting work.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. PVC under drain: ASTM D2729, minimum 6-inch diameter, plain or perforated type as indicated on the Drawings, with required fittings. Perforated pipe shall comply with requirements of ASTM 272a, with 2 rows of evenly spaced 3/8-inch diameter perforations, 120-degrees apart, providing a minimum number of holes of 4 per foot.
- B. Geotextile Fabric: Non-woven fabric equal to "140N" by Tencate-Mirafi.
- C. Bedding Material: Solid pipe bedding material to be 3/4-inch crushed stone. Perforated pipe, refer to manufacturers specifications or drawings for required bedding material.
- D. Filter Material: 3/4-inch crushed stone.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. PVC under drain: Install pipe under drains as shown on the Drawings. Pitch shall be a minimum of 0.5% or as shown on drawings. Contractor is responsible to immediately notify the Project Manager of any discrepancies.
- B. Solid Pipe: Refer to the City and County of Eagle standard details and specifications.

- C. Geotextile fabric used for the pipe under drains system shall be placed in the trench once pipe trench is prepared to receive pipe. The fabric shall be placed in full contact with the trench bottom and sides. The fabric shall be secured to the trench sides or top edge in a manner which does not damage the integrity of the fabric. The fabric shall be protected from damage during the placement of the pipe and granular fill. Install granular fill and pipe in trench to dimensions specified on Drawings. Contractor is responsible to ensure that no debris, sediment or foreign material enters the granular fill that inhibit drainage. Any installation that does not meet these standards shall be replaced at the direction of the Project Manager at no additional cost to the City. Fabric edges shall overlap at least 6-inches for the full width of the trench.

3.2 CLEANING

- A. Clean and flush out lines before covering. Remove and legally dispose of all waste material and debris offsite.

3.3 RESTORATION

- A. Restore all fences, ditches, yards, lawns, and other structures or surfaces to condition equal to or better than before work began.

END OF SECTION 33 46 00

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PART 1 GENERAL

1.1 DESCRIPTION

- A. Work Included: Excavation, rock excavation, blasting, rock disposal, dewatering, backfill, bedding, compaction, installation of conduits and all necessary appurtenances and coordination with the gas company.
- B. Related Work:
 - 1. Site Clearing: Section 311000
- C. Definitions:
 - 1. Trench Excavation: Excavation of all material encountered along trench other than rock excavation.
 - 2. Rock Excavation: All solid rock formations which cannot be reasonably broken by a backhoe with 3/4 cubic yard bucket with bucket curling force and stick crowd force 35,000 lbs each, and requiring drilling and blasting.
- D. Utility Company Specifications: All work shall conform to the standard specifications of the gas company. Contractor shall coordinate work with gas company and obtain approval of the system after it is installed.

1.2 SUBMITTALS

- A. Submit shop drawings or product data showing specific dimensions and construction materials for pipe, fittings, and vaults; or certifications that products conform with specifications.
- B. Test Reports: Submit laboratory gradation tests for bedding and trench stabilization materials, concrete mix design, and compression test.
- C. Permits: Submit copies of all permits issued for project.

1.3 JOB CONDITIONS

Environmental Requirements: Except by specific written authorization, cease concreting when descending air temperature in shade and away from artificial heat, falls below 35 degrees F, and there is frost in subgrade. When concreting is permitted during cold weather, temperature of mix shall not be less than 60 degrees F at time of placing.

PART 2 PRODUCTS

2.1 PIPE AND FITTINGS

- A. Gas pipe to be supplied and placed by gas company.

2.2 VAULTS

N/A.

2.3 BEDDING

- A. Use sand or 3/8" minus well graded screened material.

2.4 CONCRETE MATERIAL

- A. General: All materials furnished from sources agreed to by the gas company.
- B. Cement: ASTM C-150 for Portland Cement, Type II. Cement which has become partially set or contains lumps of caked cement shall be rejected.
- C. Aggregate: ASTM C33.
- D. Water: Water used in mixing or curing concrete shall be clean and free from oil, acids, salt, alkali, or organic materials harmful to concrete.

2.5 CONCRETE MIX

- A. Design Mix
 - 1. Proportions:
 - Cement 5-1/2 sacks per cubic yard
 - Coarse aggregate - 43%
 - Water - 5.5 gallons per sack
 - Maximum size aggregate - 3/4"
 - 2. Slump: 4" maximum
 - 3. Strength: Minimum 3,000 psi at 28 days
 - 4. Air Content: 5% - 7%

- B. Job-Mixed Concrete

Mixed in drum mixer conforming to Concrete Paving Mixer Standards of Mixer Manufacturers Bureau of Associated General Contractors of America. Mixer shall be capable of combining aggregates, cement, and water into thoroughly mixed and uniform mass. Discharge entire contents of drum before recharging. Continue mixing of each batch for not less than ten (10) minutes after all materials are in drum.

- C. Ready Mixed Concrete
 - Proportioned, mixed and transported in accordance with ASTM C94. Any concrete not plastic and workable when it reaches project shall be rejected.

PART 3 EXECUTION

3.1 TRENCHING

- A. Trench Excavation: Excavate to depths required. Confine excavation to work limits.
- B. Rock Excavation: Prior to removal, notify Engineer of areas requiring rock excavation.
- C. Blasting: In general, blasting will be allowed in order to expedite the work if a permit by the local authority having jurisdiction is granted. All explosives and appurtenances shall be transported, handled, stored and used in accordance with the laws of the local, state and federal governments, as applicable.

All blasting shall be controlled so as not to injure any existing structure or facility. The protection of life and property and all liability for blasting shall be placed solely on the person or persons conducting the blasting operation. The hours of blasting shall be in accordance with the permit of the local authority. Prior to blasting, provide minimum 24 hour notification to Owner, Engineer and Fire Department.

- D. Trench Support: The trench shall be adequately supported and the safety of workers provided for as required by the most recent standards adopted by the Occupational Safety and Health Administration (OSHA) Standards Board. Sheet piling and shoring shall be utilized where required to prevent any excessive widening or sloughing of the trench, which may be detrimental to human safety, to the pipe and appurtenances being installed, to existing utilities, to existing structures, or to any other existing facility or item.

3.2 UNSTABLE TRENCH BOTTOM AND EXCAVATION IN POOR SOIL

If the bottom of the excavation at subgrade is found to be soft or unstable or to include ashes, cinders, refuse, vegetable or other organic material, or large pieces or fragments of inorganic material that cannot satisfactorily support the pipe or structure, then the Contractor shall further excavate and remove such unsuitable material. Before the pipe or structure is installed, the subgrade shall be accepted by the Engineer.

3.3 BEDDING

Install in conformance with drawings. Place from minimum of 3" below bottom of pipe to centerline for entire width of trench.

3.4 UNDERDRAIN

- A. Water seeping from trench banks, but not flowing in trench bottom: Install gravel underdrain in accordance with drawings.
- B. Water flowing in trench bottom: Install underdrain pipe in addition to gravel where water volume will fill a 4" pipe 1/4 full. Cleanouts at each manhole in conformance with drawings.

- C. Daylight all underdrains as shown on drawings or as directed by Engineer.

3.5 PIPE INSTALLATION

- A. Construct pipe accurately to line and grade shown on drawings. Remove and replace pipe not conforming to line and grade at Contractor's expense.

3.6 CONCRETE WORK

- A. Placement: Place to required depth and width conforming to drawings. Place concrete as uniformly as possible in order to minimize amount of additional spreading. Place and consolidate with suitable tools to avoid formations of voids, honeycomb, or pockets. Well vibrated and tamped against forms.
- B. Retempering: Do not retemper concrete or mortar which has partially hardened by remixing with or without additional cement, aggregate, or water. Provide concrete in such quantity as is required for immediate use.
- C. Curing: Protect against loss of moisture, rapid temperature change, rain, and flowing water, for not less than two days from placement of concrete. Immediately after finishing, cover concrete surface with curing medium which is applicable to local conditions as approved by Engineer. Protect exposed edge of concrete slabs exposed by removing forms immediately to provide these surfaces with continuous curing treatment.

3.7 BACKFILL

- A. One Foot Over Pipe: Use sand or 3/8" wall graded screened material (if approved by Engineer) for cover material and backfill by approved mechanical methods. Cover material shall be clean soil, free from organic materials, chunks of soil, frozen material, debris, or other unsuitable materials. Place and compact starting at top of pipe bedding extending upwards to above top of pipe for entire trench width. Place in lifts to a density of 90% AASHTO T99.
- B. Remainder of Trench: Backfill with same materials excavated from work limits unless unsuitable. No rocks over 6" in diameter in top 12" of trench. No backfill material with rocks larger than 12" in diameter. Carefully lower rocks up to 12" in diameter into trench.

3.8 COMPACTION

- A. Demonstrate method of compaction. Engineer will test compacted demonstration section for uniform density throughout depth of each lift. Alter construction methods until providing one acceptable to Engineer. Continue same procedure until significant change in soils occurs, or compaction is not being achieved, then demonstrate new method.

B. Compaction requirements for all trenches:

1. Predominantly of cohesive soils where AASHTO T99 procedures are applicable: Compacted uniformly throughout each lift to 95% AASHTO T99. Moisture content shall be within 2% of optimum.
2. Predominately of rock 12" in diameter: Place in loose lifts up to average rock dimension. Placing of occasional boulders of sizes larger than maximum layer thickness may be agreed to by Engineer, provided material is carefully placed and large stones well distributed with voids completely filled with smaller stones, earth, sand, or gravel. Level and smooth each layer to distribute soils and finer fragments of earth. Wet each loose layer as necessary to facilitate compaction prior to placing additional lifts.

3.9 PAVEMENT REMOVAL AND REPLACEMENT

Score existing surface with cutting wheel to create clean break line. Remove and dispose of existing surface and aggregate base course leave 6" undisturbed subgrade lip on each side of trench. After trench has been backfilled and properly compacted, place aggregate base course in accordance with permit requirements, or minimum thickness in these specifications. Compact aggregate base course to 95% AASHTO T180 moisture content shall be within 2% of optimum. Replace pavement in accordance with permit requirements or minimum thickness in these specifications. Compact asphalt to 95% ASTM D1559; consolidate concrete with vibrators.

3.10 FIELD QUALITY CONTROL

- A. Notify Engineer at least 24 hours in advance of pipe being laid in any trench. Cover no pipes until observed by Engineer. Notify Engineer at least 48 hours before pipe is to be tested.
- B. Testing
 1. General: Conduct testing in accordance with procedures approved by the appropriate utility company or as directed by engineer.

3.11 CLEANUP AND RESTORATION

Restore all pavements, curbs, gutters, utilities, fences, irrigation ditches, yards, lawns, and other structures or surfaces to condition equal to or better than before work began, and to satisfaction of Engineer. Deposit all waste material in designated waste areas. Grade and shape disposal site.

Complete topsoil and reseedling of site, is required. Where disposal sites are not designated, remove and dispose of all waste material off site.

END OF SECTION 335100

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SECTION 337000 - ELECTRICAL UTILITIES

PART 1 GENERAL

1.1 DESCRIPTION

- A. Work Included: Excavation, rock excavation, blasting, rock disposal, dewatering, backfill, bedding, compaction, installation of conduits, vaults, pads and all necessary appurtenances and coordination with the electric company.
- B. Related Work:
 - 1. Site Clearing: Section 311000
- C. Definitions:
 - 1. Trench Excavation: Excavation of all material encountered along trench other than rock excavation.
 - 2. Rock Excavation: All solid rock formations which cannot be reasonably broken by a backhoe with 3/4 cubic yard bucket with bucket curling force and stick crowd force 35,000 lbs each, and requiring drilling and blasting.
- D. Utility Company Specifications: All work shall conform to the standard specifications of the electric company. Contractor shall coordinate work with electric company and obtain approval of the system after it is installed.

1.2 SUBMITTALS

- A. Submit shop drawings or product data showing specific dimensions and construction materials for pipe, fittings, and vaults; or certifications that products conform with specifications.
- B. Test Reports: Submit laboratory gradation tests for bedding and trench stabilization materials, concrete mix design, and compression test.
- C. Permits: Submit copies of all permits issued for project.

1.3 JOB CONDITIONS

Environmental Requirements: Except by specific written authorization, cease concreting when descending air temperature in shade and away from artificial heat, falls below 35 degrees F, and there is frost in subgrade. When concreting is permitted during cold weather, temperature of mix shall not be less than 60 degrees F at time of placing.

PART 2 PRODUCTS

2.1 PIPE AND FITTINGS

- A. Polyvinyl Chloride (PVC): 2"-8", Schedule 40 PVC. Electric rated for electric application.

- B. Electric primary conduit supplied by Holy Cross Energy.

2.2 VAULTS

All switchgear, transformer, splice vaults, pads, and bases to be supplied by Holy Cross Energy.

2.3 BEDDING

- A. Granular material - 3/4" screened rock.
- B. On-site 1-1/2" minus well graded screened material, free from organic materials, chunks of soil, frozen material, debris, or other suitable materials. Use of on-site bedding material must have prior written approval of the utility company and Engineer.

2.4 CONCRETE MATERIAL

- A. General: All materials furnished from sources agreed to by the Utility Companies.
- B. Cement: ASTM C-150 for Portland Cement, Type II. Cement which has become partially set or contains lumps of caked cement shall be rejected.
- C. Aggregate: ASTM C33.
- D. Water: Water used in mixing or curing concrete shall be clean and free from oil, acids, salt, alkali, or organic materials harmful to concrete.

2.5 CONCRETE MIX

- A. Design Mix
 - 1. Proportions:
 - Cement 5-1/2 sacks per cubic yard
 - Coarse aggregate - 43%
 - Water - 5.5 gallons per sack
 - Maximum size aggregate - 3/4"
 - 2. Slump: 4" maximum
 - 3. Strength: Minimum 3,000 psi at 28 days
 - 4. Air Content: 5% - 7%

- B. Job-Mixed Concrete

Mixed in drum mixer conforming to Concrete Paving Mixer Standards of Mixer Manufacturers Bureau of Associated General Contractors of America. Mixer shall be capable of combining aggregates, cement, and water into thoroughly mixed and uniform mass. Discharge entire contents of drum before recharging. Continue mixing of each batch for not less than ten (10) minutes after all materials are in drum.

C. Ready Mixed Concrete

Proportioned, mixed and transported in accordance with ASTM C94. Any concrete not plastic and workable when it reaches project shall be rejected.

PART 3 EXECUTION

3.1 TRENCHING

- A. Trench Excavation: Excavate to depths required. Confine excavation to work limits.
- B. Rock Excavation: Prior to removal, notify Engineer of areas requiring rock excavation.
- C. Blasting: In general, blasting will be allowed in order to expedite the work if a permit by the local authority having jurisdiction is granted. All explosives and appurtenances shall be transported, handled, stored and used in accordance with the laws of the local, state and federal governments, as applicable.

All blasting shall be controlled so as not to injure any existing structure or facility. The protection of life and property and all liability for blasting shall be placed solely on the person or persons conducting the blasting operation. The hours of blasting shall be in accordance with the permit of the local authority. Prior to blasting, provide minimum 24 hour notification to Owner, Engineer and Fire Department.

- D. Trench Support: The trench shall be adequately supported and the safety of workers provided for as required by the most recent standards adopted by the Occupational Safety and Health Administration (OSHA) Standards Board. Sheet piling and shoring shall be utilized where required to prevent any excessive widening or sloughing of the trench, which may be detrimental to human safety, to the pipe and appurtenances being installed, to existing utilities, to existing structures, or to any other existing facility or item.

3.2 UNSTABLE TRENCH BOTTOM AND EXCAVATION IN POOR SOIL

If the bottom of the excavation at subgrade is found to be soft or unstable or to include ashes, cinders, refuse, vegetable or other organic material, or large pieces or fragments of inorganic material that cannot satisfactorily support the pipe or structure, then the Contractor shall further excavate and remove such unsuitable material. Before the pipe or structure is installed, the subgrade shall be accepted by the Engineer.

3.3 BEDDING

Install in conformance with drawings. Place from minimum of 3" below bottom of pipe to centerline for entire width of trench.

3.4 UNDERDRAIN

- A. Water seeping from trench banks, but not flowing in trench bottom: Install gravel underdrain in accordance with drawings.
- B. Water flowing in trench bottom: Install underdrain pipe in addition to gravel where water volume will fill a 4" pipe 1/4 full. Cleanouts at each manhole in conformance with drawings.
- C. Daylight all underdrains as shown on drawings or as directed by Engineer.

3.5 PIPE INSTALLATION

- A. Construct pipe accurately to line and grade shown on drawings. Remove and replace pipe not conforming to line and grade at Contractor's expense.
- B. Install to manufacturer's recommendations, continuously upgrade. Bell ends face upgrade. Prior to making joints, clean and dry all surfaces. Use lubricants in conformance with manufacturer's recommendations for insertion of pipe in joint. Set pipe in position and check line and grade. Keep dirt from entering all exposed pipe ends. Joints watertight.

3.6 PADS AND VAULTS

Install pads and vaults to line and grade shown on drawings.

3.7 PULL STRING

Pull string shall be labeled to identify which utility company or spare conduit the use of the conduit is intended for.

3.8 CONCRETE WORK

- A. Placement: Place to required depth and width conforming to drawings. Place concrete as uniformly as possible in order to minimize amount of additional spreading. Place and consolidate with suitable tools to avoid formations of voids, honeycomb, or pockets. Well vibrated and tamped against forms.
- B. Retempering: Do not retemper concrete or mortar which has partially hardened by remixing with or without additional cement, aggregate, or water. Provide concrete in such quantity as is required for immediate use.
- C. Curing: Protect against loss of moisture, rapid temperature change, rain, and flowing water, for not less than two days from placement of concrete. Immediately after finishing, cover concrete surface with curing medium which is applicable to local conditions as approved by Engineer. Protect exposed edge of concrete slabs exposed by removing forms immediately to provide these surfaces with continuous curing treatment.

3.9 BACKFILL

- A. One Foot Over Pipe: Use 3/4" screened rock or on-site screened material (if approved by Engineer) for cover material and backfill by approved mechanical methods. Cover material shall be clean soil, free from organic materials, chunks of soil, frozen material, debris, or other unsuitable materials. Place and compact starting at top of pipe bedding extending upwards to above top of pipe for entire trench width. Place in lifts to a density of 90% AASHTO T99.
- B. Remainder of Trench: Backfill with same materials excavated from work limits unless unsuitable. No rocks over 6" in diameter in top 12" of trench. No backfill material with rocks larger than 12" in diameter. Carefully lower rocks up to 12" in diameter into trench.

3.10 COMPACTION

- A. Demonstrate method of compaction. Engineer will test compacted demonstration section for uniform density throughout depth of each lift. Alter construction methods until providing one acceptable to Engineer. Continue same procedure until significant change in soils occurs, or compaction is not being achieved, then demonstrate new method.
- B. Compaction requirements for all trenches:
 - 1. Predominantly of cohesive soils where AASHTO T99 procedures are applicable: Compacted uniformly throughout each lift to 95% AASHTO T99. Moisture content shall be within 2% of optimum.
 - 2. Predominately of rock 12" in diameter: Place in loose lifts up to average rock dimension. Placing of occasional boulders of sizes larger than maximum layer thickness may be agreed to by Engineer, provided material is carefully placed and large stones well distributed with voids completely filled with smaller stones, earth, sand, or gravel. Level and smooth each layer to distribute soils and finer fragments of earth. Wet each loose layer as necessary to facilitate compaction prior to placing additional lifts.

3.11 PAVEMENT REMOVAL AND REPLACEMENT

Score existing surface with cutting wheel to create clean break line. Remove and dispose of existing surface and aggregate base course leave 6" undisturbed subgrade lip on each side of trench. After trench has been backfilled and properly compacted, place aggregate base course in accordance with permit requirements, or minimum thickness in these specifications. Compact aggregate base course to 95% AASHTO T180 moisture content shall be within 2% of optimum. Replace pavement in accordance with permit requirements or minimum thickness in these specifications. Compact asphalt to 95% ASTM D1559; consolidate concrete with vibrators.

3.12 FIELD QUALITY CONTROL

- A. Notify Engineer at least 24 hours in advance of pipe being laid in any trench.

Strawberry Park Elementary – Addition/Renovations

Cover no pipes until observed by Engineer. Notify Engineer at least 48 hours before pipe is to be tested.

B. Testing

1. General: Conduct testing in accordance with procedures approved by the appropriate utility company or as directed by engineer.

3.13 CLEANUP AND RESTORATION

Restore all pavements, curbs, gutters, utilities, fences, irrigation ditches, yards, lawns, and other structures or surfaces to condition equal to or better than before work began, and to satisfaction of Engineer. Deposit all waste material in designated waste areas. Grade and shape disposal site.

Complete topsoil and reseeding of site, is required. Where disposal sites are not designated, remove and dispose of all waste material off site.

END OF SECTION 337000

PART 1 GENERAL

1.1 DESCRIPTION

- A. Work Included: Excavation, rock excavation, blasting, rock disposal, dewatering, backfill, bedding, compaction, installation of conduits, vaults, pads and all necessary appurtenances and coordination with the telephone, and cable television companies.
- B. Related Work:
 - 1. Site Clearing: Section 311000
- C. Definitions:
 - 1. Trench Excavation: Excavation of all material encountered along trench other than rock excavation.
 - 2. Rock Excavation: All solid rock formations which cannot be reasonably broken by a backhoe with 3/4 cubic yard bucket with bucket curling force and stick crowd force 35,000 lbs each, and requiring drilling and blasting.
- D. Utility Company Specifications: All work shall conform to the standard specifications of the telephone company and the cable television company. Contractor shall coordinate work with telephone and cable television companies and obtain approval of the system after it is installed.

1.2 SUBMITTALS

- A. Submit shop drawings or product data showing specific dimensions and construction materials for pipe, fittings, and vaults; or certifications that products conform with specifications.
- B. Test Reports: Submit laboratory gradation tests for bedding and trench stabilization materials, concrete mix design, and compression test.
- C. Permits: Submit copies of all permits issued for project.

1.3 JOB CONDITIONS

Environmental Requirements: Except by specific written authorization, cease concreting when descending air temperature in shade and away from artificial heat, falls below 35 degrees F, and there is frost in subgrade. When concreting is permitted during cold weather, temperature of mix shall not be less than 60 degrees F at time of placing.

PART 2 PRODUCTS

2.1 PIPE AND FITTINGS

- A. Polyvinyl Chloride (PVC): 2"-8", Schedule 40 PVC.

2.2 VAULTS

- A. Communication vaults, splice vaults, pads and bases.

2.3 BEDDING

- A. Granular material - 3/4" screened rock.
- B. On-site 1-1/2" minus well graded screened material, free from organic materials, chunks of soil, frozen material, debris, or other suitable materials. Use of on-site bedding material must have prior written approval of the utility company and Engineer.

2.4 CONCRETE MATERIAL

- A. General: All materials furnished from sources agreed to by the Utility Companies.
- B. Cement: ASTM C-150 for Portland Cement, Type II. Cement which has become partially set or contains lumps of caked cement shall be rejected.
- C. Aggregate: ASTM C33.
- D. Water: Water used in mixing or curing concrete shall be clean and free from oil, acids, salt, alkali, or organic materials harmful to concrete.

2.5 CONCRETE MIX

- A. Design Mix
 - 1. Proportions:
Cement 5-1/2 sacks per cubic yard
Coarse aggregate - 43%
Water - 5.5 gallons per sack
Maximum size aggregate - 3/4"
 - 2. Slump: 4" maximum
 - 3. Strength: Minimum 3,000 psi at 28 days
 - 4. Air Content: 5% - 7%

- B. Job-Mixed Concrete

Mixed in drum mixer conforming to Concrete Paving Mixer Standards of Mixer Manufacturers Bureau of Associated General Contractors of America. Mixer shall be capable of combining aggregates, cement, and water into thoroughly

mixed and uniform mass. Discharge entire contents of drum before recharging. Continue mixing of each batch for not less than ten (10) minutes after all materials are in drum.

C. Ready Mixed Concrete

Proportioned, mixed and transported in accordance with ASTM C94. Any concrete not plastic and workable when it reaches project shall be rejected.

PART 3 EXECUTION

3.1 TRENCHING

- A. Trench Excavation: Excavate to depths required. Confine excavation to work limits.
- B. Rock Excavation: Prior to removal, notify Engineer of areas requiring rock excavation.
- C. Blasting: In general, blasting will be allowed in order to expedite the work if a permit by the local authority having jurisdiction is granted. All explosives and appurtenances shall be transported, handled, stored and used in accordance with the laws of the local, state and federal governments, as applicable.

All blasting shall be controlled so as not to injure any existing structure or facility. The protection of life and property and all liability for blasting shall be placed solely on the person or persons conducting the blasting operation. The hours of blasting shall be in accordance with the permit of the local authority. Prior to blasting, provide minimum 24 hour notification to Owner, Engineer and Fire Department.

- D. Trench Support: The trench shall be adequately supported and the safety of workers provided for as required by the most recent standards adopted by the Occupational Safety and Health Administration (OSHA) Standards Board. Sheet piling and shoring shall be utilized where required to prevent any excessive widening or sloughing of the trench, which may be detrimental to human safety, to the pipe and appurtenances being installed, to existing utilities, to existing structures, or to any other existing facility or item.

3.2 UNSTABLE TRENCH BOTTOM AND EXCAVATION IN POOR SOIL

If the bottom of the excavation at subgrade is found to be soft or unstable or to include ashes, cinders, refuse, vegetable or other organic material, or large pieces or fragments of inorganic material that cannot satisfactorily support the pipe or structure, then the Contractor shall further excavate and remove such unsuitable material. Before the pipe or structure is installed, the subgrade shall be accepted by the Engineer.

3.3 BEDDING

Install in conformance with drawings. Place from minimum of 3" below bottom of pipe to centerline for entire width of trench.

3.4 UNDERDRAIN

- A. Water seeping from trench banks, but not flowing in trench bottom: Install gravel underdrain in accordance with drawings.
- B. Water flowing in trench bottom: Install underdrain pipe in addition to gravel where water volume will fill a 4" pipe 1/4 full. Cleanouts at each manhole in conformance with drawings.
- C. Daylight all underdrains as shown on drawings or as directed by Engineer.

3.5 PIPE INSTALLATION

- A. Construct pipe accurately to line and grade shown on drawings. Remove and replace pipe not conforming to line and grade at Contractor's expense.
- B. Install to manufacturer's recommendations, continuously upgrade. Bell ends face upgrade. Prior to making joints, clean and dry all surfaces. Use lubricants in conformance with manufacturer's recommendations for insertion of pipe in joint. Set pipe in position and check line and grade. Keep dirt from entering all exposed pipe ends. Joints watertight.

3.6 PADS AND VAULTS

Install pads and vaults to line and grade shown on drawings.

3.7 PULL STRING

Pull string shall be labeled to identify which utility company or spare conduit the use of the conduit is intended for.

3.8 CONCRETE WORK

- A. Placement: Place to required depth and width conforming to drawings. Place concrete as uniformly as possible in order to minimize amount of additional spreading. Place and consolidate with suitable tools to avoid formations of voids, honeycomb, or pockets. Well vibrated and tamped against forms.
- B. Retempering: Do not retemper concrete or mortar which has partially hardened by remixing with or without additional cement, aggregate, or water. Provide concrete in such quantity as is required for immediate use.
- C. Curing: Protect against loss of moisture, rapid temperature change, rain, and flowing water, for not less than two days from placement of concrete. Immediately after finishing, cover concrete surface with curing medium which is

applicable to local conditions as approved by Engineer. Protect exposed edge of concrete slabs exposed by removing forms immediately to provide these surfaces with continuous curing treatment.

3.9 BACKFILL

- A. One Foot Over Pipe: Use 3/4" screened rock or on-site screened material (if approved by Engineer) for cover material and backfill by approved mechanical methods. Cover material shall be clean soil, free from organic materials, chunks of soil, frozen material, debris, or other unsuitable materials. Place and compact starting at top of pipe bedding extending upwards to above top of pipe for entire trench width. Place in lifts to a density of 90% AASHTO T99.
- B. Remainder of Trench: Backfill with same materials excavated from work limits unless unsuitable. No rocks over 6" in diameter in top 12" of trench. No backfill material with rocks larger than 12" in diameter. Carefully lower rocks up to 12" in diameter into trench.

3.10 COMPACTION

- A. Demonstrate method of compaction. Engineer will test compacted demonstration section for uniform density throughout depth of each lift. Alter construction methods until providing one acceptable to Engineer. Continue same procedure until significant change in soils occurs, or compaction is not being achieved, then demonstrate new method.
- B. Compaction requirements for all trenches:
 - 1. Predominantly of cohesive soils where AASHTO T99 procedures are applicable: Compacted uniformly throughout each lift to 95% AASHTO T99. Moisture content shall be within 2% of optimum.
 - 2. Predominately of rock 12" in diameter: Place in loose lifts up to average rock dimension. Placing of occasional boulders of sizes larger than maximum layer thickness may be agreed to by Engineer, provided material is carefully placed and large stones well distributed with voids completely filled with smaller stones, earth, sand, or gravel. Level and smooth each layer to distribute soils and finer fragments of earth. Wet each loose layer as necessary to facilitate compaction prior to placing additional lifts.

3.11 PAVEMENT REMOVAL AND REPLACEMENT

Score existing surface with cutting wheel to create clean break line. Remove and dispose of existing surface and aggregate base course leave 6" undisturbed subgrade lip on each side of trench. After trench has been backfilled and properly compacted, place aggregate base course in accordance with permit requirements, or minimum thickness in these specifications. Compact aggregate base course to 95% AASHTO T180 moisture content shall be within 2% of optimum. Replace pavement in accordance with permit requirements or minimum thickness in these specifications. Compact asphalt to 95% ASTM D1559; consolidate concrete with vibrators.

3.12 FIELD QUALITY CONTROL

- A. Notify Engineer at least 24 hours in advance of pipe being laid in any trench. Cover no pipes until observed by Engineer. Notify Engineer at least 48 hours before pipe is to be tested.
- B. Testing
 - 1. General: Conduct testing in accordance with procedures approved by the appropriate utility company or as directed by engineer.

3.13 CLEANUP AND RESTORATION

Restore all pavements, curbs, gutters, utilities, fences, irrigation ditches, yards, lawns, and other structures or surfaces to condition equal to or better than before work began, and to satisfaction of Engineer. Deposit all waste material in designated waste areas. Grade and shape disposal site.

Complete topsoil and reseedling of site, is required. Where disposal sites are not designated, remove and dispose of all waste material off site.

END OF SECTION 338000